

COMPUTER SHOPPER

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VERSION

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PRESENT
& CORRECT

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WITH YOUR PC

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#MONITORS 4 GAMERS
by *iiyama*

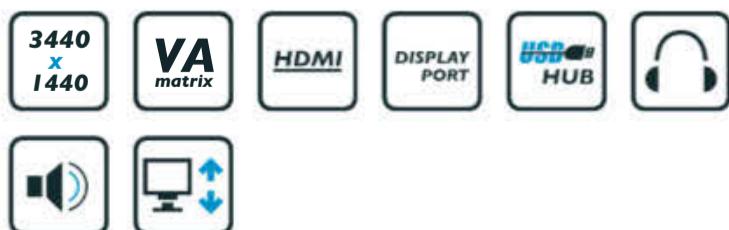
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I made a rare trip outside the house this week to pop to my nearest Apple store to get my iPhone fixed. Luckily for me, my phone is still covered by the warranty and the fix was free, although it's unclear yet whether the fault has been fully resolved by a new screen or if the device requires a factory reset and manual restore.

While I was in the store, a nervous-looking customer – fully masked and gloved up – came over to the table I was sitting at. She listened intently to the blue-T-shirted employee trying to reassure her he could fix her phone, which hadn't been charging. She really hoped so, she explained, as it was her only lifeline to the outside world.

Sitting opposite, another iPhone user was explaining to his allocated Apple fixer that the audio on his phone was totally inaudible, whether for phone calls, video chats or web video.

Smartphones truly proved their worth during lockdown, and are continuing to do so. Many of us still feel reluctant to go out and about, and rely on these pocket-sized devices instead for communication and basic activities.

For those of us stuck with a dodgy device, now is the time to get it fixed – or invest in an upgrade if it's beyond hope. We've got a huge round-up of the best and latest handsets in this issue, testing out every feature and spec to help you select the perfect model (p64).

With handsets starting from just £80 – and a Best Buy award-winning one at that – there's really no reason to stay on an older device if it's preventing you from doing the tasks that are so vital in these strange times, whether that's online food shopping, playing games or video-calling loved ones.

Madeline

Madeline Bennett, Editor
madeline@computershopper.co.uk

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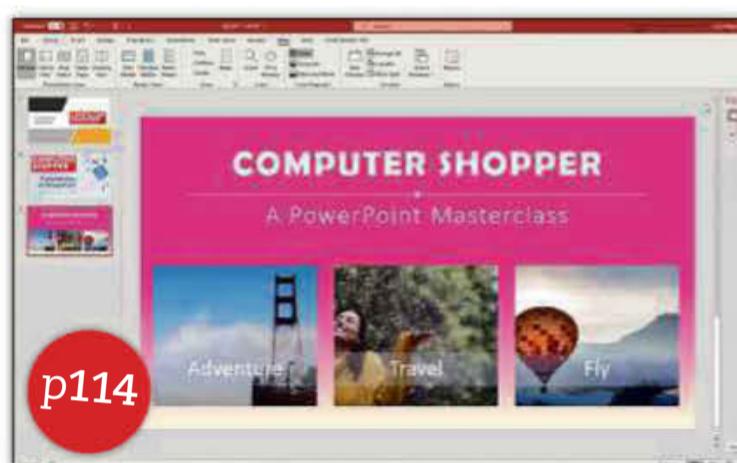


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60 Your Software*

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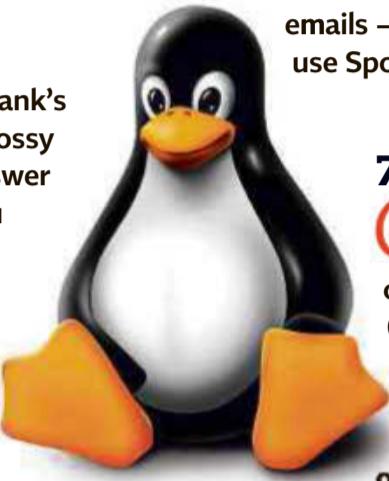
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Letters

As readers rally behind the call to take back control of our PCs from nagging and intrusive software, one correspondent has a possible solution

 letters@computershopper.co.uk

A solution to Kay's bossy boots

 **@** I sympathise with Kay Ewbank's issues with Windows 10 'Bossy bootups' (*Shopper* 392). The answer is simple: Linux. With Linux, you are in control of when to install updates, and no software can be installed without your explicit consent.

Her favourite browsers, Firefox and Chromium (Chrome's open-source sibling), are both available, with Firefox usually being the default browser in new Linux installs.

Best of all, most of the software you use is free and open source. Word & Excel – use LibreOffice; personal finance – use HomeBank; image editing – use GIMP;

emails – use Thunderbird; Spotify – well, use Spotify, it has a Linux app.

Christopher Bowser

7 up

@ With reference to the letter from Gareth Williams on encrypting a USB stick ('Hello Vera', *Shopper* 392), a far easier way than using an external program like VeraCrypt is to encrypt files or folders using 7Zip.

Create a new archive, add your files, and then before saving it, enter a password as shown in the archive window. Access to the contents now requires the saved password. The archive can be copied between devices, and still includes the encryption.

Roger Farnside

Show me the light

@ I read Clive Webster's feature on automating lighting with interest (*Shopper* 389). Now as a follow-up to this article, I have a laptop and need to acquire a new desk lamp.

The old halogen lamps seem to be very bright and expensive to run, and now there are LED bulbs. But what is best for my eyes, what type of bulb, light, lumens/wattage, ideal distance from the keyboard?

I hope you agree that while this is an important subject, perhaps not normally covered within the scope of your magazine, with the dark nights approaching now is a good time to give it consideration.

M Weare

● As you say, this is a bit out of our remit at *Shopper*, but it's definitely a worthwhile topic.

★ Star letter

Take back control

@ I smiled when I read Kay Ewbank's article 'Bossy bootups' (*Shopper* 392). Like Kay, I have been having issues with Microsoft and other software providers.

I suppose it all started a few years ago, when Apple decided I could no longer use my Final Cut Pro Studio video-editing software following an upgrade to its operating system. It was a great program, and I have now reinstalled this on my iMac by going back to an older operating system and taking the machine off the internet. It's up and running, and a good standby for any edits I want to do on video.

The other day, I wanted to print an address on an envelope for a birthday card – I have Windows 10 Professional as my operating system – and was prevented from doing so by Microsoft trying to force me to sign into Office 2019. I have never had to sign into any MS Office suite, and I am not about to do so at the whim of Microsoft. If this nagging continues, then MS Office will be ditched permanently; after all, there are now alternatives.

But that was only the start. The printer, which I have been using for years – an HP

1320N – suddenly disappeared from my list of printers. I had done nothing to it, so I deduced from this that it must be one of Microsoft's updates that had removed it. Why, when there are up-to-date Windows 64-bit drivers for the printer?

I needed to reply to some emails, and started typing as normal, only to be interrupted by a notice informing me that:

Ccleaner has a new update
Iobituninstaller requires updating
Adobe Flash Player requires updating
WhatsApp requires updating



And of course, my machine was being slowed down by software, according to Avast, which continually sends messages on to my screen. This is all in the space of fewer than 10 minutes. I've also had the irritating Edge message on my screen and just ignore it.

It's time we all took back control of our machines. Companies wishing to install anything on our machine should be forced to ask for our permission. Pre-ticked boxes should be banned, and any company trying to force PUPs on to our systems without our permission should face large fines.

Derek Mathieson

» Write in and win

Do you wish your computer was faster when booting and loading applications? Thanks to Crucial, you can achieve your dream of a faster PC or laptop with a 500GB MX500 SSD. The writer of our Star Letter will be awarded one of these solid-state devices, which can be installed in a desktop PC or a laptop.

This SSD is 45 times more energy-efficient than a typical hard drive, and has sequential read and write speeds up to 560/510MB/s and random reads/writes up to 95K/90K IOPS, making it the perfect replacement for the ageing hard drive in your sluggish PC.



STAR PRIZE
500GB SSD

Hopefully our readers might have some tips on desk lighting options that work well for them; please write in if so.

Epson drivers me mad

@ Two or three years ago, I downloaded an update from Epson for my SX535WD printer, only to find that it included a firmware change that prohibited use of compatible inks, which was particularly galling as I had just bought a supply for a large printing job the following week.

Just the other week, I downloaded another driver update from Epson – I am a slow learner! – and now find that print quality is variable. I can no longer rely on the quality of printouts.

The occasional email printout is virtually illegible, which makes them useless as a permanent record, some documents print as consistently faint – both black and colour – and some show marked variations between paragraphs, with some normal and some faint.

This happens most often when downloading a PDF document that's been sent to me. Am I being unfairly suspicious of Epson, or is this an attempt to make me buy a new printer?

Either way, I will think twice before even considering buying from them again. I have recently been told that HP also plays the blocking compatibles game.



I believe that such practices should be banned by law.

Graham Sturdy

We need a Moore's Law for efficiency, not speed

@ In the climate crisis, we have to look at how to reduce the carbon footprint of our computing. This would involve minimising greenhouse gases in production, use, recycling and deconstruction at end of life.

Buying our products in carbon-intensive China is a suicide mission, and we can be leading the way to getting a cleaner China by ensuring that our component-producing companies use renewable energy to power construction, which is now cheaper than new-build fossil fuels.

Factory cooling can be most cheaply done by planting trees nearby rather than having air conditioning, as Google has found to good effect. As the United Nations is attempting to plant a trillion trees, every one counts; if we plant the trees in equilateral triangles, we can plant 15% more trees.

We must now design our tech to use as little electricity as possible, and have a Moore's Law for efficiency instead of speed. Every time there is an increase in computer speed, the software becomes sloppier. We can reduce future energy consumption by improving software design; minimalism must be made to be more important than bells and whistles.

Do we really need a new version of our favourite game every year when a new



extra-difficult level could be downloaded? Bloatware must be confined to the past.

Mobile phones are renowned for having a battery that lasts for two years, and those phones in which you can replace the battery often die soon afterwards. This cynical design flaw should be removed by law.

Refurbished tech should become a standard. Once we break free from the tradition of replacing our tech every three years for insurance purposes, we can have a Luddite policy of producing replacement parts for old tech (have you tried to get a replacement motherboard for one that has failed only to find you need a new chip and RAM as well?).

New tech and software should only be allowed if it can be proven to cut CO₂ emissions in the medium term, and this would have the effect of keeping prices down.

All of these policies would help to spread computing into the developing world, either as new, refurbished or free.

Andy Kadir-Buxton

In the next issue



» Upgrade your laptop

Save money on buying a new laptop by giving your portable computer extra storage, memory and features



» Software glitch

We investigate the massive cost of software failures – in terms of money and human life – and the methods used by software engineers to help prevent future incidents



Life after lockdown

As coronavirus continues to impact all our lives, we outline the most useful websites and apps to help you adjust to the new normal

Listen up

Our guide to the best speakers to enjoy your favourite sounds around the house or in the garden



COMPUTER SHOPPER ISSUE 394 ON SALE IN NEWSAGENTS FROM 8th OCTOBER

Game changers

The videogame industry has long been blighted by racism and offensive stereotypes. But now, says **Mel Croucher**, independent developers are changing things for the better



MEL CROUCHER

Tech pioneer and all-round good egg
letters@computershopper.co.uk

BLACK LIVES MATTER.

Unless black lives feature in a videogame, in which case they don't matter a toss. I still remember the feeling of hope and despair when I played Daley Thompson's Decathlon for the first time. That was way back in the Olympic year of 1984, and it was a primitive sports simulation from Ocean software for a little home computer called the 48k Sinclair ZX Spectrum. Daley Thompson was an Olympic gold medal winner from Notting Hill. He had a fine body, and a great moustache, and according to his skin he was the son of his assassinated Nigerian dad.

Anyway, I fired up the game and there on my glowing colour monitor was the pixellated figure of Daley, the great black athlete, running along a red cinder track. The thing was, the programmers had made him white. No, I couldn't believe it either. A huge crowd of spectators also appeared in the gameplay, and every one of them was as white as a Ku Klux Klan convention in a chalk pit.

It's not as if no black characters ever appeared in videogames. Almost all the

the one where the white player gets sent off on a quest to murder blacks. It is equal-opportunity racism, because you also score points for killing Latinos and Jews. And speaking of equal opportunities, let's hear it for the computer character Letitia, who appears in an update of Deus Ex, which is set in a cyberpunk future. Letitia lives on a rubbish dump, she is as horny as she is simple, and she speaks minstrel drivel in the sort of deep-South accent last heard in a Mel Brooks parody. You couldn't make it up. Except that's exactly what they did. And shame on you Mary DeMarle for writing it, Amanda Strawn for acting it, and Square Enix for publishing it.

BLACK MARKS

In the USA, over 70% of all African Americans play videogames, but they make up less than 3% of game developers, which tells me quite a lot about the state of the play over there. This side of the pond, things are much better, where we have over 10% of people working in game development of a BAME demographic. That's a higher percentage than their number in the national working population, and way higher than in UK publishing, TV and music. This is good news, but it's where the good news ends. Last time I visited a major gaming studio in pre-lockdown, I saw several black faces. One was on security at street level, one was behind the reception desk, two were behind the counter in the canteen, and one was swilling out the bogs. The number of black and minority ethnic decision-makers in the UK computer gaming industry is shockingly low. As a result, race has lagged way behind gender and sexuality when it comes to stereotypes in gaming.

Mainstream game designers tend not to question a norm, and they rarely rock the boat by refusing to carry out a

questionable storyboard handed down to them by predominantly white hands from above. Most game designers I come across have less creative imagination than Rufus my Irish Setter, not to mention a much poorer sense of loyalty and the inability to lick their own genitalia. Videogames have always followed movies in characterisation, and they are painfully stiff with stereotypes. Historically, lazy, myopic creatives have allocated blacks four roles: the violent black, the servile black, the sidekick black and the comedy black. I am removing sports games and music games from my list, since they exhibit no imagination whatsoever, but simply copy real people from the real world, unless you happen to be Daley Thompson or Michael Jackson, of course.

A CHANGE IS GONNA COME

The blame for all this lies squarely with the course leaders who purport to teach videogame creation in universities and colleges. I have never met a creative course leader who is darker skinned than me, and I'm a sort of mottled puce. They may well instruct their students to bung in a character of the negro persuasion as if to fill some sort of racial-minority quota, a bit like when those TV adverts suddenly started to feature blacks doing non-traditional things, like working in building societies and driving new cars.

The change is coming through independent videogame creators, so-called home-brew developers, and the change had begun in the UK way before the Black Lives Matter movement gathered such momentum. Creative change always comes from the mavericks and rarely from the corporates. As for the people who play the games, next time you come across a racial stereotype you know what to do. Take a knee. To the groins of the writer, programmer and publisher. ☎

Race has lagged way behind gender and sexuality when it comes to stereotypes in gaming

assassins, hoodlums, terrorists, monsters and mobsters were black, and their purpose was to be killed off willy nilly. Apart from Michael Jackson. He was the hero in a Sega videogame called Moonwalker, and his role was to rescue kidnapped children and take them home. So there was nothing creepy about that, was there? Mind you, wee Michael was mostly as white in the game as he was in real life.

For a real black-and-white issue from the early 21st century, I have revisited Ethnic Cleansing, developed by Resistance Records for PC desktop machines. That's

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You don't have to bury all your precious files and photos under several metres of Arctic permafrost to keep them forever. **Kay Ewbank** has some better storage ideas



KAY EW BANK

Software guru and Shopper legend
letters@computershopper.co.uk

AS YOU MAY have read in Shopper last month, GitHub is putting a copy of every piece of open-source code into cold storage in Svalbard, Norway. The idea is that by depositing all the open-source software on archival film in a decommissioned coalmine deep under the permafrost of the Arctic island, generations to come will be able to access it if they need to at some point in the next 1,000 years.

As the proud possessor of a wide variety of archives on formats no longer supported by current computers (5.25in floppy diskettes, anyone? Zip disks, Sony Minidiscs?), I have my doubts. It sounds a good idea, but the software is being stored in a format called piqlFilm that uses QR codes as the data format. I suppose a future technology trying to re-create Linux (or more likely Spider Solitaire if that ever went missing, heaven forfend) might be able to reinvent QR codes, but on the whole I reckon my box of old IBM 360 punch cards are a better bet for future readability.

We're increasingly handing over the problem of keeping stuff saved and available to companies that we have no control over

The problem is, how do you choose to store information in a format that will work in the future? It's not just the IT industry that's careless about backwards compatibility, but we are particularly bad at this. When was the last time you had a computer with a built-in 3.5in disk drive, never mind a 5.25in or 8in floppy drive? You may be giggling at the thought this is important, but what about the day you unpack a new machine without a USB slot? Believe me, it will happen as

soon as there's the digital equivalent of a better mousetrap.

Ah, you're probably thinking, but everything's stored online these days. That's increasingly true, but that's just moving the problem from your desktop to someone else's storage, and it raises another question: how can you be sure your online storage won't at some point be closed down? This is particularly true of free storage, or storage that's linked to some other service you're paying for. We're increasingly handing over the problem of keeping stuff saved and available to companies that we have no control over if they change their rules and ditch us.

Old documents or digital photos are a lot harder to get at; if you forget to copy them to a new machine, they could just be gone. Emails are even worse: change email provider and your old ones are so much vapour.

ACE OF BASE

It's not just personal data that disappears, either. Information on the web is particularly prone to culling. For example, Microsoft used to have a really excellent resource called Knowledge Base, a collection of documents describing how to do things in Microsoft products. As the company ends support for older versions of software, it removes the articles from Knowledge Base, even though they're still relevant and useful. Microsoft is a high-profile example, but there are plenty of others. Websites cost money to run and maintain, and if there's no longer a reason to pay, they can disappear.

So how can you make sure you can still get your hands on old information?

For online material, it's worth knowing about the Wayback machine. This is described as a digital library of internet sites and other cultural artefacts in digital form. To begin with, Wayback was purely a web

archive. These days, it also archives printed material as well, so in addition to its 330 billion web pages, it also has 20 million books and texts, along with audio and video recordings, images, and software programs. You can look for particular website addresses you remember, or more generally can enter search terms such as someone's name or other text.

DOUBLING UP

For your own stuff, there are a few golden rules. First, always go for belt and braces. In other words, don't rely on just one technique – keep a copy online, and another on a USB stick, removable hard disk, or a rewritable DVD. Just make sure you also have the means to read whatever format you've chosen.

The second important thing is to work out what matters to you. When you upgrade your computer, how can you be sure you've copied everything that matters to you? It's true that modern operating systems try to help by copying specific folders for you, but you also ought to know where documents and photos are stored so you can definitely copy them across. Take backups, too, and store them separately. Imagine if your phone or computer was stolen or stopped working in a non-mendable way. What would you cry about losing? That's what you should have a copy of, ideally somewhere physically separate.

One final thought. If you treasure a photo or that first email correspondence with your darling, why not print them out as well? It may sound ludicrous from someone like me who's spent so much time digitally, but it's a lot easier to look at an album of photos or a box of letters 50 years down the line than it is to get your 5.25in floppy disk to work. Trust me on this one. ☺

RANTS & RAVES

Apple is ditching Intel processors from its computers. We can only hope the chip maker will rise to the challenge by innovating, as it has done so often in the past

David Ludlow

RAVES



WITH APPLE ANNOUNCING that it's shifting away from Intel processors to focus on its own ARM-based chips in its MacBooks, now could be seen as a sad time, heralding the decline of the dominant desktop architecture.

Yet it's a move I believe we should celebrate, as it injects some much-needed competition into the market, and changes the way that processors are developed and used. Today, computing, as with most tech, is as much about efficiency as it is about power. Only using the amount of power that's needed to do the job at hand is far more important than having an always-on, full-throttle system.

That's what Apple's silicon will do, using the super-efficient ARM architecture for devices that use less power, last longer on battery life, yet are ready to go full-pelt when there's a tougher job at hand.

We've seen ARM dominate mobile devices for this very reason, and now octa-core processors are the norm: they have low-power quad-core processing for smaller jobs to save battery life, and four faster cores when required. It's something Intel currently can't offer.

The move should be a wake-up call to Intel, and the company has always responded well to a challenge. Think back to the earlier days of computing, when Intel was moving from the 486 to the Pentium. Back then, the goal was to push clock speeds and go for raw power only, a move that left it open to a challenge from AMD with its Athlon processors.

Intel's response was to take the Core architecture from its laptop line-up, delivering efficiency and multiple cores to the desktop, pushing back the challenge from AMD. Now, the company is at a crossroads again, under threat from a resurgent AMD, as well as ARM-based architecture.

I'm hoping the result is that the company delves deep and innovates, continuing to push what PCs are capable of, while delivering more efficient components that give us the all-day battery life that we've been dreaming of.

Madeline Bennett

RANTS



THERE HAVE CERTAINLY been some technology winners of the coronavirus pandemic. Apple recently became the first US company to reach a \$2 trillion market value, while every lockdown web-based sale nudged Amazon a little further towards total domination of the online shopping market.

However, closer to home the picture isn't as bright. Bletchley Park, famed home of the World War II codebreakers, is struggling to stay afloat in the wake of the pandemic.

The base of Alan Turing and his team during the war already fought a successful battle just over a decade ago to stave off closure. Led by technologist Sue Black, the previous fundraising efforts meant that much-needed restoration work could be carried out. And so Bletchley Park, and the National Museum of Computing, which is located on the site, were able to keep their doors open to showcase the history of British computing excellence.

However, Covid-19 is proving a new and tough enemy to beat. Bletchley Park closed its gates to the public on 19th March 2020,

only reopening on 4th July. The implications of social distancing and living with the consequent lower visitor numbers has meant the need for a radical review of the Trust's organisation, spending and priorities.

The Bletchley Park Trust is now proposing to restructure as a result of the financial impact of coronavirus. This saw the organisation lose over 95% of its income from March to July this year, and it expects to lose around £2m in 2020. The restructure includes a possible 35 redundancies, around a third of the workforce.

In a fair and just world, one of the tech giants that has benefited from the pandemic would be stepping up to make a significant donation to secure the future of the Trust, and even help it swerve the need for redundancies. However, I hold out little hope that Jeff Bezos or Tim Cook are rushing to make a large online donation at any point soon, and hence it falls on us – technology enthusiasts, Shopper readers – to do our own small bit where we can.

As Twitter user Kevin Evans noted, “£2m loss this year would be offset by 25,000 people becoming @bletchleypark friend+ members. That's not a big number; I've done my bit, 24,999 to go!”.

I did my bit. If you want to do yours, you can sign up as a Friend of Bletchley Park from £50 by visiting tinyurl.com/393rants. You'll get an annual pass, an invite to Bletchley Events, and the knowledge that your donation is keeping our national computing heritage alive. A worthier cause than another Amazon or Apple purchase, surely.

NEED TO KNOW

The biggest stories from the tech world, and what they mean for you

AI algorithm controversy forces exams U-turn

SAY WHAT?

STUDENTS IN ENGLAND were given exam grades estimated by their teachers, rather than by an algorithm, after a government U-turn.

The about-turn followed uproar after about 40% of A-level results were downgraded by exams regulator Ofqual, which used a formula based on schools' prior grades.

Students in the UK didn't sit exams this year because schools were closed following the coronavirus lockdown. In England, they were given grades by the official exam regulator, Ofqual.

Teachers had been asked to supply an estimated grade and a ranking against other pupils at the school within that same estimated grade, for each student and subject. These were then put through an algorithm, which also factored in the school's performances in each subject over the previous three years.

The idea was that grades would be consistent with how schools had done in the past. Teachers' rankings would then decide which pupils received the top grades in their particular school.

Ofqual had said this was a more accurate way of awarding grades than simply relying on teachers' assessments, as teachers were likely to be more generous in assigning an estimated mark, which might lead to grade inflation.

Similar algorithms were used for pupils in Wales and Northern Ireland, and for the Scottish Higher qualification, broadly comparable with A-levels.

However, the algorithm-based results caused controversy as soon as A-level results were revealed in mid-August.

Across England, Wales and Northern Ireland, almost 40% of grades awarded were lower than teachers' assessments. In England, 36% of



entries had a lower grade than teachers recommended and 3% were down two grades.

The downgrading affected state schools much more than the private sector.

The problem was widely blamed on the simplicity of the algorithm. The two key pieces of information used to produce the grades – how students have been ranked in ability; and how well their school or college has performed in exams in recent years – meant that bright students in low-achieving schools were awarded significantly lower grades than expected or deserved.

Initially, students were directed to an appeals process to try and rectify the issue, but it soon became clear this wouldn't work in the face of so many botched results, and with a looming deadline for getting a university place for autumn 2020.

Ofqual chair Roger Taylor and education secretary Gavin Williamson both apologised for the distress caused.

The Department for Education had worked with Ofqual to design "the fairest possible model", Williamson said, but it had become clear that the process of awarding grades had resulted in "more significant inconsistencies than can be resolved through an appeals process".

On 17th August, four days after the results were revealed, the government announced that A-level results would be changed to reflect the original teachers' estimates rather than the result produced by the algorithm. The only exception would be if a student had received a higher grade from the algorithm. At the same time, Williamson said GCSE results would also be decided according to teacher assessments.

Samsung unpacks new smartphones and tablets

SAY WHAT?

DESPITE COVID-19 DISRUPTING the usual spate of tech launches, Samsung has shown off a wide variety of tech products at its virtual Galaxy Unpacked event. These include the 5G-enabled Samsung Galaxy Tab S7 Plus (right), a new pair of Bluetooth earphones, the Galaxy Watch 3, and two new smartphones: the Galaxy Note 20 and Note 20 Ultra.

The starting price of the Note 20 Ultra – a lofty £1,179 – means it isn't for the faint of heart, so you might want to do your wallet a favour and pick up the regular Note 20 instead, which starts from £849 for the 4G model.

The Note 20 comes with an FHD+ (2,400x1,080), Super AMOLED screen, an octa-core 2.73GHz Samsung Exynos 990 processor, 8GB of RAM and 256GB of storage – with no option for microSD expansion.

Despite the price difference, the 6.7in Note 20 is still as eye-catching as its Ultra counterpart. It might not have curved edges, but the Note 20

looks rather lovely, with a frosted glass back and neat rectangular camera housing. The Note 20 can be picked up in a choice of three colours in the UK: mystic green, mystic grey and mystic bronze.

On the front, there's barely a whiff of a bezel, with just a simple circular hole-punch notch in the top-centre of the screen, which houses the 10-megapixel selfie snapper. The phone itself is IP68-rated for protection against water and dust.

Being a Note phone, Samsung's S Pen makes yet another appearance, albeit with a few slight changes. It now slots into the bottom-left corner of the handset, has a slightly changed design, and there are some new Air Actions gestures, such as the ability to waggle the stylus to take a screenshot.

There are three cameras on the back: a 12-megapixel (f/1.8) camera, 64-megapixel (f/2.0) 3x zoom sensor and a 12-megapixel (f/2.2) ultra-wide unit. There's also a 10-megapixel (f/2.2) camera on the front, housed inside a pinhole notch in the top-centre of the screen.



BOOTING UP

The big Apple

Apple has become the first US-based company to reach a valuation of \$2 trillion, only two years after hitting a \$1 trillion market cap



Swine theft

A nudist bather who chased a wild boar near a Berlin lake after it stole his laptop was applauded by onlookers after a successful pursuit

Telly addicts

Adults spent 40% of their waking day watching TV during lockdown, according to comms regulator Ofcom

BlackBerry fans

The BlackBerry brand has been licensed by Texas startup OnwardMobility, which is promising to release a 5G BlackBerry device with Android and a physical QWERTY keyboard next year

Trump's royal disapproval

Rock band Queen is trying – and failing – to get US President Donald Trump to stop using its songs in his online campaign videos



Toshiba portables

Toshiba has shut the lid on 35 years in the laptop business, after the Japanese electronics giant sold its final stake in personal computer maker Dynabook

Lockdown parties

Airbnb has banned house parties as part of its efforts to comply with limits on gatherings in the wake of the coronavirus pandemic. Occupancy will be limited to 16 people, with a few exceptions for some venues

Google satisfaction

Gmail is the UK's most complained about remote-working app, according to research from Uswitch. Skype and Zoom came in second and third

CRASHING

SO WHAT?

THE GOVERNMENT AND Ofqual faced various legal challenges regarding the use of the algorithm to determine this summer's A-Level and GCSE results.

Following fundraising efforts and a petition signed by approximately 250,000 people, students Curtis Parfitt-Ford and Martha Dark wrote to the regulator with the intent to seek a judicial review against the use of the algorithm.

Backed by the legal campaigning group Foxyglove and law firm Leigh Day, the challenge argued that the use of the algorithm violated the GDPR by profiling individuals based on personal information.

Profiling would be based either wholly or partly on automated decision making, which may lead to discrimination and socioeconomic disadvantage, according to the data protection laws.

A separate legal challenge, from the director of the Good Law Project, Jo Maughan QC, focused on the unfairness of the system, and the limited and flawed appeals process.

Greater Manchester Mayor Andy Burnham also warned he was taking legal advice, and would write to Ofqual to initiate action.

“The debacle could have wide-reaching implications for the future of artificial intelligence”

In the face of so much controversy, it is not surprising the government took only four days to perform its U-turn. However, while the change of heart is good news for students, who will now get the grades they personally deserve – and for teachers by restoring faith in their ability to award marks fairly – the debacle could have wide-reaching implications for the future of artificial intelligence.

Dr Nicolai Baldin, a former machine-learning researcher from the University of Cambridge and founder of AI firm Synthesized, noted that this is one of the first examples of an algorithm being relied on to make far-reaching decisions on a national level and affecting millions of people.

“The use of a similar algorithm again will be considered long and hard, but this situation has also sped up the likelihood of the introduction of legislation regulating their use. This can only be a good thing, with the potential regulations focusing on the issue of fairness,” he said.

“Yet the key lesson is not that algorithms are inherently biased; instead, such bias happens when an algorithm is built from poor-quality or unrepresentative information.”

SO WHAT?

THE GALAXY NOTE 20 Ultra might be primed to steal the limelight this year, since it's where you'll find all the extra bells and whistles. The high-end upgrades include Samsung's most up-to-date flagship processor, the Exynos 990, as well as a 6.9in 120Hz screen, a 108-megapixel camera (accompanied by wide-angle and telephoto zoom lenses) and 5G as standard.

Since this is a Note device, the S Pen returns with a handful of new features, along with DeX mode, Samsung's desktop-like interface which now supports wireless screen mirroring.

While it lacks such headline-grabbing features, the Note 20 still looks to be a remarkable Android flagship that's worthy of any potential admiration that comes its way.

However, despite costing less than the Ultra, it still doesn't come cheap. The Note 20

starts at £849, and that's for the model without 5G – you have to pay an extra £100 if you want access to the new mobile network.

On the tablet side, Samsung is taking aim at Apple's iPad Pro line-up. The Galaxy Tab S7 features a 12.4-in AMOLED screen, along with an improved add-on keyboard and trackpad combo.

With more people looking for better and different ways to work from home, there's renewed interest in finally bridging the gap between laptop and tablet, which Samsung is hoping the Galaxy Tab S7 and its larger sibling the Galaxy Tab S7 Plus will fulfil.

For those interested in the latest batch of foldable phones, Samsung unveiled the Galaxy Z Fold 2 handset, although it hasn't yet revealed pricing or a release date.

FROM THE LAB

Intel unveils new transistor technology for Tiger Lake platform

INTEL HAS UNVEILED what's next for the chip maker at its Architecture Day 2020, revealing a glimpse at the Tiger Lake platform, Willow Cove architecture and a new transistor technology.

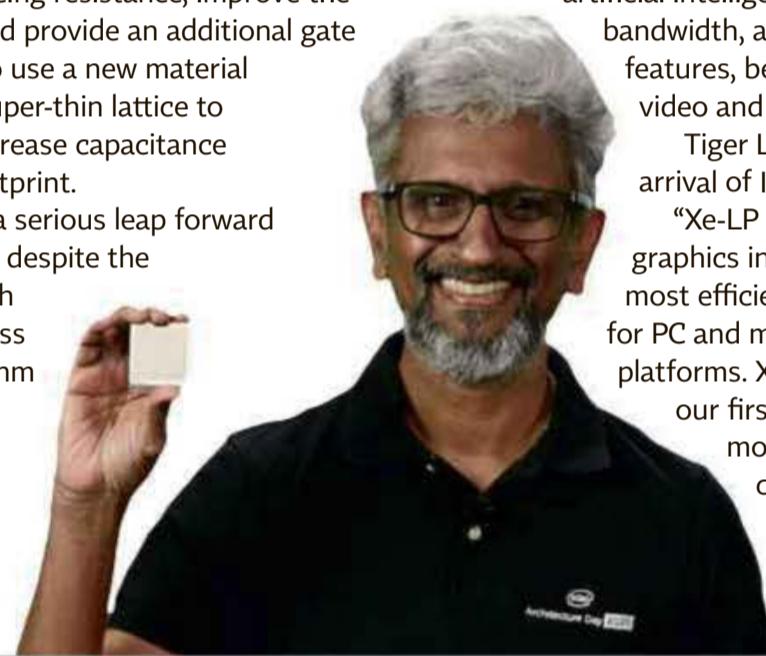
The latter is the 10nm SuperFin, which Intel says is a redefinition of its FinFET (fin field-effect transistor).

"After years of refining the FinFET transistor, Intel is redefining the technology to enable the largest single intranode enhancement in its history, delivering performance improvement comparable to a full-node transition," the company said.

The SuperFin technology will allow more current through the channel by increasing strain and reducing resistance, improve the gate process and provide an additional gate pitch. It will also use a new material arranged in a super-thin lattice to dramatically increase capacitance in the same footprint.

This means a serious leap forward in performance, despite the firm staying with the 10nm process after delaying 7nm until 2022.

"It is 20%, the largest intra-node jump ever in our history,"



Raja Koduri, Intel's chief architect (pictured below), explained of the performance gain.

"It's actually the same as what you would get with one full Moore's Law node of performance."

That system will be first seen in the Tiger Lake chips due this autumn, which will use the Willow Cove CPU architecture alongside the new 10nm SuperFin technology and Xe graphics. Intel claims that Tiger Lake will offer more processing power while drawing less power.

"We unpacked details of the upcoming Tiger Lake system-on-chip architecture, which provides a generational leap in CPU performance, leadership graphics, leadership artificial intelligence, more memory bandwidth, additional security features, better display, better video and more," Koduri said.

Tiger Lake will also see the arrival of Intel's Xe-LP graphics.

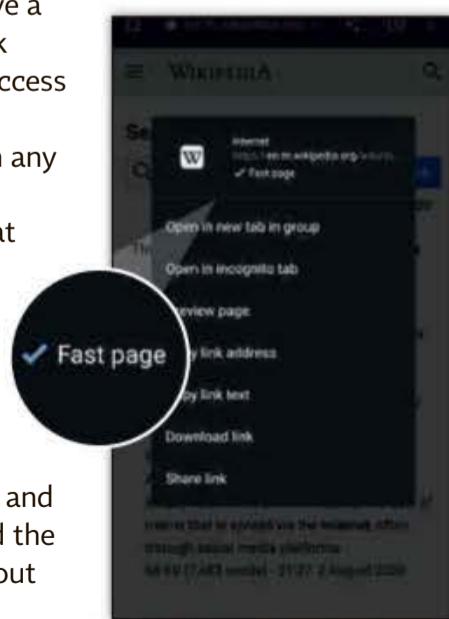
"Xe-LP powers leadership graphics in Tiger Lake and is our most efficient microarchitecture for PC and mobile computing platforms. Xe-LP also powers our first discrete GPU in more than 20 years, codenamed DG1. This GPU is now in production," Koduri added.

Google Chrome to reward fast-loading sites with 'fast page' badge

GOOGLE HAS ANNOUNCED it will soon start tagging fast-loading sites in its Chrome browsers. The first version to get this update will be the Android Chrome browser.

Pages deemed fast loading, according to Core Web Vitals, will receive a 'fast page' badge in the link context menu. Users can access the link context menu by performing a long press on any hyperlink on a web page.

Core Web Vitals looks at three key metrics when determining if a site is fast or not: the time it takes for a web page's main content to load; the time it takes before a user can interact with the page; and a page's visual stability and the number of unexpected layout shifts a website has.



Sites that consistently meet or exceed the Core Web Vitals thresholds will receive the 'fast page' tag.

Because this tag is designed to help users on unreliable internet connections know if a page will load quickly or not, only those who have activated Lite mode or turned on 'Make Searches and Browsing Better' will see them.

Google is rolling out the badge on a limited basis on the Android Chrome 85 Beta, but a broader rollout will come soon. If you want to activate it now, you can type `chrome://flags/#enable-context-menu-performance` in the Chrome URL box and enable 'Context menu performance info and remote hint fetching'.

There's no word yet on when the 'fast page' tag will come to desktop.

England starts trial of new Covid-19 contact-tracing app

ENGLAND'S NEW, DECENTRALISED version of its contact-tracing app has entered its public trial phase, two months after the previous app was scrapped by Test and Trace programme head, Baroness Dido Harding.

The new contact-tracing app, based on Google and Apple's jointly developed API, is being trialled on the Isle of Wight, although it is already in use in other regions of the UK, such as Northern Ireland, and in countries across the EU.



The model was the initial choice of software at the beginning of the coronavirus pandemic, until it was snubbed by the government in late April in favour of a centralised model. This was also trialled on the Isle of Wight in early May, before being cancelled a month later after it was discovered that the app could only pick up 4% of other iPhones it came in contact with.

The new software has been designed to monitor distance between people with the help of their smartphones, alerting users if they have been in close proximity to another person for a set period of time that could heighten the risk of contagion. If one user later tests positive for Covid-19, the other person is to be alerted to the fact even before they begin showing symptoms, lowering the chances of passing on the virus to others.

What's more, users who go out to public places such as bars will also be asked to scan a QR barcode upon entrance, in order to make it easier to alert them later if they have visited a location linked to multiple infections.

Unlike the previous version, Apple and Google claim their API is able to pick up 99% of smartphones it comes in contact with.

However, the new app is already facing significant challenges. One such issue is faulty distance estimates, which translates into smartphones wrongly recording users standing within two metres of one another. This could lead to a higher number of contagion alerts being sent, forcing users to isolate when there is no need to do so, as well as potentially causing emotional distress.

THE LOWDOWN

H.266/VVC video codec

The new compression standard that promises to halve the size of video files

WHAT'S H.266/VVC?

A new video technology has been developed that halves the size of compressed files, letting you stream footage in higher quality than before, without any buffering. H.266/Versatile Video Coding (VVC) – to give the tech its full name – has been developed by the Fraunhofer Heinrich Hertz Institute in Berlin, the electrical engineering and computer science division of German research organisation, the Fraunhofer Society.

"Through a reduction of data requirements, H.266/VVC makes video transmission in mobile networks (where data capacity is limited) more efficient," the Institute boasts.

"For instance, the previous standard H.265/HEVC requires 10GB of data to transmit a 90-minute UHD video. With this new technology, only 5GB of data is required to achieve the same quality. Because H.266/VVC was developed with ultra-high-resolution video content in mind, the new standard is particularly beneficial when streaming 4K or 8K videos on a flat screen TV. Furthermore, H.266/VVC is ideal for all types of moving images, from high-resolution 360° video panoramas to screen-sharing content."

SO VVC WILL REPLACE HEVC?

The codec is designed to be a successor not only to the newer H.265/High Efficiency Video Coding (HEVC), but also to the current industry-standard H.264/Advanced Video Coding (AVC) format.

"Today, compressed video data make up 80% of global internet traffic. H.266/VVC represents the pinnacle of (at least) four generations of international standards for video coding," the Institute explains.

"The previous standards H.264/Advanced Video Coding (AVC) and H.265/HEVC, which were produced with substantial contributions from Fraunhofer HHI, remain active in more than 10 billion end devices, processing over 90% of the total global volume of video bits."

WHY NOT JUST STICK WITH HEVC AND AVC?

HEVC, released in 2013, has proved controversial due to patent disputes from various stakeholders. Hence AVC, the predecessor to HEVC, remains the more dominant standard, despite being released in 2003.

VVC could be a path forward for the industry, as almost every major hardware and software company is currently tied up in a patent royalty system that dictates how much stakeholders must pay to use different compression and transmission standards for devices, websites and apps.

WILL VVC CHANGE THE ONLINE VIDEO MARKET?

One benefit is that it could lead to streaming services providing 8K content. Tests indicate that homes need a broadband speed of



85Mbit/s to stream 8K video reliably. This would drop to around 40-50Mbit/s if H.266 VVC takes off.

Another benefit is that you should be able to save twice the amount of footage on the same amount of storage, as long as you don't use the codec to capture video in higher quality.

It's also expected that the new codec will lead to growth in the use of internet video.

"Because of the quantum leap in coding efficiency offered by H.266/VVC, the use of video will increase further worldwide. Moreover, the increased versatility of H.266/VVC makes its use more attractive for a broader range of applications related to the transmission and storage of video," the Institute says.

ARE THERE ANY OTHER VIDEO STANDARDS AVAILABLE?

As noted, Fraunhofer HHI also contributed heavily to the creation of H.264 and H.265, so the organisation certainly has a successful history working in data compression. But there's also AV1, an open-source and royalty-free competitor to the HEVC standard. This was created by the Open Media Alliance, a group including Amazon, Apple, Facebook, Google and Samsung.

AV1 and its predecessor, VP9, are integral for streaming 4K content from platforms such as YouTube, so it's likely these standards will continue to compete for years to come.

It's not currently clear to what extent AV1, AVC, HEVC and VVC will all coexist in the future.

HOW SOON WILL VVC COME INTO USE?

The Institute claims the Media Coding Industry Forum is currently working toward chip designs to support VVC at the hardware level. However, it may take several years for firms to build processors powerful enough to handle the new technology. The hardware we use today wasn't built to play H.266/VVC content. 

REVIEWS

YOUR TRUSTED GUIDE TO WHAT'S NEW



DESKTOP GAMING PC

ALPHABETAPC Quiet PC i7-2070S



£1,699 • From www.alphabetaapc.com

VERDICT

A 4K-capable and highly customisable gaming system, even if its sound dampening is limited by ventilation needs

IT WAS ONLY last issue that we saw the appeal of a sound-dampened PC: the Chillblast Photo Zen (*Shopper* 392), with its substantial chassis and noise-absorbent lining, successfully quietened internal fan noise, resulting in a desktop system that won't distract you while you're using it.

However, it's rare to see similar measures employed by more leisure-focused PCs; at least when it comes to pre-builds, sound dampening seems largely reserved for home office and workstation systems. The Quiet PC i7-2070S therefore makes for an exciting change as it adopts the same techniques as the Photo Zen, but in a gaming rig. It includes linings of sound-dampening fabric and foam, as well as a hinged door at the front to limit escaping noise without completely denying front panel access for modifications and cleaning.

WORKING OVERTIME

It's also a very high-specced machine, what with its namesake Intel Core i7-10700K processor and GeForce RTX 2070 Super graphics card. That CPU comprises eight physical cores and 16 total threads, and what's more, it comes overclocked to 4.8GHz, a full 1GHz above its stock base speed. To help keep the resultant core temperatures under control, it's fitted with an all-in-one watercooler with a 240mm radiator.

Then there's the more than ample 32GB of DDR4 RAM, enough for a respectable media production PC, let alone a gaming one. There's loads of storage space, too, split between a 960GB SSD – of the fast NVMe variety – and a 2TB hard disk.

Design-wise, the Quiet PC i7-2070S couldn't be further from the cube-shaped RGB explosions that were the previous AlphaBetaPC systems we've tested. It's all contained in a sensible black mid-tower case, and although it's not as weighty or solid-feeling as the Photo Zen, build quality is still good throughout, with no cheap-feeling flexibility to any particular part of the chassis. There's not even a side window, as this would lower the structural integrity.

The front door holds shut magnetically, so there's no clicky locking mechanism that could break, and opening it reveals a couple of nice touches. One is the dust filter for the front fans (or fan, singular, in this case), which also removes easily from its magnetic grip for quicker reinstallation after cleaning. The second is a 5.25in drive slot, which is something that's become very rare indeed on mainstream mid-tower designs. There's nothing in there by default, although it wouldn't be a costly upgrade to add your own DVD or Blu-ray drive, or a multicard reader for some extra connectivity.

This door is also where the anti-noise lining is at its thickest and puffiest, possibly to compensate for the fact that it needs to leave some gaps either side to allow for airflow in. On the left and right side panels, it's more of a fabric lining, though this still



proves to have a positive effect, specifically in negating the sound of the panels themselves vibrating. On flimsier cases, the PC's moving parts can cause side panels to buzz if they're not fastened in tightly, but here they sit silently even if they're only partially slotted in.

BREAK THE SILENCE

That said, you shouldn't expect silent running in general. For all the cases's anti-noise measures, the watercooler fans in particular are clearly heard through the vent in the roof, which is only covered by another removable dust filter. With the CPU at maximum load, we recorded the Quiet PC i7-2070S producing 55dB of noise right next to this vent, and 45dB from about 10cm away – about the same as the ambient noise in an open-plan office.

Does this mean the Quiet PC i7-2070S is unreasonably loud? Not at all – among gaming systems in particular, it's probably about average, which in a way is pretty good when you factor in overclocking. We'd also

rather keep the vent open to maintain airflow than block it up for volume's sake, risking a buildup of heat in the process. Just don't see the name and expect it to run at a whisper when resource-demanding software is in play.

FUN FOR ALL

Speaking of which, the RTX 2070 Super proved why it's still a gaming force to be reckoned with even as Nvidia's Ampere GPUs approach. The highest-quality settings in *Dirt Showdown* were no match, with the Quiet PC i7-2070S averaging 190fps at 1,920x1,080 and 176fps at 2,560x1,440. Even 4K, or 3,840x2,160, was beautifully smooth at 116fps.

The SteamVR Performance Test returned a perfect score of 11, certifying this PC as a top-class partner to any Oculus, HTC Vive or Valve Index headset, and the typically GPU-hungry *Metro: Last Light Redux* was managed well too, averaging 120fps at 1080p with Very High quality and SSAA on. This dropped to 63fps at 1440p, but that's still smooth enough to play without any quality

reductions. It took 4K to change that, as while you could largely get by with a 27fps average, it would make a lot more sense to switch off SSAA. Sure enough, this produced a bounce up to 57fps, close enough to the coveted 60fps, and with minimal impact on visuals as 4K is such a high resolution that disabling anti-aliasing doesn't reveal anything like the jaggedness you'd get at 1080p.

It helps that the Core i7-10700K, a great gaming processor at stock speeds, is overclocked; this in turn unlocks extra GPU strength, especially in more bottleneck-sensitive games such as Dirt. The Quiet PC i7-2070S's single-core power is further evidenced in the image test component of our 4K application benchmarks, in which it scored a superb 193.

SINGLE Minded

However, its video test and multitasking test results – 225 and 252 respectively – show that Intel still lags behind AMD and its Ryzen chips on multithreaded performance. The Quiet PC i7-2070S's overall score of 233 makes it decent enough for the occasional spot of media editing, but for nearly £1,700 it's easy to get a PC with the Ryzen 3700X or Ryzen 3800X, both of which would comfortably break a score of 300.

Storage, luckily, is much more competitive. Besides the huge combined capacity of the two drives, the main 960GB SSD reaches sequential read speeds of 1,891MB/s and sequential write speeds of 1,576MB/s. That's several times faster than any SATA SSD, and without compromising on size, either.

A stack of three 3.5in drive bays and five 2.5in mounting points – three on top of the PSU shroud and two behind the motherboard tray – also ensure that there's an abundance of potential to add yet more storage. So much, in fact, that the five unused SATA ports won't be enough to handle a full set, especially if you also install a drive in the 5.25in bay. For the best results, however, you can make use of the two unused M.2 slots on the motherboard.

This high upgrade potential continues elsewhere. Two of the four RAM slots are free, in the unlikely event that you want even more memory than 32GB, while both PCI-E x16 and PCI-E x1 have one unused slot each. There's one more PCI-E x1 slot on top of these, but it's covered up by the graphics card.



Another slot is taken up by a 802.11n Wi-Fi card. We're always pleased to see built-in wireless capability on PCs, even when they almost always come with a Gigabit Ethernet jack (as the Quiet PC i7-2070S), though this particularly Wi-Fi standard is more than a little old hat when 802.11ac and 802.11ax exist. It only lets you connect to 2.4GHz networks, not 5GHz, like most modern wireless devices can.

ONLY CONNECT

If you'd prefer to maximise speeds by using a wired Ethernet connection, you'll find the requisite port on the rear I/O panel, alongside two USB2 ports, two USB3 ports, one USB3.1 ports and one USB Type-C port. That's a reasonable assortment, and one that's completed by the two USB3 ports near the front of the PC, along with a built-in SD card reader, another great inclusion.

Back on the rear, there are only line-in, line-out and headphone jacks for audio – no S/PDIF or the like – but the GPU offers plenty of outputs, namely one HDMI port and three DisplayPort sockets, while a PS/2 port on the I/O panel ensures

compatibility with any older keyboard or mouse you can't bear to part with.

Between this varied connectivity, the fast GPU, quality storage and thoughtfully designed chassis, the Quiet PC i7-2070S will be a good choice for anyone with the budget for a high-end gaming system but also with a taste for something more grown-up.

That said, if you're more willing to indulge the extravagant side of premium desktops, AlphaBetaPC has also produced the AMD Ryzen 7 Pro Gaming Desktop PC (Shopper 388). This is bulkier and far flashier, which won't be to everyone's tastes, and also costs £151 more – but then that's not much extra when you're already spending 10 times that, and in exchange, you get a much more powerful Ryzen 7 3800X processor, as well as an even more powerful RTX 2080 Super graphics card.

James Archer

SPECIFICATIONS

PROCESSOR Octa-core 4.8GHz Intel Core i7-10700K • **RAM** 32GB DDR4 • **FRONT USB PORTS** 2x USB3 • **REAR USB PORTS** 2x USB2, 2x USB3, 1x USB3.1, 1x USB Type-C • **TOTAL STORAGE** 960GB SSD, 2TB hard disk • **GRAPHICS CARD** 8GB Gigabyte GeForce RTX 2070 Super Windforce OC 3X 8G • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 Home • **WARRANTY** Three years RTB including 30 days collect and return • **DETAILS** www.alphabeta.com • **PART CODE** Quiet PC i7-2070S

Windows overall	233
Multitasking	252
Dirt Showdown	190fps
Metro Last Light	120fps

0% -50 Reference +50 +100

See page 90 for performance details

AMD IMPULSE (RYZ7)

AMD Ryzen 5 2600 - 6 Cores (O.C 4Ghz)

ASUS PRIME B450M-A

CORSAIR 8GB DDR4 3000Mhz

INTEL 512GB M.2 nVME 660P

AMD RX 560 2GB

GAMEMAX Expedition

MICROSOFT Windows 10 or 10 Pro

£499.99

Impulse

£599.99

mercury

£1249.99

NAVIGATOR

AMD NAVIGATOR (RYZ8)

AMD Ryzen 5 3600X (O.C 4.3Ghz)

ASUS TUF X570-Plus Gaming

CORSAIR 16GB DDR4 3600Mhz - RGB

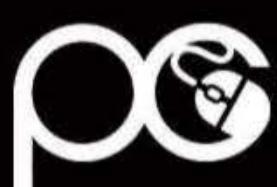
INTEL 512GB M.2 nVME 660P

SEAGATE 2TB Sata3 HDD

AMD 5700XT 8GB

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WINDOWS 10 LAPTOP

AVITA Pura 14 R5



£439 • From www.studio.co.uk

VERDICT

A surprisingly potent budget laptop, let down by its plasticky build and dull display

UNEXPECTEDLY, GIVEN ITS relative lack of laptop pedigree, we quite liked the Avita Liber 14 (*Shopper* 382). It was, and still is, a very respectable budget clamshell, with a solid-feeling aluminium chassis and other higher-end features such as a built-in fingerprint reader.

Avita's newest laptop, the Pura 14 R5, is even cheaper; there certainly aren't many 14in laptops this close to £400, especially not with mid-range Ryzen 5 processors as this one has. However, with this affordability, the Pura 14 R5 also retreats from the plusher features of its Liber 14 cousin.

CRYING OUT LOUD

At a glance, the Pura 14 R5 does a good job of at least replicating the aesthetic of a modern lightweight. Instead of the flowery decals on the Liber 14, you get a smart, solid silvery grey, with tasteful branding and what appears to be brushed aluminium around the keyboard. It's not eye-catching slim, but it's not unduly chunky either, and feels light enough to carry without complaint.

However, with any real amount of time under your fingertips, the Pura 14 R5's budget tendencies reveal themselves. The whole chassis is plastic, not metal – the brushed effect is exactly that, an effect – and in stark contrast to the Liber 14, it's not been put together too solidly either. There's an audible creaking sound to be heard whenever handling the base, especially from within the keyboard area, almost as if the keyboard's membrane is crinkling. There's not much visible flexing when you apply pressure to a corner, but there's not much of a sense that you're holding a quality product.

Another noise complaint could be made against the fan, which is keen to kick around at maximum speed even when the CPU is only handling lightweight software. Despite this, the Pura 14 R5 runs hot to the touch, to the point where we could only use it comfortably when it was perched on a desk.

Connectivity is, thankfully, better. With two USB3 ports, one USB Type-C, a microSD card slot, a 3.5mm headphone jack and a full-size HDMI output, the Pura 14 R5 isn't just equipped with a versatile range of sockets, it



also outdoes the Liber 14, which had only a Micro HDMI output instead of a full-size one, and mixed in a slower USB2 port instead of sticking to the USB3 standard.

LOW KEY

Sadly, this laptop lacks the integrated fingerprint reader of the Liber 14. Normally we wouldn't expect this particular feature from such a cheap laptop, but knowing Avita has form for including it on sub-£500 models, it does end up being a disappointing omission.

One thing it has in common with the Liber 14 is a spongy-feeling keyboard. Other than the single-row Enter key initially throwing us off, it's all laid out sensibly, but don't expect much in the way of tactile response. This is as basic as laptop keyboards come, and that means no backlighting, shallow travel distance and plasticky keycaps.

It's also a shame to see the trackpad much smaller than it was on the Liber 14. It still works well enough, and feels smoother than

Judging by the incredibly high average delta-E of 4.65, it doesn't reproduce the available hues with much accuracy, either.

Compounding the problem is a very low peak brightness of 192cd/m², which drops to an even duller 113cd/m² on battery power. The only decent showing comes with contrast, which hits a competent 1,052:1, though that's not enough to perk up this dim display. At least its matt coating will ward off reflections, something the low brightness would otherwise leave it vulnerable to.

SAVING PACE

As it stands, the Pura 14 R5 is in dire need of a lifeline, and in fairness that's exactly what it gets: performance is very good by budget standards. Although its 4GB of RAM looks weedy, it's been paired with a quad-core AMD Ryzen 5 3500U, the same chip recently seen propelling the Honor MagicBook 14 (*Shopper* 391) to speeds on a par with the most expensive ultraportables.

The Pura 14 R5's CPU power is practically unheard of among budget Windows laptops, and its storage is pretty nifty too

the overly matt pads you sometimes get on cheap laptops, but you can tell – from the gaps between it and both the keyboard and lower edge – that its dimensions aren't making the most of the available space.

The display, too, is poor. A Full HD resolution – 1,920x1,080 – is good enough for a 14in screen in terms of sharpness, but the TFT panel covers only 57.4% of the sRGB colour gamut, so it looks dull and flat.

The Pura 14 R5 doesn't reach such heady heights, but still performed very nicely in our 4K benchmarks: it scored 107 in the image test, 83 in the video test, 64 in the multitasking test and 78 overall. Although that last score is short of the MagicBook 14's 109 – down in part to the Honor laptop having twice as much RAM and, we suspect, better cooling – it's enough to put the Pura 14 R5 on a par with the likes of the Samsung Galaxy





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Book Ion (*Shopper* 392) and Huawei MateBook X Pro (*Shopper* 389), both of which are £1,000-plus flagship ultraportables. It's also a big step up from the Liber 14, which only scored 47 overall.

There's also enough integrated graphics power for basic gaming, albeit with the emphasis on 'basic'. Dirt Showdown ran at a playable 44fps at 720p resolution and on the High quality preset, though at native 1080p with the Ultra preset, this dropped to 14fps.

FOND MEMORY

You get a decent storage setup, too. The 256GB SSD only runs at SATA speeds, not NVMe, but that's to be expected given the pricing, and it's not exactly a slowpoke either. We recorded sequential read and write speeds of 434MB/s and 439MB/s respectively, which will suit standard everyday use just fine.

The capacity is also notably double that of the Liber 14's SSD, and makes it much less likely that you'll need to rely on the SD card slot as a Chromebook-style permanent expanded storage slot. Speaking of which, it's always better to have an SSD than the kind of sluggish eMMC Flash drive often used by budget Chromebooks, not to mention mechanical hard disks that can slow down Windows-based laptops in this price range.

Battery life, unfortunately, brings the Pura 14 R5 back down to earth. The fact that screen brightness can only reach 113cd/m² on battery power complicated our video playback test, as this is usually performed at 170cd/m²;

that would seemingly give Avita's laptop a cheeky advantage, but even so it only lasted for a deeply mediocre 5h 26m. That's an hour and a half less than the Liber 14, as well as the even cheaper Acer Chromebook Spin 311 (*Shopper* 391).

PUSH AND PULL

Cutbacks are to be expected at such a low price point, but then Avita already had the blueprint for a good budget clamshell in the Liber 14, so it's hard not to look at the Pura 14 R5 and notice the regression. The screen and build quality are both worse, it doesn't last nearly as long on battery power, and it's lacking in the little luxuries that can make you feel like you're using a superior product, such as the Liber 14's fingerprint sensor and upsized trackpad.

At the same time, the Pura 14 R5's CPU power is practically unheard of among budget Windows laptops, and its storage is pretty nifty too, so Avita has at least improved its grasp on the fundamentals. It would mean having to make peace with those other drawbacks, but for someone who needs the absolute most bang for their buck, the Pura 14 R5 is a rare high performer well below the £500 mark.

In the future, however, we hope that Avita will aim for the best of both worlds: a laptop with the Liber 14's build quality and the Pura 14 R5's performance would be a very compelling prospect indeed.

James Archer

SPECIFICATIONS

PROCESSOR	Quad-core 2.1GHz AMD Ryzen 5 3500U
RAM	4GB
DIMENSIONS	332x221x20mm
WEIGHT	1.21kg
SCREEN SIZE	14in
SCREEN RESOLUTION	1,920x1,080
GRAPHICS ADAPTOR	AMD Radeon Vega 8
TOTAL STORAGE	256GB SSD
OPERATING SYSTEM	Windows 10 Home
WARRANTY	One year RTB
DETAILS	www.avita.com
PART CODE	NS14A6UKV441-IG



WINDOWS 10 GAMING LAPTOP

PC SPECIALIST

Cosmos XR



£849 • From www.pc specialist.co.uk

VERDICT

A competent and cleanly designed gaming notebook, though its display isn't as vivid as it is fast

CUSTOM DESKTOPS AREN'T the only machines under PC Specialist's purview. Its Cosmos XR, for one, is a ready-made gaming laptop, and a reasonably priced one at that, even if that means a mix of mid-range and more basic components, like the Intel Core i5-10300H CPU, 8GB of RAM and GeForce GTX 1650 graphics chip.

Measuring 359x238x22mm, it sits between the slimmest gaming laptops and the chunkier designs of yesteryear. It's manageably sized in any case, and is just light enough to be comfortably carried with one hand.

REAR LOADER

There's also an appealing simplicity to the magnesium alloy chassis; there's no gaming overdesign here. It's equipped with a helpfully diverse range of ports, with the left side combining one USB2, one USB3 and separate mic and headphone sockets, while the right serves up another USB3 port, a USB Type-C, an SD card reader and a neat fold-out Ethernet jack. We also like how the power, HDMI output and Mini DisplayPort are positioned on the back, so their cables won't encroach on your desk space as much.

It's great to see Wi-Fi 6 support, too, along with Bluetooth 5.1, both benefits granted by the 10th-gen Intel chips.

Many cheaper – by which we mean, less expensive – gaming laptops make do with a very simple, mushy membrane keyboard. Fortunately, the Cosmos XR aims a little higher: its key switches aren't mechanical but have a nice, firm response to each press, offering just a dash of audible feedback when



typing but not clacking enough to disturb you when playing games. It's all backlit, too.

Squeezing in a number pad has forced each keycap to be slightly slimmer than you might be used to, but for us this didn't prove to be the cause of any typing errors. Conversely, the trackpad is spacious, and has a beautifully smooth finish that's perfect for swipes and multitouch gestures.

COLOUR DRAIN

It's so far, so good for the Cosmos XR, although testing the 15.6in, 1,920x1,080 display revealed some weaknesses. Not the most colourful screen to have ever graced a laptop – in fact, its 57% coverage of the sRGB gamut is quite poor. As is colour accuracy, with a very high average delta-E of 5.01.

Contrast is decent, at 1,021:1, but there's nothing special about it, nor the Cosmos XR's peak brightness of 267cd/m².

In one very big way, however, this display regains a lot of credibility: its 120Hz refresh rate makes games look much smoother than they would on a 60Hz screen, provided they're running at a sufficiently high frame rate. What's more, PC Specialist told us after we'd received the Cosmos XR that it will actually be sold with a 144Hz panel, which will likely look even smoother.

Still, remember that the Cosmos XR's GTX 1650 is a relatively modest dedicated GPU. It could pump out the frames in *Dirt Showdown* without issue, averaging 86fps at native 1080p with the Ultra quality preset, but using the equivalent settings in *Metro: Last Light Redux*, it just scraped to 33fps.

That's still technically playable, but for £150 more you could have the Acer Nitro 5 AN517, which has a much faster RTX 2060 as well as an older but more powerful CPU.

The Cosmos XR performed respectably in our benchmarks, scoring 125 in our multitasking test and 130 overall, but the Nitro 5 AN517 is even better with 164 overall.

Acer's laptop also has a faster SSD, though the Cosmos XR's own 256GB drive is

light on its feet as well. We measured a sequential read speed of 1,665MB/s and a sequential write speed of 1,084MB/s, both good results that will ensure short load times.

In our battery test, the Cosmos XR lasted for 3h 54m before running dry. As with the display, this isn't the worst it could be – it's not uncommon for gaming laptops to crash out in less than a couple of hours – but then battery life is also an area that other recent models have improved upon. The Nitro 5 AN517 lasted for 5h 38m and the admittedly more expensive Gigabyte Aorus 15G (Shopper 391) made it all the way to 6h 25m.

WELL PLAYED

Despite more than a couple of shortcomings, however, the Cosmos XR has enough appeal to make itself a viable sub-£1,000 gaming option, even if it's not the outright best. Acer's Nitro 5 AN517 is clearly a better performer, and for not much more cash, but it lacks the build quality and smart finish of PC Specialist's effort. The Cosmos XR's keyboard and trackpad are particular strong points, and Wi-Fi 6 is an excellent bonus as well.

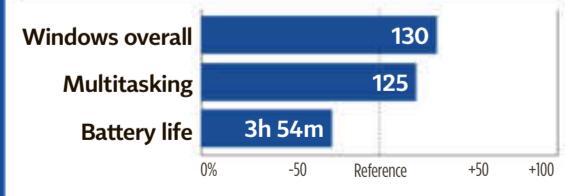
The main issues you'd have to put up with are the low battery life and general lack of vibrancy in the display, but even then, dull hues aren't enough to spoil the experience completely, especially when the 120Hz refresh rate – or 144Hz, in the retail version's case – is smoothing things over.

James Archer



SPECIFICATIONS

PROCESSOR	Quad-core 2.5GHz Core i5-10300H	• RAM	8GB
• DIMENSIONS	359x238x22mm	• WEIGHT	Not stated
SCREEN SIZE	15.6in	• SCREEN RESOLUTION	1,920x1,080
GRAPHICS ADAPTOR	Nvidia GeForce GTX 1650	• TOTAL STORAGE	256GB SSD
OPERATING SYSTEM	Windows 10 Home	• WARRANTY	Three years labour, one year parts, one month collect and return
• DETAILS	www.pc specialist.co.uk		
• PART CODE	Cosmos XR		



See page 90 for performance details



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WINDOWS 10 ULTRAPORTABLE

ACER Swift 3 (2020)



£812 • From www.amazon.co.uk

VERDICT

The Swift 3 is a highly portable, speedy laptop with a lovely Full HD display and just a few rough edges

KEEPING WITH ITS role as the least expensive of the Swift range, the Swift 3 could be seen as a more sensible choice of ultraportable. Unlike the latest Dell XPS 13 (Shopper 392) or Microsoft Surface Laptop 3 (Shopper 385), it won't inspire the awe and jealousy of your friends and colleagues, but it's the laptop to buy if you want a competent, well-made machine that gets the job done without breaking the bank.

While it may not be the most luxurious Windows 10 ultraportable on the market, it's one of the most keenly priced. The question is, can you spend less and do even better?

NEW AND IMPROVED

The history of the Swift 3 – this is the latest in a line of refreshes – hasn't exactly been glorious. Several of the previous models were underpowered disappointments, which is why it's such a relief to see that the 2020 version is surprisingly well specified.

Running Windows 10 Home, it's powered by a 10th-Gen Intel Core i7-1065G7 CPU with integrated Intel Iris Plus Graphics and backed by 8GB of RAM. For storage, it has a 512GB SSD, and its 14in IPS non-touch display has a Full HD resolution. You can also get the Acer Swift 3 (2020) with an Intel Core i5-1035G1 processor, but it's harder to find online.

The Swift 3's design could be described as minimalist, but that might be being a bit generous. It's no beauty, favouring function over frills, but it is fairly well put together. The laptop is encased in a thin metal chassis and finished in plain iron grey. Although for the most part it's a sturdy build, the lid and wrist rest could do with some reinforcement.

Weighing 1.2kg and measuring 320x217x15.6mm, it's a lightweight, slender machine. It isn't quite as slim as the LG Gram 14 – but then again, nothing is. Acer has incorporated a robust 180° hinge on the Swift 3, and this swivels back and forth with ease, making it a pleasure to open up. The Swift's bezel-to-screen ratio is good, too, with slim borders on the left and right and thicker bezels on the top and bottom. Its bog-standard 720p webcam is housed in the bezel above the display.

There's a decent selection of ports here, including an HDMI output and a Thunderbolt

3-compatible USB Type-C slot on the left-hand side along with the power connector and a USB3.1 port. On the right is a 3.5mm audio jack, one USB2 port and a cable lock slot, and below the keyboard is a recessed rectangular fingerprint reader. It's an unusual shape for a fingerprint sensor, and we found it had a hard time reading our prints, so you're probably better off just typing in a PIN.

RAGE UP

The keyboard has a standard chiclet-style design with three levels of LED backlighting. There's not much travel to the keys and they have a muted sound when pressed, so typing is fairly quiet as a result. Because there's not much space to work with, the keyboard layout is compact, meaning that some keys have been downsized or squeezed together.

This is mostly fine apart from the arrow, Page Up and Page Down keys, all of which have been squashed into a tiny space in the corner. We accidentally hit both of the latter with a maddening frequency, to the point we ended up disabling them. At least there are no complaints about the trackpad; it's on the small side but it's responsive enough, and the diving board-style clickers work well.

Somewhat unexpectedly, the Swift 3's 14in, 1,920x1,080 IPS display is fantastic. Both of the previous two Swift 3 versions had pretty terrible screens – not this one.

Covering 93.7% of the sRGB colour gamut and with an average delta-E of 1.74, it's impressively vibrant and accurate, too. It hits 291cd/m² at peak brightness, which is perfectly fine for a typical working environment, and its 1,232:1 contrast ratio lends the screen plenty of pop.

WHINE TASTING

The Swift 3 has a pair of tinny speakers located on the underside of the chassis. These stereo speakers aren't very loud, however, and the bass is awful: whatever you're playing, music comes across sounding whiny and metallic. They're fine for Zoom calls and YouTube videos, but that's about it.

As with many other 14in notebooks we've tested this year, the Swift 3 runs on a quad-core Intel Core i7-1065G7 processor with a base clock speed of 1.3GHz and a maximum frequency of 3.9GHz. This is supported by 8GB of RAM, which is soldered in and thus goes without free slots for expansion, but you shouldn't need more on a laptop of this specification.

In day-to-day use, the Swift 3 feels snappy enough. It powers on rapidly, boots up games without issue and seems comfortable running dozens of Chrome tabs at once. However,

our review unit let out a persistent humming noise, even when the CPU wasn't being taxed that heavily.

In our 4K media benchmark, the Swift 3 performed roughly as expected, reaching an overall score of 87, beating the 75 achieved by the Core i5-powered Swift 5 from last year.

It's outperformed by the XPS 13 and Surface Laptop 3, despite both having the same CPU, but then again they also have twice as much memory





and are far more expensive. Interestingly, all these laptops are beaten by the Honor MagicBook 14 (Shopper 390), which hit 109 in the 4K media test with its AMD Ryzen 5 3500 processor and 8GB of RAM.

FAST FINISH

The Core i7-1065G7 has an integrated Intel Iris Plus Graphics chip, so while it's no gaming laptop, the Swift can at least get a wider range of games running playably than the more common UHD Graphics 630 GPU. This included a smooth 54fps in Dirt Showdown, and even Metro: Last Light can make it to 30fps if you settle for lower graphical quality. Using the High preset, it only reached 25fps.

You also get a rather spacious NVMe SSD: 512GB, to be exact. In the AS SSD test, it recorded a sequential file read speed of 1,567MB/s and a write speed of 1,382MB/s. That read speed in particular is behind the likes of the XPS 13 and MagicBook 14, but then it's still pretty quick compared to SATA SSDs and any mechanical hard disk.

The battery life isn't great, however. In our video rundown test, the Swift 3 lasted only 6h 15m before powering down. With laptops such as the Dell XPS 13 cruising over the 10-hour mark, we were expecting more from the Swift. As it stands, you'll be needing to top up its 48Wh battery at least once during the average working day.

At just over £800, the latest Swift 3 is positioned quite neatly between the luxurious ultraportables of Dell and Microsoft and the tempting affordability of Honor's MagicBook 14. It's a strong performer in most areas thanks to its cutting-edge Intel processor, and its Full HD display is as good as you could hope for in a laptop of this price. The build quality is great for the money, too.

HUM DRUM

There are a few things holding it back from an unqualified recommendation, however. First, there's that insistent humming noise. Second, there's the sub-par battery life; it's just not an all-day, take-it-anywhere work unit. Lastly, there's the weak audio and that awkward cursor key placement.

So what do you buy, if not this? The £549 Honor MagicBook 14 is the obvious choice so long as you don't mind the display's poor colour accuracy. And if money is less of an issue, then you can't go wrong with the Surface Laptop 3 or the XPS 13.

Tom Bruce



SPECIFICATIONS

PROCESSOR	Quad-core 1.3GHz Intel Core i7-1065G7
RAM	8GB
DIMENSIONS	320x217x15.6mm
WEIGHT	1.2kg
SCREEN SIZE	14in
SCREEN RESOLUTION	1,920x1,080
GRAPHICS ADAPTOR	Intel Iris Plus Graphics
TOTAL STORAGE	512GB SSD
OPERATING SYSTEM	Windows 10 Home
WARRANTY	One year RTB
DETAILS	www.acer.com
PART CODE	SF314-57



See page 90 for performance details

3.5mm MICROPHONE ADAPTOR

ASUS AI Noise-Canceling Mic Adapter

COMPUTER
SHOPPER
RECOMMENDED



£40 • From www.amazon.co.uk

VERDICT

Although it doesn't entirely leave your own speech unaffected, this adaptor's noise cancellation works a treat

THIS DIMINUTIVE DONGLE is the rarest of technology products: one you might buy to benefit others, rather than yourself. A 3.5mm-to-USB Type-C adaptor, it's designed not to enhance the audio output of your headphones, but to cut down on ambient noise that your microphone might pick up.

It's probably true that, especially in recent months, a good chunk of us have been on the end of a phone or video call where a washing machine is whirring away in the background, or heard a friend's housemate's TV bleed though voice chat during a gaming session. The AI Noise-Canceling Mic Adapter aims to intercept these distractions, using machine learning to identify and silence unwanted noise while allowing purposeful speech to come through unimpeded.

GROUP CHAT

It's a similar concept, if varying in execution, to the RTX Voice system Nvidia launched earlier this year. This too uses AI to suppress background noise coming through a microphone and, while effective, it's also relatively limited. It only works on Windows 10, and not only does it specifically require a GeForce RTX or Quadro RTX graphics card – none of which are especially cheap – it also puts a surprising strain on the GPU, causing performance drops when gaming.

The AI Noise-Canceling Mic Adapter has no such hardware requirements. As long as your microphone or headset can plug into the 3.5mm end, everything is handled by and on



the adaptor itself, so there's no performance hit, and it's plug-and-play-compatible with a vast range of devices, from basic Chromebooks to ultraportable laptops, gaming PCs to the handheld Nintendo Switch.

All you need is a USB Type-C port, or even just a USB2 port, as a Type-C-to-USB2 adaptor (as in, an adaptor for the adaptor) is included in the box. Even Android smartphones are compatible, and if your handset lacks a 3.5mm headphone jack, it also functions as a straightforward adaptor for wired headphones, thanks to the onboard DAC.

It's clearly much more flexible than RTX Voice, and at £40 it's reasonably priced. Another, purely software-based noise cancellation option, Krisp, costs about the same for one year of unlimited use; the AI Noise-Canceling Mic Adapter should, avoiding any mishaps, last much longer than that. Still, squeezing a feature that can require a big bite of premium GPU power into a small dongle is quite the ask, and ultimately Asus's adaptor will live or die on how well it cancels noise.

SHUSH HOUR

Luckily, it actually performed beyond our expectations. We made recordings of a headset microphone while various items made a racket around us, starting with a kitchen extractor fan. Without the adaptor, its droning hum could be heard, but with it installed, that noise was subdued completely, to the point we couldn't hear it on our recording with the speakers on maximum volume.

It was a similar story with our next test subject, an electric fan. This was much closer to the microphone, to the point of producing some mild air turbulence sound, but again the AI Noise-Canceling Mic Adapter completely silenced it.

In both of these cases, the offending noise is consistent and predictable, which we know from noise-cancelling headphones makes for the easiest type of sound to cut out. For more free-flowing noise, this adaptor is no slouch: it can even help fix a build quality issue of some headsets, namely headphone bleed.

This is where whatever is playing through your headset's headphones is picked up by your own microphone, resulting in an unpleasant repetition effect for anyone on the other end of a call. We played some loud music through ours, and sure enough it came through clearly on the mic, but after fitting the adaptor, the same music was inaudible.

It also gave a spirited, if less perfect, performance in cancelling out the sound of a nearby TV. With the adaptor, some brief snippets of dialogue could still be heard, but even those became much quieter.

As a final test, we tried breathing directly on to the microphone to simulate the ever-uncomfortable experience of a friend or family member having theirs too close to their face. We're glad to report that the AI Noise-Canceling Mic Adapter mostly eliminates such creepy exhaling, leaving only some very brief, essentially unidentifiable vestiges of the original sound.

QUIET LIFE

Strictly in terms of how well it cancels noise, this smart yet simple gadget is definitely a success – but there is one problem. Although the user's own speech is allowed past the noise cancellation without cutting in and out, we found that speech quality overall sounded worse when it was passing through the adaptor. Compared to when our headset mic was connected straight into one of our PC's 3.5mm inputs, running it through the adaptor made our speech a bit grainier, as though we were speaking on a telephone.

How important that is depends on whether you want maximum clarity for professional calls and intense gaming sessions, or if you're happy with some slight fuzziness in exchange for blocking out ambient noise during more leisurely chats. Either way, this adaptor's noise cancellation talents are very impressive indeed.

James Archer

SPECIFICATIONS

INTERFACE 3.5mm to USB Type-C/USB2 • WARRANTY One year RTB • DETAILS www.asus.com/uk • PART CODE POYH02L1-B2UA00



↑ The adaptor does a good job of cutting out unwanted noise

LASER MULTIFUNCTION PERIPHERAL

XEROX B205



£158 • From printerbase.co.uk

VERDICT

Xerox's B205 is a good laser MFP, but it could be cheaper to buy and run

EAGERLY JOINING THE Xerox B215 mono laser MFP (*Shopper 382*) is the much cheaper B205. Its more illustrious sibling has a showy colour touchscreen and automatic duplex (double-sided) printing, but the B205 makes do with a basic mono display and expects you to manually turn the paper over.

Despite these limitations, it has many good features. The B205 supports both wired and wireless networks, and despite its basic screen there's a front-panel USB port supporting walk-up prints and scanning. Its 30-page-per-minute (ppm) print engine should be more than fast enough for a home office, while it's built for an impressive 30,000-page monthly duty cycle (although that's the one-off maximum). Unusually at this price, there's also support for the PostScript print language.

DUSTY PRINT FIELD

At the B205's base is a 250-sheet paper tray, which can't be upgraded. Fill it with A4 paper and it projects, uncovered, out of the back – if you leave the printer idle, you could find the first page dusty. Both the 40-page automatic document feeder and the 120-sheet paper output tray have flip-up stops to arrest paper. There's little clearance between the latter and the base of the scanner: there's a knack to extending it without trapping your finger.

In use, this is a quiet MFP even in spite of its relatively quick printer. There are no harsh notes to the paper mechanism or

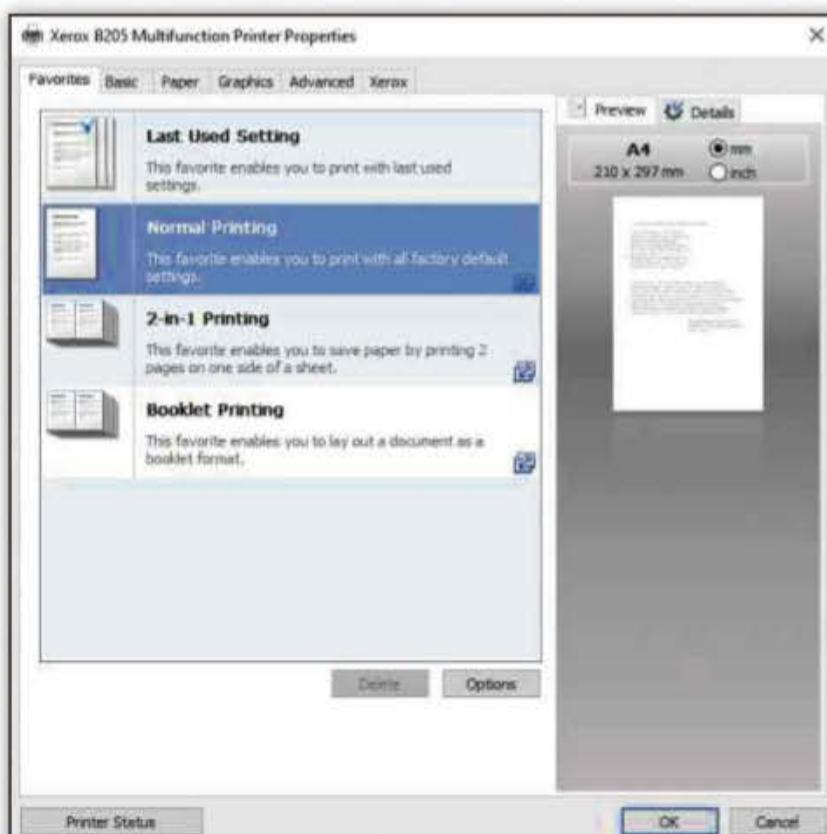


Generally, the B205 produced excellent results. Text was perfect when using the PostScript driver

the fans, and the scanner head moves with a lovely whirr. Sadly, it's harsher when parking after a scan. The fans shut down quickly after jobs, helping prevent intrusion in a small or quiet office.

The B205 performed strongly across our tests. From standby it produced a first page of text in 10 seconds, and went on to hit 26.8ppm on our 25-page test. After an hour in sleep mode, the first page took 22 seconds. The printer's slower 20ppm performance on our mixed graphics test was almost entirely down to a longer spool time; there were no further pauses once it began physically printing. Photocopies were also swift, with a single page completing in 10 seconds. The ADF dispatched a 10-page job in an impressive 38 seconds.

Scans were quick, with previews and A4 scans completing in 12 seconds or less at resolutions up to 300 dots per inch (dpi). When trying to scan at 600dpi, however, we encountered exactly the same driver crash as we did with the B215. Switching to the supplied Easy Document Creator allowed us to complete a photo scan in just 14 seconds, but this software doesn't support the scanner's maximum 1,200dpi resolution.



↑ The B205's features are fairly basic, but print quality is good

Generally, the B205 produced excellent results. Text was near-perfect using the default PCL driver, and it was perfect when using the PostScript driver. Printed graphics were good, with barely noticeable artefacts, while scans were more than up to everyday office work.

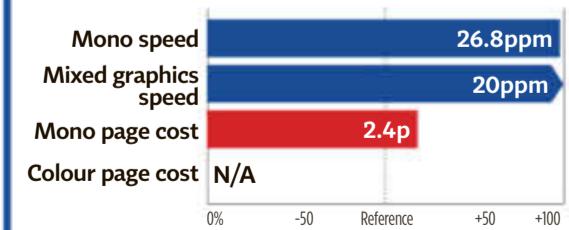
TONER CONTENTION

The B205 arrives with a 1,500-page starter toner, and takes high-capacity replacements rated at 3,000 pages. Factoring in the 10,000-page drum, running costs work out at 2.4p per page, which is a little on the high side given that this isn't exactly a cheap device. The B205 is a decent choice, but heavy-duty users would save money overall by opting for HP's Neverstop 1202nw (*Shopper 390*).

Simon Handby

SPECIFICATIONS

TECHNOLOGY	Mono laser	• MAXIMUM PRINT
RESOLUTION	600x600dpi	• MAXIMUM OPTICAL SCAN
RESOLUTION (OUTPUT BIT DEPTH)	1,200x1,200dpi (24-bit)	
• DIMENSIONS	366x401x362mm	• WEIGHT 11kg
MAXIMUM PAPER SIZE	A4/legal	• WARRANTY One year replacement
DETAILS	www.xerox.co.uk	•
PART CODE	B205V_NI	



See page 90 for performance details

CURVED QHD MONITOR

MSI Optix MAG272CQR



£399 • From www.amazon.co.uk

VERDICT

The appeal of this fast and strongly curved gaming monitor manages to endure a few foibles

CURVED SCREENS AREN'T just for titanic ultrawide monitors you'd struggle to fully see otherwise. Even on a mid-sized monitor such as this, the 27in Optix MAG272CQR, a rounded shape can provide a certain immersive effect that's particularly well suited to gaming or watching films.

At £399 it's expensive for its size, but with its curved VA panel – running at a 2,560x1,440 resolution and with a speedy 165Hz refresh rate – it's highly spec'd, too.

ARC RIVAL

This is unmistakably a gaming monitor, what with the swooshing finish on its plastic back panel and accompanying strip of RGB lighting. Viewed from the front, there's no such pomp, though the top and side borders are all modishly slim.

At 1500R, the Optix MAG272CQR's curvature is a little tighter than the 1800R norm. Fortunately, this doesn't mean it's like looking into a section of a Pringles can – it just helps the corners fill your peripheral vision slightly better. We used it right next to a flat 27in monitor, and we felt as though we didn't need to work our eyes as much to focus on the Optix MAG272CQR's furthest edges.

The stand is pretty good, too. It keeps a firm grip on the screen, with almost no



wobble at all, and both height and tilt adjustment are included. There's no rotating the screen into portrait mode, but that wouldn't make sense with a curved monitor anyway. The

lack of pivot adjustment is more keenly felt, so you'll need those long, raised metal feet positioned front and centre.

This base design takes up a lot of space in terms of the purely horizontal footprint, but unlike with, say, the similarly pronged LG 27GL850 (*Shopper 392*), the raised design allows you to slip small items underneath the legs; as such, it's not quite as much of a desk hog. Alternatively, you could detach the entire stand and fit it with a 100x100mm VESA mounting plate for use with a wall mount or a different stand entirely.

PORTS OF CALL

The port range is commendably varied: input options range from one DisplayPort and two HDMI ports to a USB Type-C socket, although this can't carry data, only video and power. Still, two USB3 ports can handle peripherals, so long as your PC is also connected via the USB Type-B port, and a 3.5mm headphone jack completes the set.

While a relative of the outrageously feature-rammed Optix MPG341CQR (*Shopper 384*), the much cheaper Optix MAG272CQR's remaining bells and whistles are limited to a small pop-out headset hook on the left edge. It does the job, in any case.

Other than a simple power button on the underside, the Optix MAG272CQR wisely

adopts a joystick as an all-in-one control scheme. This is easily better than having a range of buttons: it's faster and more intuitive to flick through the onscreen display (OSD) menus than

having a load of different buttons performing different actions. Our only complaint is that while the joystick being placed on the rear of the monitor isn't an issue in itself, it's sufficiently far away from the bottom edge and right side that those with small hands might need to stretch to reach it.

Otherwise, it proved quick and easy to get set up within the OSD. We've always liked how MSI's menu designs tend to keep key information (like the current refresh rate and FreeSync status) permanently at the top, for an at-a-glance reference, and deep-diving into the menus reveals a good range of options.

Under the Image tab, for instance, there's not just the expected brightness and contrast sliders, but also an optional sharpening filter with five levels of intensity. Don't whack this up too high, though: levels one and two hone the image, but anything above that makes finer details such as text look a little distorted.

DIFFERENT FLAVOURS

There are also loads of different display profiles, split across the Gaming and Professional tabs. While most of these make overly drastic changes to image quality (the Racing profile, for instance, cranks up saturation and overdoes the sharpening filter), some of these can be more practical, such as the low-blue-light Reader mode.

If you just want self-tailored settings, simply stick with the default User profile and





customise it with whatever tweaks and extras you want; the refresh rate and response time can be altered from the Gaming tab as well. Beware of the enticing-sounding Anti-Motion Blur setting, however: it cuts brightness in half, disables frame-rate syncing and locks the response time to its highest setting.

Lastly, if all that menu-wrangling doesn't appeal, you can just assign shortcuts to the joystick. Pressing it straight down will always open the full OSD, but pushing it up, down, left or right can helpfully bring up a quick-access toggle or slider for your chosen options, such as opening a preferred profile or the brightness and contrast sliders.

MISSED THE BRIGHT SIDE

When it comes to picture quality, VA panels are always going to have certain baked-in qualities or drawbacks: they typically have great contrast, for example, but their viewing angles aren't the best. Both are true of the Optix MAG272CQR, even if the curved shape essentially forces you into viewing the screen from a central position, making viewing angles less of an issue.

Using entirely default settings (except brightness, which we whacked up to full), we recorded a high contrast ratio of 2,534:1 and sRGB gamut coverage of 98.5%. These are very commanding performance figures for out-of-the-box settings, and anecdotally they make for a palette that's lively without too much excess pop.

Then again, average delta-E came in at 3.5, so it's not particularly colour-accurate. How important this is will mainly depend on what you want a new monitor for: in games, it's not much of a factor, but for editing videos or reviewing photos you've taken, it's perhaps too far off the mark.

The 300cd/m² peak brightness result also means that the Optix MAG272CQR's claimed HDR support is a bust, as this isn't high enough to meet the DisplayHDR 400 standard, the lowest possible for 'true' HDR. However, it's fine enough for general use, and with the screen's matt finish we didn't suffer any problems with glare or reflections even in a well-lit room.

Of all the available pre-set profiles, the Designer setting sounded as though it would improve on these results the most. To be fair, it did bump brightness up to 348cd/m² and contrast even higher up to 2,999:1, while sRGB coverage stayed at 98.5% exactly. Given the name, however, we were surprised to see average delta-E shoot to an awful 13.2, making the Designer profile even worse for design work.

Nevertheless, this is a gaming machine in heart and mind, so attention must be turned

to the Response Time setting. MSI claims a minimum 1ms MPRT response time, presumably using the Fastest setting; this can be dropped down to Fast or Normal. The latter leaves in motion blur, which is heavily cut down on both the Fast and Fastest settings, so it's definitely worth choosing one of the latter.

Unfortunately, none of these settings could overcome the Optix MAG272CQR's ghosting habit. This is, again, a common weakness of VA monitors, and although this one doesn't have it as bad as the AOC C27G2ZE (*Shopper 392*), there were still visible coronas left in the wake of fast-moving objects.

That said, it's not so bad to be offputting when actually playing games. Ghosting is noticeable when you're looking for it, as we were in our usual UFO test (www.testufo.com/ghosting), but in the thick of the action it's actually easy to miss.

The 165Hz refresh rate also allows for sumptuously smooth gaming at higher frame rates, and although only AMD's anti-tearing FreeSync tech is supported officially, Nvidia's equivalent G-Sync is 'compatible' within the same 48-165Hz range. The piggybacking G-Sync worked well in testing, with only a smidgen of screen tearing above 170Hz and eliminated entirely within its effective range.

BEND GAME

The Optix MAG272CQR ends up reminding us more of the flat LG 27GL850 than curved brethren such as the C27G2ZE: both are 27in, QHD monitors that make up for imperfect colour accuracy with considerable high-speed gaming prowess.

Admittedly, given the choice we'd rather own the 27GL850. It's not curved and its refresh rate is 'only' 144Hz, but its more vibrant IPS panel is both free of ghosting and just a tad nicer to look at more generally. It's been dropping in price recently, too, and is currently only £40 more than the VA-equipped MAG272CQR.

If, however, you want to try a curved monitor specifically, the Optix MAG272CQR remains a respectable option all round.

James Archer

SPECIFICATIONS

SCREEN SIZE 27in • RESOLUTION 2,560x1,440 • SCREEN TECHNOLOGY VA • REFRESH RATE 165Hz • VIDEO INPUTS HDMI, DisplayPort, USB Type-C • WARRANTY Three years RTB • DETAILS www.msi.com • PART CODE 3CA6

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FIRE OS TABLET

AMAZON Fire HD 8 (2020)

COMPUTER
SHOPPER
BEST BUY



£90 • From www.amazon.co.uk

VERDICT

Amazon's budget-priced tablet adds a faster processor, more RAM and USB Type-C for its best version yet

NEVER ONE TO shy away from a hardware update, Amazon has brought back two of its budget Fire OS tablets for another round: the Fire HD 8 and Fire HD 8 Plus (opposite).

You can probably guess that the Fire HD 8 is the cheaper of the two, and at first it doesn't look like much has changed. The 8in, 1,280x800 display and matt plastic chassis are largely unchanged from the previous model, so it takes a look inside to find the new stuff: it's powered by a faster MediaTek MT8168 processor, and the total RAM has been given a slight boost from 1.5GB to 2GB. Amazon has also doubled the base storage to 32GB, and is producing a 64GB option for the very first time.

SIDEWAYS MOVE

It's also possible to find some other differences if you look hard enough. The 2-megapixel webcam, volume rocker and 3.5mm headphone have all been repositioned to favour a landscape orientation over portrait, and the welcome addition of a USB Type-C port speeds up charging. A pair of speakers point upwards on the top edge, and the microSD slot, which can take cards up to 1TB in capacity, is on the bottom.

This is a cheap tablet, so you shouldn't expect luxurious finishes and materials, but the Fire HD 8 remains a well-made, robust-feeling device. It's lightweight at only 355g, and doesn't flex or bend under considerable pressure.

The screen resolution, on the other hand, is showing its age. A pixel density of just 189ppi makes for a screen that looks rather pixellated and fuzzy by modern standards,

and the IPS panel's sRGB colour gamut coverage of 70% means colours look a bit muted as well.

Still, for less than £100, the Fire HD 8 was never going to set the standard for screen quality. On a more positive note, the Fire HD 8's screen gets bright enough, at 396cd/m², contrast is good at 1,440:1, and viewing angles aren't too bad either.

Performance, while modest in the grander scheme, is also downright unbeatable for the money. By scoring 911 in Geekbench 3's single-core test and 2,644 in the multicore test, it outperforms the previous Fire HD by about a third.

Gaming performance is much improved, achieving over triple its predecessor's onscreen frame rate in the GFXBench Manhattan 3 onscreen test: a jump from 7fps to 24fps. The choice of available gaming apps isn't as diverse as it is on conventional Android or iOS tablets, but you should be able to run most games on Amazon's Appstore without many hiccups.

LONG TIME COMING

Battery life is another area that has seen a huge increase over the previous version. Despite the small 2% bump in battery capacity, the Fire HD 8 lasted for 15h 23m in our video rundown test. This a massive stamina increase of almost 38% compared to the previous model.

Like the rest of the Amazon Fire family, the Fire HD 8's software is Android-based, with Amazon's own software launcher, Fire OS, placed on top. Fire OS 7 is the new version for this year, which uses a more recent version of Google's widely used mobile operating system, Android 9.0.

If you've used a Fire tablet previously, then the experience remains largely the same. Your Kindle library, Prime Video content, Amazon Music tracks and more can be accessed with simple swipes left and right of the homescreen, as well as a list of your downloaded apps.

The number of applications on the Amazon Appstore continues to be rather limited, however. As an example, we typically use Geekbench 4 or 5 for performance testing of various devices, but Amazon's store only contains the



older Geekbench 3 benchmark. Although most popular apps can be found, such as Facebook, Netflix, BBC iPlayer and Disney Plus, many games available on the Apple App Store and Google Play are missing in action.

ORDER HERE

The Fire HD 8 also includes hands-free Alexa. This allows you to bark commands at Amazon's digital assistant without pressing any buttons, and it works just the same as on Amazon's Echo devices. You can ask Alexa to tell you the weather, show sports fixtures or play the latest TV show on Amazon

Once again, Amazon has cooked up a fantastically priced tablet with its newest Fire HD 8. The 2018 model was already a five-star product, so Amazon's decision to boost performance, extend the battery life and add USB Type-C charging for 2020 was always going to lead to another recommendation.

Make no mistake, even with its drawbacks – the old-school screen and slight software restrictions – you won't find a better tablet for less than £100. The iPad will continue to reign supreme, but there's no beating the Fire HD 8 in terms of sheer value.

Nathan Spendelow



SPECIFICATIONS

PROCESSOR Quad-core 2GHz MediaTek MT8168 • **SCREEN SIZE** 8in • **SCREEN RESOLUTION** 1,280x800 • **REAR CAMERA** 2 megapixels • **STORAGE** 32GB • **WIRELESS DATA** No • **NFC** No • **DIMENSIONS** 202x137x9.7mm • **WEIGHT** 355g • **OPERATING SYSTEM** Fire OS • **WARRANTY** One year RTB • **DETAILS** www.amazon.co.uk • **PART CODE** Fire HD 8 (2020)

Battery life 15h 23m



See page 90 for performance details

FIRE OS TABLET

AMAZON Fire HD 8 Plus (2020)

COMPUTER
SHOPPER
RECOMMENDED



£110 • From www.amazon.co.uk

VERDICT

Wireless charging, extra RAM and a faster charger are nice upgrades, but the cheaper Fire HD 8 is the better buy

IN ADDITION TO the standard Fire HD 8 (opposite), this year Amazon has released another souped-up version, offering a handful of extras for a bit more money.

The Fire HD 8 Plus is still a very cheap tablet, and most differences are relatively minor. Design-wise, they're practically identical. Both have a 1,280x800-resolution screen, a drop-friendly plastic chassis, and USB Type-C charging. Both tablets also benefit from a new MediaTek MT8168 processor and run a tweaked version of Android 9.0 with Amazon's Fire OS 7 launcher placed on top.

CHARGING AHEAD

Where, then, does your extra £20 go? First, the Fire HD 8 Plus includes 3GB of RAM, rather than the 2GB offered with the cheaper model, and has a faster 9W charger in the box. The Fire HD 8 Plus also comes with three months of Kindle Unlimited for free.

The main reason why you might want to pick up the Fire HD 8 Plus, however, is for wireless charging. The tablet works with Amazon's new Wireless Charging Dock, which can also be used as a stand to turn the tablet into an Alexa-powered smart display.

It's not included as standard, although it can be bought as a bundle with the Fire HD 8 Plus for £140, and is ultimately a rudimentary stand that can only hold the tablet at a fixed angle. What's more, while the stand's built-in wireless charging is decently fast, because the Fire HD 8 Plus uses the Qi wireless charging standard, most third-party wireless chargers will work just fine.

Back to the tablet itself. As with its cheaper sibling it's clearly intended for landscape use, with a pair of top-firing speakers on one of its long edges and a 2-megapixel front-facing camera on the same side.

The Fire's 8in screen uses an IPS panel with a resolution of 1,280x800. This remains unchanged from previous models, which is a bit of a shame. The tablet's pixel density of 189ppi is quite poor by modern standards, too.

An overall sRGB colour gamut coverage of 74% isn't ideal, either. The screen looks quite dull compared to higher priced tablets such as the Samsung Galaxy Tab S6 Lite (*Shopper* 391) and iPad family, but an overall contrast of 1,381:1 isn't too bad. Viewing angles are also better than expected, despite the overly reflective screen coating.

ENGINE TUNE

An area of major improvement is in the Fire HD 8 Plus's performance. Both of Amazon's new 8in tablets are fitted with a newer MediaTek MT8168 chip, which is clocked at 2GHz and uses a Mali-T730MP3 GPU for graphics processing duties.

As expected, then, performance is very high by Fire tablet standards, but it can still feel a bit sluggish from time to time. In Geekbench 3, where the Fire HD 8 Plus scored 900 in the single-core test and 2,630 in the multitasking test, the tablet outperformed the 2018 version by up to 50%. This translates to a tablet that feels much more fluid and responsive in operation than ever before, but you will still notice a bit of slowdown when quickly switching between applications, for instance. Oddly, this tablet also scored slightly lower than the Fire HD 8, despite having an extra gigabyte of RAM.

Gaming performance is also good, although it's worth highlighting that there's a rather limited selection of games in Amazon's app store.

The Fire HD 8 Plus reached an average frame rate of 24fps in the GFXBench



Manhattan 3 onscreen benchmark, more than tripling the score of the previous model.

Running our in-house battery test, which plays a 20-hour looped video with aeroplane mode engaged and the screen set to a standard 170cd/m² brightness, the Fire HD 8 Plus lasted 17h 39m before needing a recharge. This is frankly extraordinary and is one of the best results we've seen from a tablet, regardless of cost – not to mention a step up from the standard Fire HD 8's 15h 23m.

IDENTICAL TWINS

Aside from the unloved screen, the Fire HD 8 Plus is almost the complete package. It's an affordable tablet which massively improves on previous generations in the hardware department, and manages to boost stamina by a considerable degree.

That said, unless you already have a compatible wireless charger – or are particularly keen to use this as a tablet-cum-smart display – the £90 Fire HD 8 is slightly better value. It performs just as well, lasts for a long time even if it can't match the Fire HD Plus' incredible stamina, and has the same screen size and resolution.

Nathan Spendelow



SPECIFICATIONS

PROCESSOR Quad-core 2GHz MediaTek MT8168 • **SCREEN SIZE** 8in • **SCREEN RESOLUTION** 1,280x800 • **REAR CAMERA** 2 megapixels • **STORAGE** 32GB • **WIRELESS DATA** No • **NFC** No • **DIMENSIONS** 202x137x9.7mm • **WEIGHT** 355g • **OPERATING SYSTEM** Fire OS • **WARRANTY** One year RTB • **DETAILS** www.amazon.co.uk • **PART CODE** Fire HD 8 Plus (2020)

Battery life

17h 39m

0% -50 Reference +50 +100

See page 90 for performance details



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4K OLED TV

LG OLED55CX6LA

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SHOPPER
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£1,699 • From www.currys.co.uk

VERDICT

LG's latest OLED effort combines incredible colour accuracy with top-notch HDR performance and excellent response times

SINCE IT FOLLOWS the LG C9 range, which contained some of 2019's best OLED TVs, the firm's new CX line has an awful lot to prove. The good news is that it lives up to our every expectation, and then some.

We tested the 55in model, the OLED55CX6LA. Or one of them, anyway – there's also an OLED55CX5LB with a silver stand instead of dark grey. Either way, there are also 48in, 65in and 77in sizes available, all with a 4K (3,840x2,160) resolution.

The OLED55CX6LA runs LG's WebOS and supports HDR10, Dolby Vision and HLG, but not HDR10+. Sadly, while most of the major content-streaming platforms are present and correct, Freeview Play apps such as BBC iPlayer and ITV Hub have yet to appear. Luckily, this ends up being one of very few flaws.

CONNECT FOUR

The OLED55CX6LA's design remains unchanged from last year's equivalent, the OLED55C9PLA. It's a luxurious-looking television with ultra-slim bezels on all four sides. The bottom half of the chassis bulges out at the back to accommodate the internals, but the panel above is wonderfully slender, and everything rests on a central metallic sloping stand.

All of the connections are located at the rear left of the panel, with some facing the rear and others facing the left-hand side. These include four HDMI 2.1 inputs that support the key HDMI 2.1 features: namely, VRR (Variable Refresh Rate), ALLM (Auto Low



Latency Mode), 4K at 120Hz and eARC (enhanced Audio Return Channel).

Incidentally, this is the highest number of HDMI 2.1 ports you'll find on any 2020 TV. Samsung's latest QLEDs have a maximum of one, and the Sony XH90 has two – or at least it will, following an upcoming firmware update. The latest models from Panasonic, Philips and Hisense don't have any HDMI 2.1 inputs at all.

The LG's speakers are above average by flat-screen TV standards, with a sufficient level of volume and bass to get you by. But let's face it, if you're spending this much money on a TV, then an external speaker system or good-quality soundbar is essential. In addition to the lossless audio passthrough of eARC, the LG CX also supports Dolby Atmos decoding, so there are plenty of quick, easy routes to superb surround sound.

That said, it's worth mentioning that LG has removed DTS decoding for the CX range. LG apparently feels that DTS is unnecessary since it's not supported by any of the big streaming players – Disney Plus, Amazon Prime Video and Netflix all use Dolby Digital Plus. This means that the CX cannot perform DTS:X passthrough over eARC, which may be an issue depending on your home theatre setup.

NOTHING COMES FREE

As mentioned, the OLED55CX6LA runs the latest version of LG's WebOS smart TV platform. WebOS looks and operates much the same as it did last year, although LG has given the bottom of the screen a minor facelift, and it now features a two-tier display instead of a single row.

Our favourite feature of WebOS is Magic Remote, an intuitive scrolling function that works by simply pointing the remote at the screen. It sounds underwhelming, but it's genuinely useful in practice.

App coverage is another story. Yes, you get access to all of the paid streaming platforms, but Freeview Play's absence is acutely felt. LG has failed to come to an agreement with Freeview this year, meaning that all of LG's 2020 TVs lack major UK catch-up apps such as BBC iPlayer, ITV Hub and All4. We've been informed that LG is negotiating with each player individually to secure these apps, but it's been months since launch and none of them has appeared.

Although this isn't ideal, it needn't be a deal-breaker, as you can always buy a Roku

◀ The OLED55CX6LA has four HDMI 2.1 ports, more than any other modern TV





streaming device or Amazon Fire TV Stick to fill in the app gap.

FEAST FOR THE EYES

The OLED55CX6LA's panel tech gives it one big advantage over its brighter LCD-screened rivals: true, inky blacks. Whereas LCD TVs rely on LED backlighting and can only produce extremely dark greys, OLED displays can turn off individual pixels at will, allowing them to replicate true black on a per-pixel basis. This creates the perfect backdrop for impactful, high-contrast HDR images, and goes a long way towards making up for OLED's lower peak brightness.

The OLED55CX6LA's colour vibrancy is astonishing, and the near-black gradation is even more refined than on the OLED55C9PLA. This results in cleaner, clearer detail within shadows, with less of the noise that affected last year's model. Colour accuracy is excellent right out of the box, too, and after calibration it's excellent.

Once we'd calibrated our review unit, we measured its luminance at 680cd/m² on a 10% window and 125cd/m² full-field. Compared to a high-end Samsung QLED, that's really not that bright, but in a properly darkened environment, it still looks amazing. One of the new modes, Filmmaker, only hits a peak brightness of 100cd/m². Though this is perfect for a dimly lit grading suite, it may not be bright enough for most people viewing at home, particularly if any lights are left on.

Brightness uniformity is remarkable, however, with no signs

of banding, dirty screen effect or colour tinting on our panel. Its dark uniformity is fairly typical of consumer OLEDs, exhibiting thin vertical streaks on dark grey slides.

As for colour reproduction, the OLED55CX6LA impresses again, covering 99% of the DCI-P3 gamut and 76% of Rec2020. Cinema colourists grade digital films using the DCI-P3 colour space, and with this TV, you're seeing practically every single hue that they see in their high-end mastering suites.

The panel also handles reflections well, minimising light diffusion, so you don't need to have blackout curtains to enjoy your movies. It has wide viewing angles, too, making it a great choice if your furniture isn't placed head-on with the TV.

LG has made a concerted effort to improve the motion handling on the CX range over the C9 range. First, LG has lowered the intensity of 120Hz black frame insertion (BFI). This has the intended effect of reducing motion blur while also eliminating typical side effects of BFI such as flickering and severe brightness drops.

Meanwhile, the new Cinema Clear setting attempts to reduce the mild stutter inherent to 24p video playback. This keeps the dreaded soap opera effect at bay – an unwanted symptom of frame creation that makes films look uncannily smooth – while doing a good job of keeping video free from stutters.

HOT CHIP

The OLED55CX6LA doesn't just excel with 4K content. Its new Alpha 9 Gen 3 processor does a fine job of processing 720p and 1080p sources and rendering them in high-quality upscaled 4K. And, new for the CX line, the OLED55CX6LA can finally disable overscan on standard-definition content, meaning that the picture won't be cropped unnecessarily.

The OLED55CX6LA's pixel-level light control delivers a refined, impactful HDR presentation. Its full-screen brightness is no match for the high-nit LCDs from Samsung and Sony, but the panel's incredible contrast level more than makes up for this. Provided, that is, the ambient lighting isn't too bright – like most OLED TVs, the LG thrives in darker living rooms.

HDR playback isn't perfect out of the box, however. The CX has a tendency to overbrighten darker scenes in HDR, elevating the blacks unnecessarily. It's not a major problem, however, and was mainly apparent on Dolby Vision content from Netflix.

To bolster its Dolby Vision playback, the OLED55CX6LA supports Dolby Vision IQ. This feature makes use of built-in light sensors to adjust picture brightness based on Dolby Vision's dynamic content metadata. This way, the details of a scene aren't lost due to the ambient lighting in the room. Dolby Vision IQ's brightness effect is a little excessive at its default settings, though this is only really noticeable in a darkened room.

In any case, full calibration is recommended to get the most out of the feature.

Thanks to its four HDMI 2.1 ports, the LG CX is better-equipped for gaming than any other 2020 TV. It can run games in 4K at 120Hz, and its VRR technology – which includes both Nvidia G-Sync and AMD FreeSync – allows for fantastically smooth, tear-free performance. Meanwhile, ALLM automatically kicks the TV into its low latency Game Mode when compatible consoles are connected.

Response times in Game Mode are remarkable. We measured an input lag of 13ms on a 60Hz signal (both in 1080p and 4K HDR), and this halved to a blazingly fast 6ms on a 120Hz signal. To achieve such a low input lag, the Alpha 9 Gen 3 chipset has to tune down its picture processing quite considerably. Despite this, the OLED55CX6LA's superb picture quality barely degrades at all in Game Mode. If there is one TV gamers should buy ahead of the launch of the Xbox Series X and PlayStation 5, this is it.

If we were to nitpick, we'd point out that the OLED55CX6LA's HDMI 2.1 bandwidth is 40Gbit/s, a tad lower than the OLED55C9PLA's 48Gbit/s. In practice, only very high-end PC gamers will be affected: 4K/120Hz at 12-bit 4:4:4 is possible at 48Gbit/s, but not at 40Gbit/s, which is capped to 10-bit 4:4:4 for 4K/120Hz. Again, however, it's a nitpick.

Of course, as with any OLED TV, there's a risk of screen burn-in with the OLED55CX6LA. However, provided you watch a variety of content and don't leave your games paused for hours at a time, this shouldn't be an issue.

WONDER VISION

The OLED55CX6LA is an accomplished all-rounder that's destined – or at the very least, deserves – to become a firm favourite for home cinema buffs and game enthusiasts. It delivers phenomenal colour accuracy, true blacks and stunning HDR playback across multiple formats. Its gaming performance is even better than the OLED55C9PLA, with response times that beat any TV we've tested to date.

Even calibration feels less than necessary, since, in the right picture modes, the OLED55CX6LA's picture is pretty close to perfection. With all this for £1,699 – even less if you go for the 48in OLED48CX6LB – any other OLED range launching this year will have a very hard time competing.

Vincent Teoh

SPECIFICATIONS

SCREEN SIZE 55in • NATIVE RESOLUTION 3,840x2,160 • VIDEO INPUTS 4x HDMI • TUNER N/A • DIMENSIONS 738x1,228x251 mm • WARRANTY One year parts and labour • DETAILS www.lg.com • PART CODE OLED55CX6LA

CONNECTION PORTS

HDMI x4	USB2 x3	CI+
Ethernet	RF x2	S/PDIF
		3.5mm headphone jack

WIRELESS IN-EAR HEADPHONES

SKULLCANDY Indy Evo



£90 • From www.argos.co.uk

VERDICT

The Indy Evo are a solid pair of true wireless earbuds, but they struggle to stand out from the crowd

KEENLY PRICED AND highly adjustable, the Indy Evo are one of four new pairs of true wireless earbuds from Skullcandy. They're an update of the US firm's original Indy earbuds, which were released in 2019, and have received a number of tweaks, including improved battery life, built-in Tile tracking and the ability to use each bud separately.

Your £90 nets you a pair of Bluetooth 5.0, IP55-rated (sweat, water and dust resistant) true wireless earbuds, a plastic charging case, one USB Type-A-to-Type-C charging cable, three sets of eartips and two pairs of gels that help stabilise the buds in the outer sections of your ears. The buds and case combined offer a respectable total of 30 hours of audio playback, although battery life will vary depending on listening volume.

TWO PODS IN A POD

There's a touch of the Apple AirPods to the Indy Evo but, rather than relying on one-size-fits-all earpieces, they use silicone eartips and stabiliser gels to achieve a good fit. The combination worked effectively for us: once in place, the earbuds never came loose, even during exercise.

They're comfortable for the most part, too, although we did experience some ear fatigue during longer listening sessions. There's no active noise cancellation, but the snugness of the fit provides passive noise-cancelling capable of cutting out a reasonable amount of external sound.

The Indy Evo have three different EQ modes but, after testing them all extensively, two of them prove to be pretty much redundant.

The Movies mode is far and away the best-sounding profile and negates the need for either Music or Podcast mode. It's the bassiest of the profiles, but it's also the loudest and best balanced. Heavy guitar riffs have plenty of impact, while piercing trebles are impressively articulated. The soundstage is admittedly a little congested, but for casual everyday listening, these buds are more than adequate in Movies mode.

The same can't be said for Music mode, which is lacklustre. The same songs

sounded muddy and flat compared with Movies mode, regardless of style or genre.

The third EQ – Podcast mode – strips back bass tones to give mid-range frequencies greater prominence and improve vocal clarity. It's a nice acknowledgement that not everyone uses headphones only for music or videos, and as far as boosting speech goes, this mode achieves its aim: dialogue sounds clearer than in the other two modes. We didn't feel the effect was significant enough, however, to make it worth the effort switching from Movies mode.

The Indy Evo don't support the aptX codec and are therefore unable to deliver the higher-quality, bit-rate efficient streaming that many of their rivals can. However, it's worth mentioning how little latency there is when streaming video content. We experienced none of the lag between video and audio that can plague Bluetooth headphones when watching YouTube and Netflix.

SAFE RETURN

One of the big draws of the Indy Evo is their built-in Tile-tracking feature. If you're not familiar with Tile, it's a service that uses Bluetooth to locate lost or misplaced objects. If you've misplaced your Indy Evo and are within Bluetooth range of the buds, you can have Tile trigger a high-pitched noise to help you locate them. If you've lost them while further afield, the app can be used to pinpoint the last place your phone and earbuds were connected, or via other Tile users automatically reporting their location. It doesn't guarantee you'll find them, but it gives you a place to start your search.

Other features are more humdrum, such as the Ambient Mode for those situations when you want to be able to hear some of the external noise around you. There's no sliding scale, so it's either on or off, and even with it on we found it difficult to



pick up conversations unless whatever we were listening to was at very low volume.

More compelling is the Indy Evo's extensive touch control system. There are numerous touch combinations, ranging from a single tap on the right bud to increase volume to double-tapping then pressing either bud for two seconds to switch EQ modes. Most work consistently, the only downside being that it takes a while to learn all the different combinations.

There's also an accompanying Skullcandy mobile app, though it's severely limited. You can toggle Ambient Mode on and off, access the user guides, register your earbuds and that's about it. There's no battery level indicator for the earbuds or case (although there are battery indicator LEDs on the front of the latter), and you can't switch EQ modes within the app.

EVO NOT REVO

There's a fair amount to like about the Indy Evo true wireless earbuds, and you can certainly do a lot worse for the money. They have a clean look, decent battery life, comprehensive touch controls and built-in Tile tracking, which is a big bonus.

However, if you prioritise audio quality over features and fit, you're better off checking out the similarly priced RHA TrueConnect (Shopper 375) or, especially, the Creative Outlier Air (Shopper 377).

Andy White



SPECIFICATIONS

HEADPHONES SUBTYPE In-ear • PLUG TYPE None •
WEIGHT Not stated • CABLE LENGTH N/A • WARRANTY
Two years RTB • DETAILS www.skullcandy.co.uk

WIRELESS IN-EAR HEADPHONES

ONEPLUS Buds



£79 • From www.amazon.co.uk

VERDICT

Another set of cable-free headphones that mostly sound good and are comfortable to wear

BESIDES SKULLCANDY'S EFFORT opposite, yet another pair of true wireless headphones is seeking to cash in on the trend: the OnePlus Buds.

At £79, these are a good deal cheaper than a set of Apple AirPods, despite having a very similar design. They sit in the outer part of your ear rather than needing to be inserted into your ear canal, and have long tails that dangle outside your ears.

Just like AirPods, they come with a small case that charges the headphones when you drop them in. Quick-pairing tech helps you get connected in double time, and it's even quicker if you own a OnePlus phone: just flip the earbud case lid open, press the pairing button on the rear and up pops a pairing notification at the top of your phone's display.

Alas, there's no active noise-cancelling tech here, which means the OnePlus Buds aren't the best to use in noisy environments such as planes and trains. However, they have plenty of other things to recommend them.

IN AND OUT

They're great for listening to music and podcasts while exercising because they don't block out the sound of the outside world. They're also IPX4 certified, so are sweat- and rain-resistant. You can also listen to them one at a time during phone calls.

Better yet, they pause music automatically when you take them out of your ears and resume seamlessly when you put them back in. We experienced no issues with this feature; it seems perfectly reliable.

Battery life is very impressive, too. The Buds themselves deliver up to seven hours of music playback (or three hours of phone calls) and, although the charging case doesn't support wireless charging, it holds enough capacity to charge the Buds more than three times over. What's more, if you're in a hurry, 10 minutes connected to a

charger will get you a full 10 hours of playback.

The housings of the OnePlus Buds are a little on the bulky side. These aren't the sort of headphones you're going to want to drift off to sleep with in your ears, although we found the fit to be surprisingly secure.

We wore them on several long runs and they barely budged. They're comfortable enough to wear for hours at a time, too, and, although your mileage may well vary on this, they don't seem to cause any soreness or earache.

LISTEN UP

Sound quality is good, too. One problem with this particular type of in-ear headphone is that they can struggle to muster the bass and richness a silicone-tipped earbud can create; while that's true to a certain degree here, it's also true that the OnePlus Buds deliver great sound quality and a surprising amount of low-end grunt. Presumably this is due to the relatively large 13.5mm drivers inside those bulky housings.

The OnePlus Buds can't match the best when it comes to truly heavy bass presence, but they're still fun to listen to and deliver low-end notes with tight control and plenty of agility. This also helps out with spoken material such as audio books and podcasts, which sound great.

The mids lack a little depth for our liking, but it's in the higher frequencies that the OnePlus Buds are found lacking. High-pitched parts such as piano solos sounded just a little too hard-edged, and strident, multi-layered guitar tracks in rock songs sounded harsher than they normally would.

Overall, however, these issues aren't severe enough to spoil the party. On



the whole, the OnePlus Buds deliver a nicely balanced sound that's really rather good for the money – and they sound better than most non-silicone tip earbuds to boot.

It's a similar story with the microphones, which are fine but far from perfect. There are three of these embedded in each earpiece but, despite their number, they suffered from a rather overly bassy, hollow sound. Vocal input came through clearly in phone calls, but those at the other end of the call reported that sound quality wasn't brilliant.

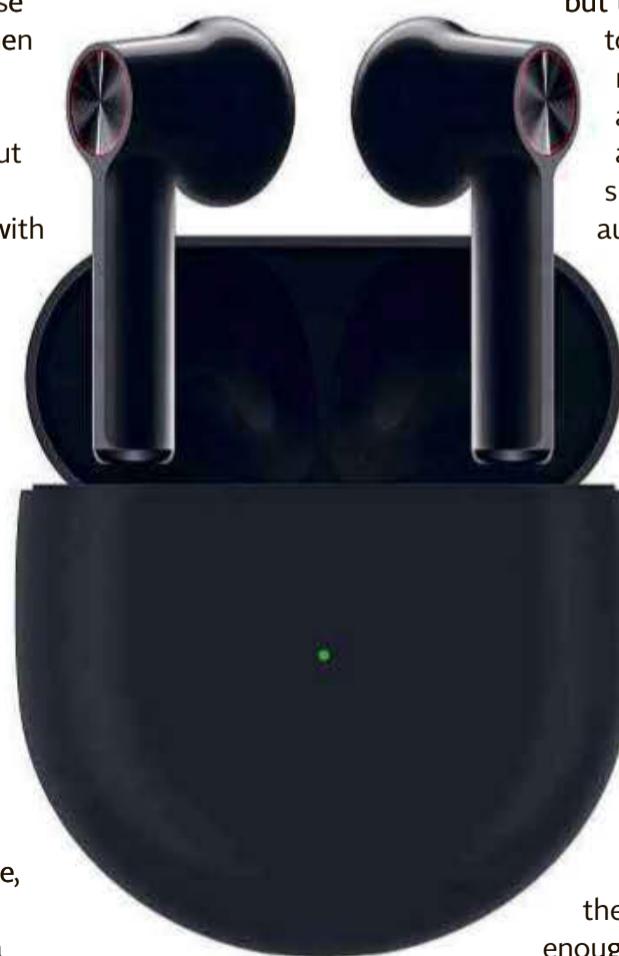
SMALL PACKAGES

The OnePlus Buds are far from perfect. They're a little sharp in the high frequencies, the microphones could do with a little tuning, there's no active noise cancellation and no wireless charging.

However, they have plenty going for them, too, not least the fact that they're incredibly comfortable, have great battery life, pair extremely quickly and deliver surprising amounts of low-end fun for very little money.

As with Skullcandy's Indy Evo buds, we'd still say OnePlus's headphones are overshadowed by the (even cheaper) Creative Outlier Air (Shopper 377). Still, if you want a pair of well-priced true wireless headphones that don't cost the earth and sound half decent, these are a fine alternative.

Jonathan Bray



SPECIFICATIONS

HEADPHONES SUBTYPE In-ear • PLUG TYPE None •
WEIGHT 4.6g per bud • CABLE LENGTH N/A • WARRANTY
One year RTB • DETAILS www.oneplus.com

GARMIN Venu



£283 • From www.amazon.co.uk

VERDICT

The screen and sports-tracking features are impressive, but the Venu lacks the smarts to really compete with the Apple Watch

YOU ONLY NEED a second with the Venu to appreciate its main point of appeal: its bright AMOLED screen. This display is really all that separates the Venu from the Vivoactive 4 (*Shopper 385*).

Both watches deliver equally impressive everyday activity and sports tracking, alongside music storage. While it's a delight to look at, however, the Venu isn't without compromises. To be specific, it will cost you more than the Vivoactive 4 and last fewer days between charges.

OLED BY EXAMPLE

In the past, Garmin always opted to prioritise function over fashion with its smartwatches. The Venu breaks this mould by offering a 390x390 AMOLED touchscreen display that really is there just to look good, and look good it certainly does.

As you'd expect of a Garmin watch, it offers all the everyday activity-tracking staples you'd find on any fitness tracker such as steps and calories, and there's also stress tracking and Body Battery, a simple score that denotes your overall energy levels out of 100. The Venu has GPS and optical heart-rate monitoring built in, too, and if you're a fitness newbie, you'll benefit from its animated guided workouts and Garmin Coach. The latter offers personalised training plans to help you get ready for runs from 5k to half marathon distance, irrespective of your fitness levels.

As for smart features, the Venu displays smartphone notifications and offers music playback, including offline support for Spotify. The watch also supports contactless payments via Garmin Pay, though very few UK banks have signed up to the service.

RUNNING TIME

Although that eye-catching 1.2in AMOLED display affects the watch's battery life, the good news is that it's not as greedy as you might expect. Indeed, even with the screen set to always-on and using the watch for runs every day, we found the Venu lasted three days between charges. If you only used it for short workouts every other day it would get closer to four, which is only a couple of days less than we eked out of the Vivoactive 4 with mixed usage.

completely. That not only saves precious battery life, but also means there isn't any unwanted light being emitted when you're trying to sleep.

We also found that the screen responded well to a flick of the wrist, waking automatically to go from always-on mode to a



In terms of sports tracking, the Venu outstrips what any other smartwatch brand offers natively

That said, we weren't using the music feature for all of those runs, and it would certainly hit battery life hard if you did. Garmin promises up to five days in smartwatch mode and just six hours of continuous GPS and music playback, so if you went for long runs or bike rides with music playing, you could easily empty the battery in under a day. Turn off the music, and Garmin claims that the Venu will provide up to 20 hours of GPS tracking.

Despite moving away from the very practical transreflective displays of most Garmin watches, however, the Venu's screen is easy to read in all conditions, which isn't always the case with this type of smartwatch display. Both the Polar Ignite and notably the Fitbit Versa 2 (*Shopper 383*) are a little tricky to read outside by comparison.

When not in use, the Venu displays a simple time or time and date watch face, depending on which watch face you choose, and if you set it to 'do not disturb' at night, the screen blacks out

more detailed watch face. As such, the only real issue with the screen is that it doesn't add any genuinely new functionality. On the contrary, the interface is more or less identical to other Garmin devices such as the Vivoactive 4, even if the heart-rate charts and animated workouts benefit from the improved contrast and resolution.

FINE TUNE

As for the watch itself, there's not much to be amazed by. The different bezel colours are attractive, with silver, gold, black and rose gold models all available, but the watch itself is rather chunky at 12.4mm thick. The Apple Watch 5 (*Shopper 383*), by comparison, is 10.7mm thick and sits far more snugly against the wrist as a result. The Venu isn't uncomfortable, but, crucially, it doesn't break the mould compared with other Garmins, and the Vivoactive 4 looks just as good.

Most features on the Venu relate to activity and sports tracking, but it does also offer a range of smart features. Music playback is the most significant of these, with the Venu letting you transfer your own music files or connect to Spotify, Amazon Music and Deezer premium accounts so



you can sync playlists across wirelessly via Wi-Fi to listen to offline. Neither the Apple Watch nor the Fitbit Versa offer this functionality, although you can find it on the Vivoactive 4 and the Vivoactive 3 Music.

Naturally, you also get smart notifications, and contactless payments are also supported via Garmin Pay. That should be a cause for celebration, but the latter remains largely useless thanks to the lack of UK banks signed up to the service; at present, Santander is the only high street bank it will work with.

BACK ON TRACK

This, and the lack of choice of apps compared with an Apple Watch or Wear OS device, is the main area in which the Venu stumbles. With no easy way to make the most of its NFC chip and very little way of expanding the Venu's features in any meaningful way – the Connect IQ app store is pretty barren aside from new watch faces – Garmin's first proper smartwatch simply isn't that smart.

Thankfully it makes up for any shortcomings in this regard with the kind of in-depth fitness tracking we've come to expect from Garmin devices. The Venu logs all the usual activity tracking metrics, including steps, calories burned and staircases climbed, and there are several brand-new metrics such as hydration tracking and menstrual cycle tracking.

Another new addition to Garmin watches including the Venu is respiration tracking, measured in breaths per minute. Beyond keeping count of your breaths during activities such as yoga, however, there's not much that most users will be able to do with this information. There's no explanation either on the Venu or the Garmin Connect app of how to interpret this info, so we worry that it might be more confusing than useful for most users.

More helpful is the Body Battery feature, which takes into account your activity levels, sleep and stress, which is recorded through your heart-rate variability to give you a simple rating out of 100 showing how much energy you have. This is a good way to check how much you're recharging overnight, and indeed how much activity such as a run or gym workout has taken out of you.



SNOOZING OUT

Our only gripe with Body Battery is that its figures appear easily skewed by inaccuracies in Garmin's sleep tracking. We consistently found that the watch recorded the total time asleep to be longer than we'd actually enjoyed, with time spent awake and lying still often logged as light sleep. As such, we almost always woke to a Body Battery rating of 100, despite daily runs and occasional interrupted sleep.

In terms of sports tracking, however, the Venu outstrips what any other smartwatch brand offers natively. Garmin's sports modes are detailed, reliable and very easy to use, and the Venu covers an impressive range of activities that includes running, cycling, pool swimming and even golf.

There are one or two notable omissions, such as open-water swimming and a multisport mode; you'll only find these on pricier Garmins such as the Fenix 6 and Forerunner 945.

Sadly, we also had some issues with the heart-rate tracking on the Venu when running. It was accurate on easy runs but would lag considerably behind a chest strap when doing intervals, so even if the overall average heart rate was fairly close, there wasn't an accurate graph showing the spikes from sprints. This problem is easily fixed by pairing an

external heart rate strap with the Venu via either ANT+ or Bluetooth. You can also pair cycling speed/cadence sensors, but not power meters, which Garmin again restricts to higher-end devices such as the Fenix 6 and Forerunner 945.

FULL SCHEDULE

One of the key selling points for the Venu compared to rival smartwatches from Apple and Samsung is the range of guided training content it offers. The watch offers guided animated workouts for strength, yoga and pilates workouts, which is great for beginners who don't want to fork out on expensive personal trainers or classes. As with most of Garmin's other new watches, you can also use Garmin Coach, which offers personalised training plans for 5K, 10K and half marathon distances that you can follow directly from your wrist.

You can also create your own custom workouts in Garmin Connect and sync them to the Venu, which is great for runners, cyclists and swimmers, though we're not so convinced how useful it is for yoga and pilates sessions. That's because you have to select every single pose of the workout, and if you're working through a yoga routine with 30 or 40 moves, it will take you a fair amount of time to set up. That's not a problem, however, as there are more than enough pre-made workouts to be getting on with, including a very useful yoga for runners session.

STAY ACTIVE

Garmin has done well to bring an always-on AMOLED screen to the Venu without crippling its battery life. On the contrary, delivering three or four days mixed use per charge in a smartwatch that offers such in-depth sports tracking puts the Venu in a category of its own.

However, while the screen is lovely, it's hard not to question its usefulness. It doesn't change the experience of using the watch drastically, and the Vivoactive 4 offers all the same sport-tracking features while lasting longer between charges.

The result is that the Venu is good, but not quite the do-it-all smartwatch you might have been hoping for. If you're after an excellent multisport watch that lasts days between charges, stick to the Vivoactive range, and if you want a device that offers best-in-class smart features and solid sports-tracking credentials, the Apple Watch is still the one to beat.

Nick Harris-Fry

SPECIFICATIONS

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 1.2in • RESOLUTION 390x390 • OS SUPPORT Android, iOS • BATTERY LIFE Four days • WARRANTY One year RTB • DETAILS www.garmin.com • PART CODE 010-02173-12

VPN SOFTWARE

VYPRVPN



£13 per month • From www.vyprvpn.com

VERDICT

A reliable VPN service with the latest protocols and strong privacy protection

EVERY VPN SERVICE is configurable to some degree, but VyprVPN pitches itself as one that truly puts you back in control, and it's not hard to see why. Not only is it a VPN with a focus on protecting privacy and security, but it's one of the most customisable we've seen.

The service has an impressive list of supported protocols and a strong set of features, many of which can be tweaked to your specific requirements. Factor in the polished user interface, and you have a service that makes a great first impression.

GOLDEN TOUCH

Based in Switzerland, VyprVPN has been around since 2009, making it one of the longest-running VPNs out there. Its biggest strength is a global network of over 700 servers, with clusters spread across Europe, Asia, Africa, the Middle East and North, Central and South America, giving the service a wider reach than many of its rivals.

While many VPNs rent their servers and supporting networks from third-party data centres and hosting providers, the company behind VyprVPN, Golden Frog, owns and manages both the servers and the core network infrastructure. In theory, this means that VyprVPN has more control over the network, which should improve reliability, security and performance.

With regard to platforms, Windows, macOS, iOS and Android are supported through the usual apps, while you can also find apps for QNAP NAS devices and routers that match VyprVPN's hardware requirements.

► VyprVPN supports Windows, macOS, Android and iOS devices



You can also sideload the app on to Amazon Fire TV devices, which might be useful for some Kodi fans, and the Android version will also run on Android TV devices.

WORLD HIDE WEB

You can sign up to VyprVPN from its web page, where you'll find links to download the apps and special offers. The Windows app keeps things nice and simple, with a big blue Connect button that connects to the fastest available server by default, a menu button in the top-left corner, and buttons for customisation and servers down below.

The server list can be sorted by country, region or speed, with the latter using ping times in milliseconds rather than estimated upload or download speeds. There's no separation of servers by application, such as P2P or streaming, but you can favourite those you plan to re-use a lot.

All the settings are accessible through the Customize button, and they're surprisingly extensive. For instance, you can configure the VPN to launch and connect when you hook up to a public Wi-Fi network, but also add networks to a list of trusted networks, so that this doesn't happen in the home or office.

The killswitch blocks all internet traffic when the VPN suddenly disconnects or isn't enabled, but you can also configure it to deactivate when the VyprVPN app quits or set it to apply or not apply to local network traffic.

VyprVPN's strongest feature is its protocol support, with support for the advanced WireGuard protocol and the speedy IKEv2 on top of the regular OpenVPN. What's more, VyprVPN also has its own proprietary Chameleon protocol, which is designed to bypass location-based blocks and disguise your VPN usage. This is particularly useful in countries where content is blocked or censored, and VPN usage is restricted or even outlawed.

PRIVATE MATTERS

Being based in Switzerland has many advantages when it comes to privacy: all VyprVPN's customer data is stored in Switzerland and, under Swiss law, Golden Frog can't directly answer any

↑ VyprVPN has a global network of over 700 servers, giving it a wider reach than many of its rivals

non-Swiss legal requests. The company doesn't log any user connection data, which means that any request that comes through the Swiss authorities would only be limited to whether someone was or was not a VyprVPN customer; there's no other information that can be supplied to authorities.

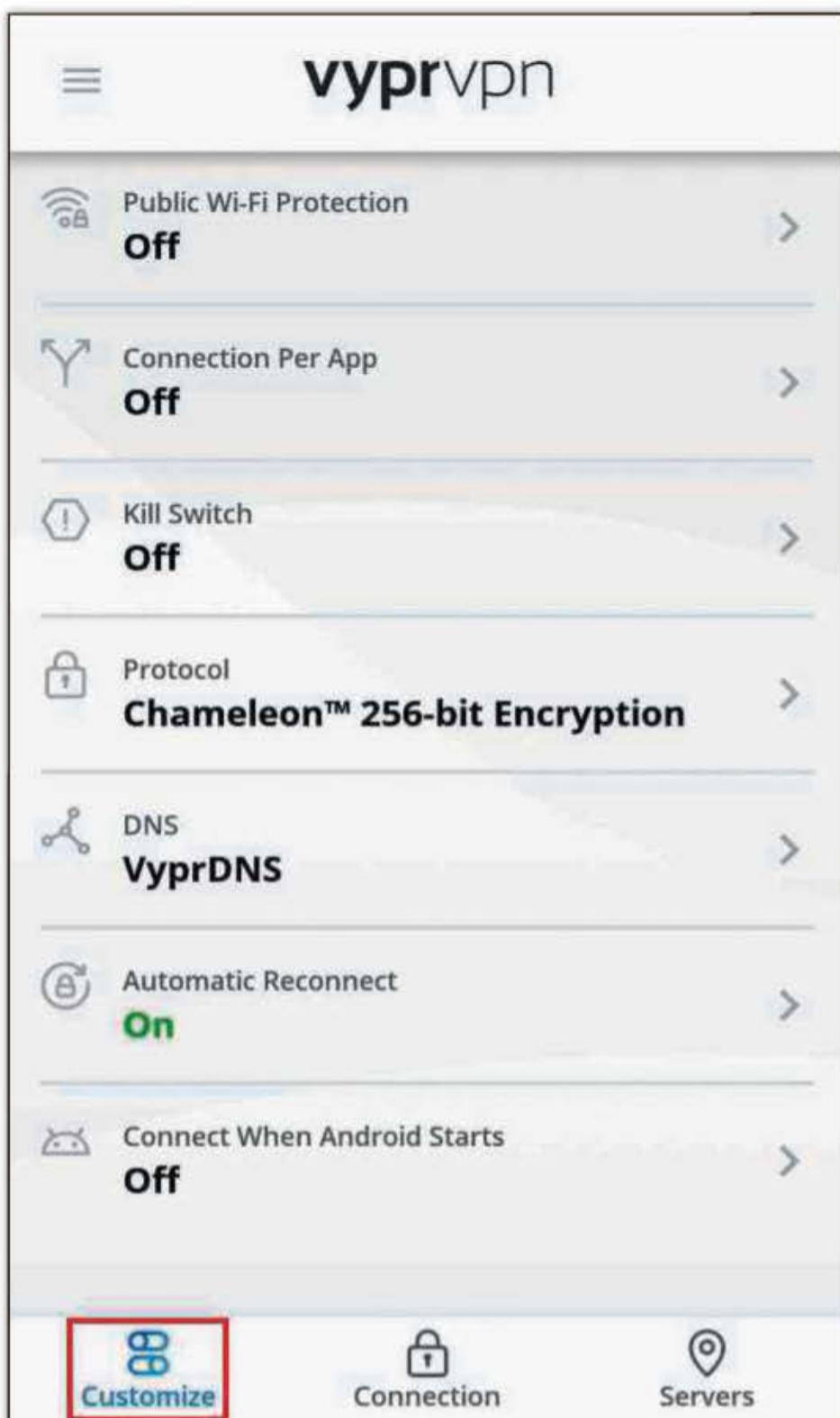
While many VPN providers claim a 'no-logging policy', Golden Frog has gone a step further and had its entire service independently audited by a third-party consultancy firm, Leviathan, which picked out some security issues that were subsequently addressed.

You can read the full report on Golden Frog's website, and the company confirms that it doesn't log any IP address assigned to the user or any connection start or stop times. Even though some providers that claim to have a no-logs policy hold this stuff for operational or security reasons, this does not apply to Golden Frog. It also scores points for having transparent and easy-to-read privacy policies.

SNAKE BYTES

VyprVPN isn't slow by any means, but it's not quite up there with the fastest. On its default, fastest connection (nearest servers), we saw download speeds drop by 5% and upload speeds reduced by 4.1%. We've seen other VPNs keep the speed hit to 4% or less on both uploads and downloads.

A connection through the Netherlands saw speeds reduce by 7.6% and 5.2%, where the Hide.Me VPN and Private Internet Access kept both to under 4%. To be clear,



↑ The extensive settings are accessible through the Customize button

this isn't the kind of difference you would feel in everyday use, but if performance is your be-all and end-all, then other VPNs certainly appear to be faster.

We had much the same experience with long-haul connections. A connection to a US server saw downstream speeds drop by an average 38%, while connecting to servers in Australia and Singapore saw download speeds reduced by 74% and 79% respectively. Again, there's still ample bandwidth for HD video streaming or online gaming – though not game streaming – but the likes of ExpressVPN and Private Internet Access retained a little more bandwidth in the same tests.

SAFE HANDS

VyprVPN's mobile apps have a similar interface to the desktop version, but the features vary. The iOS version has the same choice of protocols – a rarity for an iOS VPN – but doesn't have a killswitch. The Android version, however, has the same protocol options, more controls over automatic connection, a killswitch and even a split tunnel feature, so that you can set which apps do and do not use the VPN.

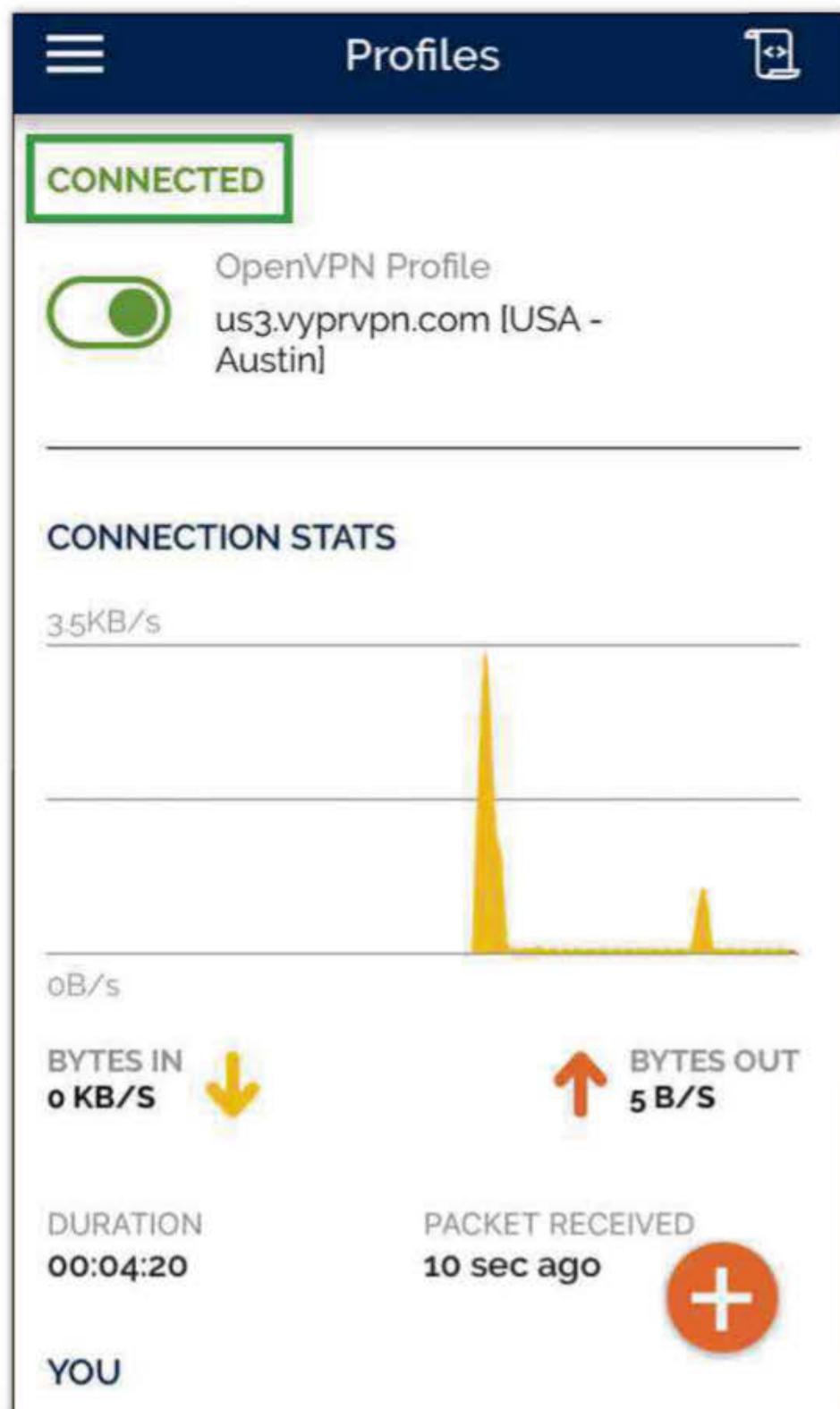
The good news is that both apps are fast. In fact, we had better results from the iOS

and Android clients than we did from the Windows app, with fast connect upload and download speeds reduced by just 4.2% and 3.2% in Android and 4.4% and 5.3% on iOS. Connections to a US server saw drops of 11% for iOS and 15% for Android. All in all, VyprVPN is a good option if you're looking for a mobile VPN.

Help is there when you need it through a mix of help articles and FAQs, forums, ticketed email support through a web form and live chat. Live chat support was extremely responsive and pointed us straight to a web article that discussed our questions in more detail. Email support was a little slower – we waited roughly three hours for a reply – but the answers we got were clear and detailed enough to be useful, again pointing us to further info on protocols and streaming.

Not all VPNs offer live chat support these days, while even some that do hide it away in the hope that you won't use it. VyprVPN gives you a link to email support from the main menu, with a button for chat support clearly visible in the bottom right-hand corner of the support page when you connect.

VyprVPN comes in at a hefty £13 per month if you pay monthly, putting it right at the premium end of VPNs. As usual, however,



↑ The iOS (pictured) and Android clients are both faster than the Windows app

there are some very tempting discounts if you're prepared to commit to a longer time frame up front. Right now, you can have two years for £60, working out to just £2.50 per month, or £45 for a year, which amounts to just under £4 per month. We'd hesitate to pay for VyprVPN at the monthly price, but if you can get it at these rates it's a competitive option, especially for the two-year deal.

PHAT CONTROLLER

On some levels, VyprVPN doesn't stand out from the crowd. It's not particularly fast, packed with features or cheap. On the other hand, it gives you access to a lot of servers based all around the world, along with more control than many other VPNs when it comes to protocols and options. Other VPNs are generally getting slicker, faster and easier to use, all of which makes it harder for any one VPN to make its pitch. That said, VyprVPN is a solid, well-balanced option with the latest protocols and robust privacy protection.

Stuart Andrews

Choosing a... PC system

01 A basic PC costing around £350 will be able to run everyday office, multimedia and education software and will easily cope with surfing the internet. It might even be able to run some modern games.

Many PCs can be sold either with or without a monitor. If you don't like the display the manufacturer is offering, you can always use your current one, or buy another one separately.

02 If you want to play games, you'll have to upgrade the graphics card. Budget cards such as the Nvidia GeForce GTX 1050 will cope well with many 3D games, but to play the latest 3D games smoothly (and enjoy the best-quality graphics) it's worth upgrading to a more powerful card such as the Nvidia GeForce GTX 1070.

03 All modern PCs come with at least a dual-core processor and are capable of most tasks. Anyone who regularly undertakes demanding tasks such as video editing and encoding should consider a hexa-core or even an octa-core processor.

04 There are plenty of good reasons to upgrade the PC's memory or hard disk. If you'll use your PC for gaming, video editing or other demanding tasks, you'll need at least 8GB of RAM and a large hard disk; 1TB should suffice. Many new PCs have an SSD, which speeds up the time it takes for your PC to boot and for programs to load.

05 Having plenty of USB ports is always useful, as most computer

peripherals attach to these ports. Most new PCs come with USB3 or the latest USB3.1 ports, which provide faster data transfers when used with supported devices than the older USB2 standard.

06 Most new PCs now come with Windows 10 pre-installed. Don't be too easily swayed by the inclusion of other software, though, as it may be that you'll never use it.

07 While most PCs come in cases of a similar size, some have more compact mini tower or mini PC cases. These smaller PCs will fit under your TV or on your desk more easily, but bear in mind that they're significantly harder to upgrade than full-size machines.

PCs

RASPBERRY PI

4 Model B



£34 • thepihut.com



COMPUTER SHOPPER
BEST BUY

A faster processor, quicker networking and dual HDMI outputs make the Pi 4 a much better desktop computer than previous Pi models, and it hasn't lost any appeal as a cheap hobbyist board, either. 4K video implementation could be better – we had issues getting smooth playback in Raspbian – but that's the only noteworthy concern.

PROCESSOR Quad-core 1.5GHz Broadcom BCM2711 • **RAM** 1GB • **USB PORTS** 1x USB Type-C (power), 2x USB2, 2x USB3 • **STORAGE** MicroSD card slot • **DISPLAY** None • **OPERATING SYSTEM** Raspbian • **WARRANTY** One year RTB • **DETAILS** www.raspberrypi.org • **PART CODE** Pi 4 Model B • **FULL REVIEW** Sep 2019

ACER Aspire XC



£400 • www.acer.com

COMPUTER SHOPPER
BEST BUY

Not only is the Aspire XC conveniently compact and attractively cheap, it's got more than enough horsepower to cope with most tasks and a smattering of handy extras, including built-in Wi-Fi and Bluetooth. We tested the XC-885 model with a solitary hard disk, but for a little extra you can add a faster SSD.

PROCESSOR Hexa-core 2.9GHz Intel Core i5-9400 • **RAM** 8GB • **FRONT USB PORTS** 1xUSB3.1, 1x USB Type-C • **REAR USB PORTS** 4x USB2, 2x USB3 • **TOTAL STORAGE** 1TB hard disk • **GRAPHICS PROCESSOR** Intel UHD Graphics 630 • **OPERATING SYSTEM** Windows 10 Home • **WARRANTY** One year carry-in • **DETAILS** www.acer.com • **PART CODE** Aspire XC-885 • **FULL REVIEW** Sep 2020



CHILLBLAST Photo Zen



£1,560 • www.chillblast.com



COMPUTER SHOPPER
BEST BUY

Photographers and designers will love the Photo Zen: a PC laser-focused on media editing. To this end it has a heavily multithreaded CPU, loads of RAM, a multicard reader and even a sound-dampening case, so you can work in peace with minimal fan noise.



PROCESSOR Octa-core 3.6GHz AMD Ryzen 7 3700X • **RAM** 32GB • **FRONT USB PORTS** 2x USB2, 5xUSB3 • **REAR USB PORTS** 2x USB2, 2x USB3, 4x USB3.1 • **TOTAL STORAGE** 500GB SSD, 2TB hard disk • **DISPLAY** None • **OPERATING SYSTEM** Windows 10 Home • **WARRANTY** Five years labour including two years collect and return • **DETAILS** www.chillblast.com • **PART CODE** Photo Zen • **FULL REVIEW** Oct 2020

PALICOMP AMD Abyss



£700 • www.palicomp.co.uk

COMPUTER SHOPPER
BEST BUY

At this price, you'd seriously struggle to find a more comprehensively capable desktop system than Palicomp's AMD Abyss. It can multitask with serious applications just as well as it can run games, and with its large, fast NVMe SSD, it won't be slowed down by storage. There's a lot of room for future upgrades, too.



PROCESSOR Hexa-core 3.6GHz AMD Ryzen 5 2600X • **RAM** 8GB • **FRONT USB PORTS** 2x USB2, 1x USB3 • **REAR USB PORTS** 2x USB2, 2x USB3, 2x USB3.1, 1x USB Type-C • **TOTAL STORAGE** 512GB SSD, 1TB hard disk • **GRAPHICS CARD** 8GB AMD Radeon RX570 Armor 8GB OC • **OPERATING SYSTEM** Windows 10 Home • **WARRANTY** Three years RTB • **DETAILS** www.palicomp.co.uk • **PART CODE** RYZ6 • **FULL REVIEW** Apr 2019

Choosing a... Laptop

01 A basic laptop costing around £300 will run everyday office, multimedia and education software, but it won't be suitable for 3D gaming or processor-intensive tasks such as video editing. Many laptops at this price have a 15.6in screen and weigh over 2kg, so they're best used around the house and for occasional journeys.

02 If you want to play modern games, you'll need a laptop with a dedicated graphics chip such as the Nvidia GeForce GTX 1060M. Good gaming laptops tend to have large 15.6 or 17in screens and weigh around 3kg, so they're best suited to use at home.

03 If you want a laptop that you can take everywhere, look for a model that weighs less than 2kg. For the best

portability, buy one that has a 13.3in or 14in screen. In general, the smaller and lighter the laptop, the more expensive it is, especially if it has plenty of processing power.

04 Battery life is extremely important for a laptop, particularly if you'll be carrying it around. We'd expect all but the biggest and heaviest to last for at least five hours on a single charge, but for an ultraportable that you carry everywhere, eight hours and above is more desirable.

05 Laptops use mobile versions of processors to conserve power, and these lag behind desktop chips when it comes to performance. For a budget Windows laptop, an Intel Core i3 processor will do the job, but if you

want better performance, you should look for an Intel Core i5 or Core i7 model instead. We recommend a minimum of 4GB of RAM, although 8GB is better for multitasking.

06 Most budget and mid-range laptops use a mechanical hard disk for storage. You'll want at least 500GB, but 1TB or more is better. Solid-state drives (SSDs) have faster performance, making your computer quicker to boot and more responsive. They have lower capacities, though. You'll need at least 128GB.

07 Convertibles and 2-in-1 laptops can change from laptop mode to tablet mode. We've listed our favourite models later on in this guide in the Tablets section.

Laptops

SAMSUNG Galaxy Book Ion



£1,250 • www.johnlewis.com



If the Galaxy Book Ion is any indication, Samsung's return to the UK laptop market is a cause for celebration. This is a wonderfully light, long-lasting Windows ultraportable with great connectivity and respectable performance from its Core i5 processor.



PROCESSOR Quad-core 1.6GHz Intel Core i5-10210U • **RAM** 8GB • **DIMENSIONS** 306x200x12.9mm • **WEIGHT** 970g • **SCREEN SIZE** 13.3in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS** Intel UHD Graphics 620 • **TOTAL STORAGE** 512GB SSD • **OPERATING SYSTEM** Windows 10 Home • **PARTS AND LABOUR WARRANTY** One year RTB • **DETAILS** www.samsung.com • **PART CODE** Galaxy Book Ion • **FULL REVIEW** Oct 2020

HONOR MagicBook 14



£500 • www.argos.co.uk



This budget ultraportable is a tremendous bargain. It's as fast as many £1,000-plus laptops, and has similarly high build quality too, complete with a good-looking metal chassis, backlit keyboard and wide range of ports. The display isn't pro-quality but is still big and sharp enough to get work done.



PROCESSOR Quad-core 2.1GHz AMD Ryzen 5 3500U • **RAM** 9GB • **DIMENSIONS** 323x215x15.9mm • **WEIGHT** 1.38kg • **SCREEN SIZE** 14in • **SCREEN RESOLUTION** 1,920x1,080 • **TOTAL STORAGE** 256GB SSD • **OPERATING SYSTEM** Windows 10 Home • **PARTS AND LABOUR WARRANTY** One year RTB • **DETAILS** www.hihonor.com • **PART CODE** NobelK-WAQ9AHNR • **FULL REVIEW** Aug 2020

DELL Latitude 3300



£689 • www.dell.com



Dell's affordable and well-built Latitude 3300 is made for students, but the fact that it has strong specs for the price can be appreciated by anyone looking for a general-purpose laptop. The quad-core CPU keeps performance up, and this particular model has a superior 256GB SSD to the even cheaper versions' eMMC drives.



PROCESSOR Quad-core 1.6GHz Intel Core i5-8250U • **RAM** 8GB • **DIMENSIONS** 330x231x22.9mm • **WEIGHT** 1.56kg • **SCREEN SIZE** 13.3in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS** Intel UHD Graphics 620 • **TOTAL STORAGE** 256GB SSD • **OPERATING SYSTEM** Windows 10 Pro • **PARTS AND LABOUR WARRANTY** One year RTB • **DETAILS** www.dell.com • **PART CODE** n013l330013emea • **FULL REVIEW** Jan 2020

GOOGLE Pixelbook Go



£829 • store.google.com



The creator of Chrome OS has once again produced one of the best laptops for the operating system. The Pixelbook Go isn't perfect – screen brightness could be higher, for instance – but it's very powerful for a Chromebook, and manages some fantastic battery life. Their keyboard is also a pleasure to type on, with comfortable, solid-feeling yet agile keys.



PROCESSOR Dual-core 1.3GHz Intel Core i5-8200Y • **RAM** 8GB • **DIMENSIONS** 311x206x13.4mm • **WEIGHT** 1.06kg • **SCREEN SIZE** 13.3in • **SCREEN RESOLUTION** 1,920x1,080 • **GRAPHICS** Intel UHD Graphics 615 • **TOTAL STORAGE** 128GB SSD • **OPERATING SYSTEM** Chrome OS • **PARTS AND LABOUR WARRANTY** One year RTB • **DETAILS** store.google.com • **PART CODE** GA00526-UK • **FULL REVIEW** May 2020

Choosing an... Internal hard disk

01 A basic 1TB internal hard disk should cost around £40. This will be fast enough for general use and will provide enough storage for most users.

Make sure the hard disk you choose has the appropriate interface type for your PC. Most hard disks and solid-state drives (SSDs) use the SATA3 interface, which enables faster speeds than the older SATA2. Pretty much every motherboard released in recent years will have multiple SATA3 ports, allowing you to connect several storage drives at once.

02 SSDs can make the most of SATA3's high bandwidth for fast file transfers. They use flash memory similar to that found in USB flash drives, and although they tend

to provide less capacity than mechanical hard disks, they're significantly faster. More expensive SSDs use the NVMe standard, which is even faster than SATA3, but require an M.2 slot on the motherboard.

03 Buy a hard disk that provides more capacity than you think you need, as your storage requirements are likely to grow. A 2TB disk strikes the best balance between capacity and low cost per gigabyte.

04 If you want more disk space or you want to protect your data against disk failure, think about buying several hard disks to create a RAID array. These use multiple hard disks to create one large logical disk with better performance, or to

duplicate your data for better protection. RAID arrays require hard disks of the same size. In theory, they can be from different manufacturers, but it's better to buy identical disks if you can.

05 A hard disk's spindle speed determines how quickly it can transfer data. A spindle speed of 7,200rpm is common in desktop drives and is fast enough for most purposes. Desktop hard disks with 5,400rpm spindle speeds are quite slow but use less power and generate less heat and noise.

To strike the best balance between speed and storage capacity, use an SSD as your system disk and store your files on a larger mechanical disk.

STORAGE

WD Blue SN550 1TB



£100 • www.ebuyer.com



There are faster SSDs, but the Blue SN550 isn't slow, either. It's therefore a good bet for when you want as much solid-state capacity for as little money as possible.



CAPACITY 1TB • PRICE PER GIGABYTE £0.10p • INTERFACE M2/NVMe • WARRANTY Five years RTB • DETAILS www.westerndigital.com • PART CODE WDS100T2B0C • FULL REVIEW Apr 2020

PNY Pro Elite 1TB



£175 • www.argos.co.uk



A tiny, very nimble portable SSD



that's both faster and cheaper than Samsung's similar T5 drive. Just make sure to connect via a USB3.1 port to get the best performance.

CAPACITY 1TB • PRICE PER GIGABYTE £0.17p • INTERFACE USB3.1 • WARRANTY Three years RTB • DETAILS www.pny.eu • PART CODE PSD0CS2060S-1TB-RB • FULL REVIEW Feb 2020

ISTORAGE CloudAshur



£99 • www.istorage-uk.com



The CloudAshur looks like a USB drive, but it's actually a module that adds PIN-protected encryption to your files as you save them to the cloud. It's not fast, but it is effective and totally unique.



CAPACITY N/A • COST PER GIGABYTE N/A • INTERFACE USB3 • WARRANTY Three years RTB with lifetime technical support • DETAILS www.istorage-uk.com • PART CODE IS-EM-CA-256 • FULL REVIEW Jun 2020

ADATA SD600Q 480GB



£48 • www.quzo.net



Put aside your fears about external SSDs being too expensive compared to hard disks – this 480GB drive is excellent value, and decently quick.



CAPACITY 480GB • COST PER GIGABYTE £0.10p • INTERFACE USB3 • CLAIMED READ 440MB/s • CLAIMED WRITE 430MB/s • WARRANTY Three years RTB • DETAILS www.adata.com • PART CODE ASD600Q-480GU31-CBL • FULL REVIEW Aug 2019

KINGSTON KC2500 1TB



£184 • www.box.co.uk



It's worth paying a little more for the KC2500's immense read and write speeds, which are maintained unusually well during more difficult transfer tasks.



CAPACITY 1TB • COST PER GIGABYTE 18p • INTERFACE M.2/NVMe • CLAIMED READ 3,500MB/s • CLAIMED WRITE 2,900MB/s • WARRANTY Five years RTB • DETAILS www.kingston.com • PART CODE SKC2500M8/1000G • FULL REVIEW Aug 2020

KINGSTON A2000 1TB



£99 • www.scan.co.uk



The A2000's maximum speeds don't look all that hot, but this SSD performs exceptionally well in the kinds of non-sequential transfer tasks you're more likely to actually undertake in your day-to-day computing.



CAPACITY 1TB • COST PER GIGABYTE £0.10p • INTERFACE M.2/NVMe • CLAIMED READ 2,200MB/s • CLAIMED WRITE 2,000MB/s • WARRANTY Five years RTB • DETAILS www.kingston.com • PART CODE SA2000M8/1000G • FULL REVIEW Dec 2019

Choosing an... AMD motherboard

01 As with Intel motherboards, you'll need to make sure you match an AMD processor with a compatible motherboard. This is relatively simple for AMD hardware, as most of its recent chips use the same AM4 socket, and the most recent second-generation Ryzen processors are backwards-compatible with first-generation chipsets, such as the X370 and B350.

02 Budget APU and a minority of Ryzen processors have integrated graphics, so to make use of this, ensure that your motherboard comes with video outputs such as DVI, HDMI and DisplayPort. For Ryzen chips that lack integrated graphics, or if you want more graphics power, install a dedicated graphics card into one of your

motherboard's PCI-E x16 slots. This also has the benefit of providing a greater range of video outputs to choose from.

03 Normal tower cases can accommodate ATX motherboards, which provide the most expansion slots. A microATX motherboard will let you build your PC in a smaller case, but if you opt for a microATX board, make sure it has all the features you need built in, as there won't be much room for expansion cards.

04 If you want to install lots of expansion cards, look for a motherboard that offers plenty of PCI and PCI-E x1 slots. Some motherboards also have PCI-E x4 slots and extra PCI-E x16

slots. PCI-E x1 and x4 cards also work in PCI-E x16 slots. If you need a lot of storage, a motherboard with plenty of SATA2 and SATA3 ports is essential. SATA2 is fine for optical drives and hard disks, but to make the most of an SSD, you need SATA3.

05 All motherboards have built-in audio chipsets, but some support only 5.1 surround sound rather than 7.1. If you're connecting to older surround-sound amplifiers that don't have HDMI, look for an optical or coaxial S/PDIF output.

All motherboards have Ethernet ports and most have the faster Gigabit version. You may also find it useful to buy a board with built-in Wi-Fi so you don't have to use up a USB port or PCI slot with an adaptor.

COMPONENTS

AMD Ryzen 9 3900X



£440 • www.scan.co.uk



COMPUTER SHOPPER **RECOMMENDED** Forget the Intel Core i9-9900K – this 12-core monster of a CPU performs far better for similar money. There is a drawback, in that it's not very overclocking-friendly, but that's partly because it's so fast to begin with. Pair it with some good RAM, and you're already most of the way to a capable home workstation.

SOCKET AM4 • CORES 12 • FREQUENCY 3.8GHz • INTEGRATED GRAPHICS None • WARRANTY Two years RTB • DETAILS www.amd.com • PART CODE 100-100000023BOX • FULL REVIEW Nov 2019

AMD Ryzen 7 3700X



£298 • www.amazon.co.uk



COMPUTER SHOPPER **BEST BUY** This octa-core chip has all the single-core strength of the Ryzen 9 3900X, with multitasking power that still puts it well beyond its Intel rivals. Low pricing and power efficiency are additional highlights: the Ryzen 7 3700X only draws up to 65W, a tiny amount for this many cores.

SOCKET AM4 • CORES 8 • FREQUENCY 3.6GHz • INTEGRATED GRAPHICS None • WARRANTY Two years RTB • DETAILS www.amd.com • PART CODE 100-100000071BOX • FULL REVIEW Dec 2019

ASUS ROG Strix Flare



£153 • www.novatech.co.uk



COMPUTER SHOPPER **BEST BUY** Besides being a comfortable and responsive gaming keyboard, thanks to its reliable Cherry MX Red switches, the ROG Strix Flare is loaded with useful features and extras: there's a set of dedicated media controls and a USB2 pass-through port, among others.

KEYBOARD SHAPE Full size • NUMBER PAD Yes • CONNECTION 1x USB2 • MEDIA KEYS Pause/play, mute, skip, volume • USB PORTS 2x USB2 • WARRANTY One year RTB • DETAILS www.asus.com/uk • PART CODE 90MP000MO-BOEA00 • FULL REVIEW Oct 2019

AMD Radeon RX 5700



£334 • shop.amd.com



COMPUTER SHOPPER **BEST BUY** AMD's 7nm GPU is cheaper than the GeForce RTX 2060 and the RTX 2060 Super, yet is just as comfortable with gaming at 1080p and 1440p. This price only seems to apply for the reference design rather than partner versions, but the blower-style cooler is the only real downside.

GPU AMD Radeon RX 5700 • MEMORY 8GB GDDR6 • GRAPHICS CARD LENGTH 268mm • WARRANTY One year RTB • DETAILS www.amd.com • PART CODE Radeon RX 5700 • FULL REVIEW Oct 2019

GIGABYTE Z490 Aorus Master



£375 • www.ebuyer.com



COMPUTER SHOPPER **BEST BUY** If you can afford to splash out on a high-end motherboard for Intel's 10th-gen chips, it should be this one. The Z490 Aorus Master has all the features and overclocking capability of its rivals, and is better designed.

PROCESSOR SOCKET LGA 1200 • DIMENSIONS 305x244mm • CHIPSET Intel Z490 • MEMORY SLOTS 4 • PCI-E x16 SLOTS 3 • PCI-E x1 SLOTS 0 • PCI SLOTS 0 • USB PORTS 4x USB2, 2x USB3, 3x USB3.1, 1x USB Type-C • VIDEO OUTPUTS 1x HDMI • WARRANTY One year RTB • DETAILS www.gigabyte.com • PART CODE Z490 Aorus Master • FULL REVIEW Oct 2020



NZXT Kraken X53



£120 • www.scan.co.uk



COMPUTER SHOPPER **BEST BUY** Not only is the Kraken X53 one of the most effective AIO watercoolers out there, it's also among the easiest to install and the easiest to customise. It works with lots of different Intel and AMD sockets too, so you can upgrade older PC builds as well as newer ones.

TECHNOLOGY Closed loop • FANS 2x 120mm • SOCKET Intel LGA 2066/2011-3/2011/1151/1150/1155/1156/1366, AMD AM4/TR4 (TR4 requires separate bracket) • RADIATOR DIMENSIONS (NO FAN) 123x275x30mm • WARRANTY Six years RTB • DETAILS www.nzxt.com • PART CODE RL-KRX53-01 • FULL REVIEW May 2020

Choosing a... Custom PC spec

01 Building your own PC is often cheaper than buying a pre-made system, and gives full control over the components. You don't need any special computer knowledge: just a few spare hours, a screwdriver and your choice of parts. Even things such as liquid-cooling systems can be found in user-friendly, easy-to-install packages, and for the most part it's as simple as inserting each component into a particular slot.

02 Arguably the most important component is the CPU. These days you can get a quad-core chip even on a tight budget, which should provide more than enough brainpower for simple tasks such as web browsing, but hexa-core and octa-core chips are better for tougher jobs such as media editing, gaming and content creation.

The CPU will also determine which motherboards you can choose from. Intel CPUs will only work with boards that use an Intel chipset, like Z390, Z370 and B360, while AMD processors need AMD chipsets, such as X470 and B450.

03 When choosing a motherboard, think about both the size of the PC's chassis (smaller cases won't fit larger ATX or EATX boards, for instance) and how many

additional components you'll want to install. For systems with a lot of expansion cards (such as graphics cards, sound cards or Wi-Fi cards), it's best to go with ATX motherboards and larger. For simpler builds, microATX or Mini-ITX boards could well provide all the connectivity you need. Keep in mind, too, that if you want to try overclocking, only certain Intel chipsets will support it, such as Z370 and Z390. AMD is more relaxed, enabling overclocking on all its Ryzen-compatible chipsets, except A320 and A300.

04 While CPU integrated graphics will suffice for everyday browsing, a dedicated graphics card is essential for high-quality gaming. These can be installed in a PCI-E x16 slot on your motherboard, and have the bonus of adding more display outputs to use – just make sure the card will fit inside your chosen case.

05 On the subject of cases, personal taste will factor highly here: nobody wants an ugly PC. That said, picking a chassis with adequate space for components is vital. As already mentioned, an ATX motherboard likely won't fit in a mini-tower case, and if you want to install a lot of hard disks, you'll need a case with sufficient drive bays.

06 Every PC requires RAM and a PSU. Performance doesn't vary much between specific models, but generally you should aim for 8GB of RAM for a basic build and 16GB for higher-end systems, and at least a 550W, Bronze-certified PSU. It's better to buy a higher-wattage PSU than you strictly need, as it will allow you to add more components in the future. Also, check which RAM is compatible with your motherboard before buying, although for all current models it's probably going to be DDR4.

07 Our recommended storage setup comprises both an SSD and a larger mechanical hard disk. By installing Windows (and a few choice applications) on the SSD, you can ensure fast booting and loading times, while the HDD is a cost-effective way of storing lots of files. Alternatively, you could buy a hard disk, and then install an Intel Optane Memory module to accelerate its write speeds to SSD levels, although since SSDs are barely more expensive than Optane drives, this is perhaps better for situations when you want to upgrade from an existing hard disk, rather than when you're building a whole new system. In the latter case, an SSD/HDD combo is better all round. See page 58 for our recommended storage drives.

BUDGET PCs

AMD Athlon 3000G



£45 • www.scan.co.uk



All eyes have been on Ryzen recently, but the Athlon 3000G is a nifty little dual-core chip: it has integrated graphics, ideal for basic builds, and unlike most budget CPUs, it's unlocked for overclocking. It's not tremendously fast, relatively speaking, but for this little cash, it's a terrific deal.

SOCKET AM4 • CORES 2 • FREQUENCY 3.5GHz • INTEGRATED GRAPHICS AMD Radeon RX Vega 3 • WARRANTY Two years RTB • DETAILS www.amd.com • PART CODE YD3000C6FHBOX • FULL REVIEW Mar 2020



ASROCK Fatal1ty AB350

Gaming-ITX/ac



£143 • www.amazon.co.uk/ASRock-Fatal1ty-AB350-Gaming-ITX-ac/dp/B07HJLZPQK



Tiny it may be, but the AB350 makes the most of what space it has available. Multiple display outputs, a rear-mounted M.2 port and onboard Wi-Fi mean it almost has the specs of a respectable ATX model.

PROCESSOR SOCKET AM4 • DIMENSIONS 170x170mm • CHIPSET AMD B350 • MEMORY SLOTS 2 • PCI-E X16 SLOTS 1 • PCI-E X1 SLOTS 0 • PCI SLOTS 0 • USB PORTS 2x USB2, 2x USB3, 1x USB Type-C • VIDEO OUTPUTS 2x HDMI • WARRANTY One year RTB • DETAILS www.asrock.com • PART CODE 90-MXB5P0-AOUAYZ • FULL REVIEW Jul 2018



SILVERSTONE

Precision Series PS15



£45 • www.scan.co.uk



As long as you work within its limit as a microATX chassis, the PS15 is a great fit for budget builds. Despite costing a pittance, it's well designed and can take a multitude of fans and radiators, so all-in-one watercooling is a possibility for future upgrades.

CASE TYPE Mini tower • MOTHERBOARD TYPE MicroATX, Mini-ITX • SUPPLIED FANS 1x 120mm • MAXIMUM DRIVE BAYS 1x 3.5in, 3x 2.5in • DIMENSIONS 381x192x351mm • WEIGHT 3.5kg • WARRANTY One year RTB • DETAILS www.silverstonetk.com • PART CODE SST-PS15B-G • FULL REVIEW Aug 2019



ASUS ROG Strix RX 570 OC



£145 • www.ebuyer.com



Although this is an older GPU, it's cheaper than a lot of the more recent 'budget' cards and, crucially, more powerful, too. It therefore comes highly recommended if you want to take a step up from integrated graphics without having to spend much.



GPU AMD Radeon RX 570 • MEMORY 4GB GDDR5 • GRAPHICS CARD LENGTH 240mm • WARRANTY Two years repair and replace • DETAILS www.asus.com • PART CODE ROG-STRIX-RX570-O4G-GAMING • FULL REVIEW Jan 2020

MID-RANGE PCs

INTEL Core i5-10600K

★★★★★

£251 • www.ebuyer.com

COMPUTER SHOPPER
RECOMMENDED

This chip is not as cheap as AMD's equivalents, nor as efficient at multitasking, but it's still a very quick, highly overclockable hexa-core CPU with gaming performance that beats some top-of-the-range enthusiast processors.

SOCKET Intel LGA 1200 • **CORES** 6 • **FREQUENCY** 4.1GHz • **INTEGRATED GRAPHICS** Intel UHD Graphics 630 • **WARRANTY** Three years RTB • **DETAILS** www.intel.com • **PART CODE** BX8070110600K • **FULL REVIEW** Aug 2020



NZXT Kraken X53

★★★★★

£120 • www.scan.co.uk

COMPUTER SHOPPER
BEST BUY

Not only is the Kraken X53 one of the most effective AIO watercoolers out there, it's also among the easiest to install and the easiest to customise. It works with loads of different Intel and AMD sockets too, so can upgrade older PC builds as well as newer ones.

TECHNOLOGY Closed loop • **FANS** 2x 120mm • **SOCKET** Intel LGA 2066/2011-3/2011/1151/1150/1155/1156/1366, AMD AM4/TR4 (TR4 requires separate bracket) • **RADIATOR DIMENSIONS (NO FAN)** 123x275x30mm • **WARRANTY** Six years RTB • **DETAILS** www.nzxt.com • **PART CODE** RL-KRX53-01 • **FULL REVIEW** May 2020



AMD Radeon RX 5700

★★★★★

£334 • shop.amd.com

COMPUTER SHOPPER
BEST BUY

AMD's 7nm GPU is cheaper than both the GeForce RTX 2060 and the RTX 2060 Super, yet is just as comfortable with gaming at 1080p and 1440p. This low price only seems to apply for the reference design rather than partner versions, but the blower-style cooler is the only real downside.

GPU AMD Radeon RX 5700 • **MEMORY** 8GB GDDR6 • **GRAPHICS CARD LENGTH** 268mm • **WARRANTY** One year RTB • **DETAILS** www.amd.com/uk • **PART CODE** Radeon RX 5700 • **FULL REVIEW** Oct 2019



COOLER MASTER MasterBox K500

★★★★★

£70 • www.scan.co.uk

COMPUTER SHOPPER
RECOMMENDED

Great looks, a full set of pre-installed fans, high build quality and a spacious interior: the MasterBox K500 is a commendable all-rounder. It's not the best on storage capacity, but you can still add at least a couple of SSDs and hard disks each.

CASE TYPE Mid-tower • **MOTHERBOARD TYPE** ATX, microATX, Mini-ITX • **SUPPLIED FANS** 3x 120mm • **MAX DRIVE BAYS** 3x 3.5in, 2x 2.5in • **DIMENSIONS** 260x190x280mm • **WEIGHT** 6.2kg • **WARRANTY** Two years RTB • **DETAILS** www.coolermaster.com • **PART CODE** MCB-K500D-KGNN-S00 • **FULL REVIEW** Jan 2019



PREMIUM PCs

AMD Ryzen 9 3900X

★★★★★

£440 • www.ebuyer.com

COMPUTER SHOPPER
RECOMMENDED

Forget the Intel Core i9-9900K – this 12-core monster of a CPU performs far better for similar money. There is a drawback, in that it's not very overclocking-friendly, but that's partly because it's so fast to begin with. Pair it with some good RAM, and you're already most of the way to a capable home workstation.

SOCKET AM4 • **CORES** 12 • **FREQUENCY** 3.8GHz • **INTEGRATED GRAPHICS** None • **WARRANTY** Two years RTB • **DETAILS** www.amd.com • **PART CODE** 100-100000023BOX • **FULL REVIEW** Nov 2019



ASUS ROG Strix Flare

★★★★★

£153 • www.novatech.co.uk

COMPUTER SHOPPER
BEST BUY

Besides being a comfortable and responsive gaming keyboard, largely thanks to its always-reliable Cherry MX Red switches, the ROG Strix Flare is loaded with useful features and cool extras: there's a set of dedicated media controls and a USB2 pass-through port, among others.

KEYBOARD SHAPE Full size • **NUMBER PAD** Yes • **CONNECTION** 2xUSB2 • **MEDIA KEYS** Pause/play, mute, skip, volume • **USB PORTS** 2x USB2 • **WARRANTY** One year RTB • **DETAILS** www.asus.com/uk • **PART CODE** 90MP000MO-BOEA00 • **FULL REVIEW** Oct 2019



THERMALTAKE View 37

★★★★★

£130 • www.scan.co.uk

COMPUTER SHOPPER
BEST BUY

A spacious, feature-rich chassis for both ATX- and EATX-based builds, the View 37 comes with a gull-wing side window that's perfect for showing off your handiwork.

CASE TYPE Mid-tower • **MOTHERBOARD TYPE** ATX, EATX, microATX, Mini-ITX • **SUPPLIED FANS** 2x 140mm • **MAXIMUM DRIVE BAYS** 7x 3.5in, 11x 2.5in • **DIMENSIONS** 525x261x538mm • **WEIGHT** 11.8kg • **WARRANTY** Three years RTB • **DETAILS** www.thermaltake.com • **PART CODE** CA-1J7-00M1WN-00 • **FULL REVIEW** Dec 2018



AMD Radeon RX 5700 XT

★★★★★

£379 • shop.amd.com

COMPUTER SHOPPER
RECOMMENDED

The standard RX 5700 is better value for lower resolutions, but if you want to play at 4K without the expense of Nvidia's top RTX graphics cards, the RX 5700 XT's higher core count and clock speeds make it a great choice.

GPU AMD Radeon RX 5700 XT • **MEMORY** 8GB GDDR6 • **GRAPHICS CARD LENGTH** 272mm • **WARRANTY** One year RTB • **DETAILS** www.amd.com/uk • **PART CODE** Radeon RX 5700 XT • **FULL REVIEW** Oct 2019



Choosing a... Display

01 A basic 24in LCD monitor costs around £100. It will be fine for typical Windows work but is likely to have poor viewing angles, so you'll need to sit straight on for the best picture quality. Its colour accuracy may not be very good, either.

02 A VGA input lets you use the monitor with any PC, but the quality may not be as good as it is over DVI or HDMI. Both are digital connections and require a compatible graphics card but they avoid the need for digital-to-analogue or analogue-to-digital conversions, which can reduce image quality. A digital connection achieves the best picture automatically, so you won't have to adjust clock or phase settings as you do with analogue connections.

Many DVI and all HDMI connections support HDCP, which lets you watch protected video content, such as Blu-ray movies. DisplayPort is becoming more popular, but you'll need a graphics card with a DisplayPort output (mini or full-size) to use this input on your monitor.

03 A larger monitor will be easier on the eye and may have a higher resolution. Most monitors have a resolution of at least 1,920x1,080 (1080p), which provides lots of room for working with multiple windows at the same time. For even higher resolutions, you'll need a larger display. Some 27in and 30in screens have 2,560x1,600 or even 4K resolutions. You'll need a graphics card with a dual-link DVI output and a dual-link DVI

cable or either HDMI or DisplayPort to use a monitor at these resolutions.

04 If you want better picture quality, look for a monitor with a high contrast ratio. The higher the ratio, the whiter the whites and the blacker the blacks. You'll also be able to see more fine detail in images with high contrast levels. Viewing angles are important, as wider angles mean you don't have to sit directly in front of the monitor to get the best picture. Wider viewing angles also allow more people to view the screen at the same time.

Fast response times reduce ghosting, but don't be dazzled by the numbers. A response time of 25ms or quicker is fine for all applications.

DISPLAYS

LG 27GL850



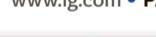
£439 • www.currys.co.uk



This monitor's size and resolution hit the sweet spot for serious gaming, and it's helped further by both G-Sync and FreeSync support, as well as an innovative IPS panel that's faster and more responsive than the technology usually is.



AOC 24B2XH



£105 • www.uk.insight.com



IPS monitors don't come any cheaper than this, and the AOC 24B2XH backs up this initial promise with vibrant onscreen tones, excellent colour accuracy and even good contrast – something even expensive IPS panels can struggle with.



ACER Nitro VG270UP



£300 • uk-store.acer.com



A great all-round gaming monitor without the premium price. Both FreeSync and G-Sync are supported, and the IPS panel combines a 144Hz refresh rate with vibrant colours, high accuracy and the kind of responsiveness you'd normally only get from a TN panel.



SCREEN SIZE 27in • RESOLUTION 2,560x1,440 • SCREEN TECHNOLOGY IPS • REFRESH RATE 144Hz • VIDEO INPUTS HDMI, DisplayPort • WARRANTY Two years RTB • DETAILS www.acer.com • FULL REVIEW Dec 2019

LENOVO ThinkVision M14



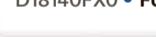
£227 • business.currys.co.uk



With the ThinkVision M14, portable USB Type-C monitors finally reach maturity. It's razor-thin, has an adjustable hinge instead of a fixed angle, and its IPS panel is leagues ahead of the competition.



AOC CQ32G1



£325 • www.ballicom.co.uk



AOC has a habit of making great-value, large-screened VA monitors, and the CQ32G1 is another to add to the list. A 144Hz gaming display first and foremost, it's as fast and good-looking as it needs to be, and supports both AMD FreeSync and, unofficially, Nvidia G-Sync.



SCREEN SIZE 31.5in • RESOLUTION 2,560x1,440 • SCREEN TECHNOLOGY VA • REFRESH RATE 144Hz • VIDEO INPUTS HDMI, DisplayPort • WARRANTY One year repair and replace • DETAILS eu.aoc.com • FULL REVIEW Nov 2019

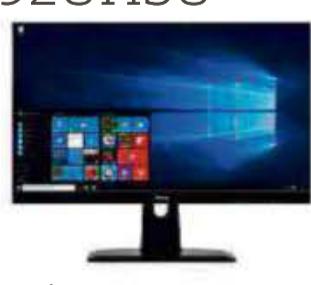
IIYAMA ProLite XUB2792UHSU



£335 • www.scan.co.uk



If you don't need all the bells and whistles of a curved ultrawide, the ProLite XUB2792UHSU nails the basics at a very attractive price. 4K sharpness, high brightness and full sRGB colour gamut coverage add up to a superb monitor.



SCREEN SIZE 27in • RESOLUTION 3,840x2,160 • SCREEN TECHNOLOGY IPS • REFRESH RATE 60Hz • VIDEO INPUTS DisplayPort, HDMI, DVI • WARRANTY Three years onsite • DETAILS www.iiyama.com • FULL REVIEW Nov 2019

Choosing an... Inkjet printer

01 You should be able to buy a decent inkjet printer for less than £40.

High-quality printing is possible on such a printer, but it will be slow. The actual print speed of an inkjet can be half the quoted (maximum) speed for text documents, and even slower when printing graphics. Budget inkjet printers such as these are designed only for light use and can be expensive to run.

02 For £80 to £90 you can buy a more capable printer that's either faster and better built or better at reproducing photos. If documents are your priority, you'll want a high minimum speed and low print costs. Look for inkjets that can handle all your office media, such as envelopes and labels.

03 If photos are your priority, speed is less important. Choose a printer that reproduces subtle tones well. You can't determine this by looking at the specifications – only hands-on testing will do, so remember to check our reviews before you buy.

Borderless printing (up to the edge of the paper) should also be possible. Pay particular attention to running costs: photos use three times as much ink as regular colour documents.

04 Heavy-duty office inkjets can cost up to £1,000 and their build quality is improving. They use large individual ink tanks, which can cut running costs. Printers with automatic duplex (double-

sided) printing or A3 capabilities are now much more affordable.

05 Pricier photo printers let you print from memory cards plugged straight into the printer, so you don't need to use a PC. An LCD preview screen offers greater control for this method of printing. Many inkjet printers now have a PictBridge USB port, which you can use to print images directly from most digital cameras.

06 If you're really serious about photography, consider buying an inkjet that can produce borderless prints up to A3 size. The best devices can print photos that look nearly as good as those from professional labs.

PRINTERS & SCANNERS

EPSON WorkForce WF-110W

★★★★★

£206 • www.printerbase.co.uk

COMPUTER SHOPPER **RECOMMENDED** Low speeds and high running costs are usually a ruinous combination, but the WF-110W makes up for its shortcomings with a nicely portable design and high print quality.

TECHNOLOGY Piezo inkjet • MAXIMUM PRINT RESOLUTION 5,760x1,440dpi • DIMENSIONS 61x309x159mm • WEIGHT 1.6kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year RTB • DETAILS www.epson.co.uk • PART CODE C11CH25401DA • FULL REVIEW Apr 2020



EPSON Expression Photo XP-8600

★★★★★

£100 • www.argos.co.uk

COMPUTER SHOPPER **BEST BUY** The Expression Photo XP-8600 focuses on creative use, and does a great job of it, too. At this kind of price, nothing else comes close on the quality of printed photos.

TECHNOLOGY Piezo inkjet • MAXIMUM PRINT RESOLUTION 5,760x1,440dpi • SCANNER RESOLUTION 1,200x4,800dpi • DIMENSIONS 142x349x340mm • WEIGHT 6.7kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year RTB • DETAILS www.epson.co.uk • PART CODE C11CH47401 • FULL REVIEW Jan 2020



CANON imageFormula DR-C230

★★★★★

£324 • www.printerbase.co.uk

COMPUTER SHOPPER **RECOMMENDED** This sheet-fed document scanner is perfect for getting through stacks of documents without having to manually scan each page. It's pleasantly fast and pairs with Canon's powerful CaptureOnTouch Pro software, which does a fine job of processing your scans.

TECHNOLOGY Dual CIS sheet-fed scanner • SCANNER RESOLUTION 600x600dpi • DIMENSIONS 231x291x530mm • WEIGHT 2.8kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year RTB • DETAILS www.canon.co.uk • PART CODE 2646C003 • FULL REVIEW Feb 2018



BROTHER MFC-J1300DW

★★★★★

£316 • www.printerbase.co.uk

COMPUTER SHOPPER **RECOMMENDED** Its grey plastic build doesn't give the best first impression, but the MFC-J1300DW All in Box is a deceptively feature-rich yet easy-to-use MFP for busy home offices. Its running costs are low, too.

TECHNOLOGY Piezo inkjet • MAXIMUM PRINT RESOLUTION 6,000x1,200dpi • SCANNER RESOLUTION 1,200x2,400dpi • DIMENSIONS 195x435x341mm • WEIGHT 8kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY Three years RTB • DETAILS www.brother.co.uk • PART CODE MFCJ1300DWZU1 • FULL REVIEW Sep 2020



CANON Pixma TS205

★★★★★

£30 • store.canon.co.uk

COMPUTER SHOPPER **RECOMMENDED** It has a basic feature set and isn't very fast, but the Pixma TS205's print quality makes it a bargain. Replacement ink cartridges are the biggest expense, but that's fine if you're only printing at home occasionally.

TECHNOLOGY Thermal inkjet • MAXIMUM PRINT RESOLUTION 4,800x1,200dpi • DIMENSIONS 131x426x255mm • WEIGHT 2.5kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY One year RTB • DETAILS www.canon.co.uk • PART CODE 2319C008 • FULL REVIEW Sep 2019



CANON Neverstop Laser 1202nw

★★★★★

£256 • store.hp.com

COMPUTER SHOPPER **BEST BUY** Unbelievably low running costs transform the Neverstop Laser 1202nw from a fairly humdrum mono MFP into an excellent choice for those who need bulk printing.

TECHNOLOGY Mono laser • MAXIMUM PRINT RESOLUTION 5,760x1,440 • SCANNER RESOLUTION 600x600dpi • DIMENSIONS 287x381x294mm • WEIGHT 8.8kg • MAXIMUM PAPER SIZE A4/legal • WARRANTY Three years RTB with registration • DETAILS www.hp.co.uk • PART CODE 5HG93A#B19 • FULL REVIEW Aug 2020



Choosing a... Wireless router

01 Wireless routers each use a number of Wi-Fi standards, so you shouldn't have any trouble connecting your computer or phone wirelessly if you get an 802.11n or 802.11ac router. Nearly all routers support 802.11n, so even a cheap model should provide decent performance.

You can expect a transfer speed of around 40Mbit/s at a distance of 10m from any modern 802.11n router. The very latest routers use the 802.11ac standard, which provides tremendously fast transfer speeds. Some devices still don't support the 802.11ac standard, so check the specifications before you buy.

02 If you subscribe to an ADSL broadband service, you should buy

a wireless router that has a built-in ADSL modem. This will cost more than the equivalent cable router, but it allows you to connect your router directly to your broadband connection without having to use a separate modem.

03 Most 802.11n wireless routers use the 2.4GHz frequency band. This has good range but it can be prone to interference if it's positioned close to a lot of other 2.4GHz devices, such as other routers and baby monitors. If you have trouble getting a consistent signal or you want faster speeds for video streaming, for example, it's worth buying a dual-band router that can use both the 2.4GHz and 5GHz bands.

Alternatively, a high-gain antenna can boost signals and improve ranges and throughputs to the entire house. You can also add a high-gain antenna to a PC's network adaptor. If wired network speeds are a priority, you should look for a router with a Gigabit Ethernet connection.

04 Many routers come with built-in USB ports that let you connect a USB drive and use the router as a network storage device. If you want to share a USB printer over your network, look for a wireless router that has a USB print server.

Finally, if you're interested in making voice calls over the internet, buy a router with built-in VoIP support (and phone sockets) because this can save you money.

NETWORKS

BT Complete Wi-Fi



£5 per month • www.bt.com



There are better-featured mesh systems available, but the Complete Wi-Fi is decently quick on both the 5GHz and 2.4GHz bands, and is well worth it for BT Plus customers in particular.



WI-FI STANDARD 802.11ac • STATED SPEED 1,733Mbit/s (5GHz), 385Mbit/s (2.4GHz) • USB PORTS 1 • WALL MOUNTABLE No • WARRANTY Under rental contract • PART CODE BT Complete Wi-Fi • FULL REVIEW Mar 2019

GOOGLE Nest WiFi



£239 • store.google.com



This mesh system is a little different: its satellites are also Google Assistant speakers, adding some neat smart home functionality throughout your house.



MODEM Gigabit Ethernet • WI-FI STANDARD 802.11ac • STATED SPEED Not stated • USB PORTS None • WALL MOUNTABLE No • WARRANTY Two years RTB • PART CODE Nest WiFi • FULL REVIEW Aug 2020

TP-LINK Deco X60



£413 • www.tp-link.com



At nearly half the price of some equivalent Wi-Fi 6 mesh systems, the TP-Link Deco X60 is a great option for those who want the latest wireless technology without breaking the bank.



MODEM Gigabit Ethernet • WI-FI STANDARD 802.11ax • STATED SPEED 2,404Mbit/s (5GHz), 574Mbit/s (2.4GHz) • USB PORTS None • WALL MOUNTABLE No • WARRANTY Two years RTB • PART CODE Deco X60 • FULL REVIEW Sep 2020

NETGEAR Nighthawk AX8



£302 • www.scan.co.uk



If you want to get in early on Wi-Fi 6/802.11ax, this is a good router to do it with. It's no more difficult to set up than an 802.11ac model, but successfully delivers the newer standard's higher speeds.



MODEM Gigabit Ethernet • WI-FI STANDARD 802.11ax • STATED SPEED 4,800Mbit/s (5GHz), 1,200Mbit/s (2.4GHz) • USB PORTS 2 • WALL MOUNTABLE Yes • WARRANTY Two years RTB • DETAILS www.netgear.com • PART CODE RAX80 • FULL REVIEW Jan 2020

D-LINK DIR-1960



£88 • www.amzn.to/2Tj1zf5



The DIR-1960 is a simple yet speedy router that can optionally be turned into a mesh system (provided you buy the additional satellites, of course). Either way, you can also take advantage of built-in Alexa and Google Assistant controls.



MODEM Gigabit Ethernet • WI-FI STANDARD 802.11ac • STATED SPEED 1,300Mbit/s (5GHz), 600Mbit/s (2.4GHz) • USB PORTS 1x USB2 • WALL MOUNTABLE Yes • WARRANTY Two years RTB • DETAILS www.d-link.com • PART CODE DIR-1960 • FULL REVIEW Nov 2019

NETGEAR Orbi Outdoor RBS50Y



£275 • www.broadbandbuyer.com



This weatherproof Wi-Fi extender is a perfect addition to mesh systems that can't quite cover a garden. It has similar internal specifications to the brilliant Orbi RBK50, meaning high speeds and reliable connections.



WI-FI STANDARD 802.11ac • STATED SPEED 1x 866Mbit/s (5GHz) 1x 1,733Mbit/s (5GHz), 1x 400Mbit/s (2.4GHz) • USB PORTS 0 • WALL MOUNTABLE Yes • WARRANTY Two years RTB • DETAILS www.netgear.co.uk • PART CODE RBS50Y • FULL REVIEW Jul 2019

Choosing a... Smart thermostat

01 A smart thermostat can save you a lot of money by intelligently controlling your heating.

Most smart heating devices are designed to be used with hot water central heating systems, with the boiler directly controlled by the system. These typically require a relay to be wired into your boiler, with a wireless thermostat giving you direct control. Smartphone apps then tie into the system to give you remote control. While it's possible to fit controls yourself, you may want to pay an experienced plumber to do the job: expect to pay around £150 for a typical installation.

If you have electric heating, there are very few choices, and the big names (Nest, Honeywell and so on) do not directly support these systems.

02 Want smart hot water control? If you want to remotely set schedules and disable hot water while you're away, choose your smart system carefully, as many don't have this option. Hot water control usually requires a second relay to be wired into the boiler.

03 What kind of heating system do you want? There are two main choices: a central system and one with individual radiator controls. The former replaces your existing thermostat, and lets you set one temperature for your entire house. The latter requires each radiator valve to be replaced with a smart valve so that each room and radiator can have its own individual control.

This option is more expensive to install but will provide you with greater savings.

04 Do you use a smart personal assistant? Make sure that your smart thermostat supports the one that you use. Amazon Alexa, powered by the Echo and Echo Dot, is the best-supported system; Apple's HomeKit, powered by Siri, isn't so well supported; Google Assistant, built into Google Home, is just gaining traction and supports Nest only.

05 If you want your smart heating system to do more, look for IFTTT support. With this handy system, you can set automatic rules, such as turning the heating off if the outside temperature rises.

SMART HOME

AMAZON Echo Dot with Clock



£55 • www.amzn.to/2LLc9aG



This is literally 'just' an Echo Dot 3rd Generation with an added LCD clock, but considering it's no more expensive and offers the same combination of capable speaker and versatile smart home controller, that's absolutely nothing to complain about.

DRIVERS 1 • RMS POWER OUTPUT Not stated • WEIGHT 300g • NETWORKING Bluetooth, 802.11n • WARRANTY One year RTB • DETAILS www.amazon.co.uk • PART CODE Echo Dot with Clock • FULL REVIEW Feb 2020



NEST Cam IQ Outdoor



£329 • www.johnlewis.com



While this is an expensive replacement for the old Nest Cam Outdoor, its image quality is without equal. Facial and sound recognition have also been improved, and it's now much harder for thieves to remove the camera from its mount.

VIDEO RESOLUTION 4K sensor, 1080p recording • CLOUD STORAGE Yes (subscription required) • NETWORKING 802.11ac • WARRANTY One year RTB • PART CODE Nest Cam IQ Outdoor • FULL REVIEW Jul 2018



TADO Smart Thermostat



£120 • www.amzn.to/2ZxwlfZ



A flexible and stylish-looking smart heating system, the Tado Smart Thermostat distinguishes itself with a clever geolocation feature that turns on your heating when you enter a room and switches it off, saving money, when you leave.

REMOTE THERMOSTAT Yes • HOT WATER SUPPORT Yes • INDIVIDUAL RADIATOR CONTROL Yes • VOICE ASSISTANT SUPPORT Alexa, Google Assistant, Siri • APPS iOS, Android and web • FULL REVIEW Jan 2018



NEOS Smartcam



£30 • shop.neos.co.uk



The Smartcam is a tremendous bargain of an indoor security camera. In many ways, it's not all that advanced – footage is only shot at up to 15fps, for instance – but the 1080p resolution, night-vision mode and free cloud storage make for a nifty little package.

VIDEO RESOLUTION 1080p • CLOUD STORAGE Yes (free) • NETWORKING 802.11n • WARRANTY One year RTB • PART CODE NS-CAM-02 • FULL REVIEW Jun 2019



GOOGLE Nest Hub Max



£219 • store.google.com



Besides the addition of a camera – which can be turned off – this is mainly just a larger Google Home Hub. Luckily, that also means it's a fantastic smart display, with a higher resolution and better-sounding speaker.

DRIVERS 3 • RMS POWER OUTPUT Not stated • DOCK CONNECTOR None • WIRELESS 802.11ac Wi-Fi, Bluetooth 5.0 • DIMENSIONS 183x250x101mm • WEIGHT 1.3kg • WARRANTY One year RTB • PART CODE Nest Hub Max • FULL REVIEW Jan 2020



RING Indoor Cam



£49 • www.amzn.to/2P1RbGj



The Indoor Cam doesn't just capture very high-quality footage for the money. With its Modes feature, you can easily activate the camera when you leave home and deactivate it when you return. It's a smart blend of security and privacy.

VIDEO RESOLUTION 1080p • CLOUD STORAGE Yes • NETWORKING 802.11n • WARRANTY One year RTB • PART CODE Ring Indoor Cam • FULL REVIEW Apr 2020



Choosing a... Smartphone

01 A smartphone's operating system (OS) dictates its basic features and which third-party software you can install. There are three main contenders: Apple's iOS, which is found on the iPhone, Google's Android, which is used by various handset manufacturers, and Windows Phone, which has few options, especially since Microsoft has discontinued support for its OS. Apple iOS and Google Android both have thousands of apps available.

02 All smartphones have colour screens, but their resolutions vary. Basic models have 1,280x720 pixels, but text can be indistinct. Look for a display that has at least 1,920x1,080 pixels so it's easier to read text

and watch Full HD videos. Don't worry too much about built-in media players or Office document editors; you can always install apps to replace these with better versions later.

The image quality of smartphone cameras has improved tremendously in recent years, and resolutions have increased to as high as 20 megapixels.

03 Very few modern smartphones have a physical keyboard for entering text; they almost exclusively use touchscreens now. Physical keyboards can aid heavy emailing, but today's touchscreen keyboards work just as well.

Android smartphones and iPhones running iOS 9 or above allow you to install

a variety of custom onscreen keyboards so you can find one that suits you.

04 Be careful when choosing a contract. Look for one that includes a large data allowance if you want to use the internet regularly or you've set your phone to synchronise your contacts, calendar and email through online services.

Built-in Wi-Fi can help you avoid high data charges by connecting to the internet through wireless hotspots when you're out, or your router when you're at home. Android and iPhone handsets can operate as wireless hotspots, letting you connect your laptop to the web over your mobile data connection. There may be an extra charge for this.

SMARTPHONES

ONEPLUS 8



£599 SIM-free • www.johnlewis.com



It doesn't take any risks, but this is still a great improvement on the OnePlus 7T.

Once again, OnePlus has provided flagship-quality hardware, from the 90Hz display to the sharp triple-lens camera, at a lower price.



PROCESSOR Octa-core Octa-core 2.84GHz Qualcomm Snapdragon 865 • **SCREEN SIZE** 6.55in • **SCREEN RESOLUTION** 2,400x1,080 • **REAR CAMERAS** 48 megapixels, 16 megapixels, 2 megapixels • **STORAGE** 128GB • **WIRELESS DATA** 5G • **NFC** Yes • **DIMENSIONS** 160x73x8mm • **WEIGHT** 180g • **OPERATING SYSTEM** Android 10 • **WARRANTY** One year RTB • **DETAILS** www.oneplus.com • **PART CODE** IN2013 • **FULL REVIEW** Aug 2020

SAMSUNG Galaxy S20



£799 SIM-free; £46-per-month contract • www.samsung.com (SIM-free); www.tescomobile.com (contract)



While still a pricey smartphone, the standard Galaxy S20 is the cheapest of Samsung's flagship line-up. It has the same processor as – and similar design to – the S20+ and S20 Ultra, so it's the best value as well.



PROCESSOR Octa-core 2.73GHz Samsung Exynos 990 • **SCREEN SIZE** 6.2in • **SCREEN RESOLUTION** 3,200x1,440 • **REAR CAMERAS** 12 megapixels, 64 megapixels, 12 megapixels • **STORAGE** 128GB • **WIRELESS DATA** 4G • **NFC** Yes • **DIMENSIONS** 152x69x7.9mm • **WEIGHT** 163g • **OPERATING SYSTEM** Android 10 • **WARRANTY** One year RTB • **DETAILS** www.samsung.com/uk • **PART CODE** SM-G980FLBDEUA • **FULL REVIEW** Jul 2020

MOTOROLA Moto E6 Plus



£80 SIM-free; £9-per-month contract • www.argos.co.uk (SIM-free); www.tescomobile.com (contract)



There's plenty of smartphone here for the money, whether it's the spacious 6.1in display or the surprisingly high performance.

It also has a removable back panel, so it's one of very few Android handsets for which you can use spare batteries.



PROCESSOR Octa-core 2GHz Mediatek Helio P22 • **SCREEN SIZE** 6.1in • **SCREEN RESOLUTION** 1,560x720 • **REAR CAMERAS** 13 megapixels, 2 megapixels • **STORAGE** 32GB • **WIRELESS DATA** 4G • **NFC** No • **DIMENSIONS** 156x73x8.6mm • **WEIGHT** 150g • **OPERATING SYSTEM** Android 9.0 • **WARRANTY** One year RTB • **DETAILS** www.motorola.co.uk • **PART CODE** PAGA0000GB • **FULL REVIEW** May 2020

GOOGLE Pixel 3a



£289 SIM-free; £22-per-month contract • www.carphonewarehouse.com



The Pixel 3a is a welcome return to mid-range smartphones on Google's part. It's essentially a cheaper version of the flagship Pixel 3, which means a bit less horsepower but the same clean, stock Android and superb camera.



PROCESSOR Quad-core 2.8GHz Qualcomm Snapdragon 845 • **SCREEN SIZE** 5.5in • **SCREEN RESOLUTION** 2,160x1,080 • **REAR CAMERA** 12.2 megapixels • **STORAGE** 64GB • **WIRELESS DATA** 4G • **NFC** Yes • **DIMENSIONS** 146x68x7.9mm • **WEIGHT** 148g • **OPERATING SYSTEM** Android 9.0 • **WARRANTY** One year RTB • **DETAILS** store.google.com • **PART CODE** Pixel 3 • **FULL REVIEW** Aug 2019

APPLE iPhone SE (2020)



£419 SIM-free; £20 up front plus £16-per-month contract • www.apple.com/uk (SIM-free); www.three.co.uk (contract)



The updated iPhone SE cuts a familiar figure: on the outside, it's essentially an iPhone 8. On the inside, however, it's fitted with the same A13 Bionic processor as the iPhone 11 range, for performance that more than meets 2020 standards.



PROCESSOR Hexa-core 2.65GHz Apple A13 Bionic • **SCREEN SIZE** 4.7in • **SCREEN RESOLUTION** 1,334x750 • **REAR CAMERA** 12 megapixels • **STORAGE** 64GB • **WIRELESS DATA** 4G • **NFC** Yes • **DIMENSIONS** 138x67x7.3mm • **WEIGHT** 138g • **OPERATING SYSTEM** iOS 13 • **WARRANTY** One year RTB • **DETAILS** www.apple.com/uk • **PART CODE** iPhone SE 2020 • **FULL REVIEW** Sep 2020

APPLE iPhone 11



£729 SIM-free; £29 up front plus £46-per-month contract • www.apple.com/uk (SIM-free); www.carphonewarehouse.com



The standard iPhone 11 is a slick and powerful smartphone. It has the same class-leading A13 Bionic chip as the iPhone 11 Pro, while costing hundreds of pounds less.



PROCESSOR Hexa-core 2.65GHz Apple A13 Bionic • **SCREEN SIZE** 6.1in • **SCREEN RESOLUTION** 1,792x828 • **REAR CAMERAS** 12 megapixels, 12 megapixels • **STORAGE** 64GB • **WIRELESS DATA** 4G • **NFC** Yes • **DIMENSIONS** 151x76x8.3mm • **WEIGHT** 194g • **OPERATING SYSTEM** iOS 13 • **WARRANTY** One year RTB • **DETAILS** www.apple.com/uk • **PART CODE** iPhone 11 • **FULL REVIEW** Mar 2020

Choosing a... Tablet

01 All tablets rely on an operating system (OS) to run apps. You have three main choices: Apple's iOS, which runs on the iPad; Android, which Google licenses to various manufacturers; and Windows 10, which has become common in hybrid tablets and convertibles. If you own an Apple or Google smartphone, you can download your apps, music and so on to a tablet that runs the same OS, so it makes sense to stick with a compatible device.

02 It's important to pick a tablet that has a good-quality, high-resolution screen. Many budget tablets have 1,280x800-resolution displays, but better tablets have Full HD 1,920x1,080 panels, and we're

starting to see tablets that have even higher screen resolutions. Some are as high as 2,560x1,600 or even 4K. Entry-level tablets typically use TN panels, which don't have particularly good viewing angles. The viewing angles of IPS panels are much better.

03 If you want to listen to music, watch films and play games, make sure your tablet has plenty of storage. Many tablets come with 8GB or 16GB of internal storage, although some budget models have less. You'll typically pay more for a higher storage capacity. Many tablets also have microSD slots that let you add extra storage, although you won't find one on an iPad. This is a cheap way of boosting storage capacity.

04 Tablets rarely include a SIM card slot. This means you'll have to rely on Wi-Fi to get online, although some tablets let you access the internet through your smartphone. If you want mobile access to the internet, look for 3G- and 4G-ready devices. These almost always cost more than Wi-Fi-only models, but they're great if you use your tablet while commuting or travelling.

05 Your choice of tablet determines the apps you can use on it. You may find that some of the apps you want are available on iOS but not Android, and vice versa. Windows 10, meanwhile, runs traditional desktop applications.

TABLETS

AMAZON Kindle Oasis (2019)



£230 • www.amzn.to/2mp6ldb



With the addition of a blue light filter, the latest Kindle Oasis is as good an e-reader as you can get.

Besides being easier on the eyes when reading at night, it has the physical page-turn buttons that cheaper Kindles lack, and the screen can auto-rotate according to how you're holding it.

PROCESSOR Not stated • **SCREEN SIZE** 7in • **SCREEN RESOLUTION** 300ppi • **REAR CAMERA** None • **STORAGE** 8GB • **WIRELESS DATA** Wi-Fi, Bluetooth • **DIMENSIONS** 159x141x8.4mm • **WEIGHT** 188g • **OPERATING SYSTEM** Kindle OS • **WARRANTY** One year RTB • **DETAILS** www.amazon.co.uk • **PART CODE** Kindle Oasis (2019) • **FULL REVIEW** Nov 2019



APPLE iPad 10.2in



£329 • www.amzn.to/32v58Ep



After the previous iPad pivoted to an education focus, the latest model changes course again, aiming to become a more affordable 2-in-1 than the iPad Pro range. It works, too: the enlarged screen, Smart Connector for keyboards and high performance make for a relatively affordable laptop alternative.

PROCESSOR Quad-core Apple A10 Fusion • **SCREEN SIZE** 10.2in • **SCREEN RESOLUTION** 2,160x1,620 • **REAR CAMERA** 8 megapixels • **STORAGE** 32GB • **WIRELESS DATA** 4G (cellular model) • **DIMENSIONS** 215x174x7.5mm • **WEIGHT** 483g • **OPERATING SYSTEM** iPadOS • **WARRANTY** One year RTB • **DETAILS** www.apple.com/uk • **PART CODE** iPad (2019) • **FULL REVIEW** Feb 2020



SAMSUNG Galaxy Tab S6 Lite



£309 • www.johnlewis.com



This is a fairly stark downgrade from the standard Tab S6, at least in performance terms, but it's nonetheless a very accomplished mid-range Android tablet. You get an S Pen stylus included in the box, too, for even more value.

PROCESSOR Octa-core 2.3GHz Samsung Exynos 9611 • **SCREEN SIZE** 10.4in • **SCREEN RESOLUTION** 2,000x1,200 • **REAR CAMERA** 8 megapixels • **STORAGE** 64GB • **WIRELESS DATA** 4G (cellular model only) • **DIMENSIONS** 245x154x7mm • **WEIGHT** 465g • **OPERATING SYSTEM** Android 9.0 • **WARRANTY** One year RTB • **DETAILS** www.samsung.com • **PART CODE** SM-P610NZABTU • **FULL REVIEW** Sep 2020



MICROSOFT Surface Go 2



£509 • www.microsoft.com



Yes, the Surface Go 2 is only half the device it can be without its sold-separately keyboard, but put together they make for a magnificently portable 2-in-1 that captures almost everything good about the Surface family as a whole.

PROCESSOR Dual-core 1.1GHz Intel Core m3-8100Y • **SCREEN SIZE** 10.5in • **SCREEN RESOLUTION** 1,920x1,280 • **REAR CAMERA** 8 megapixels • **STORAGE** 128GB • **WIRELESS DATA** No • **DIMENSIONS** 245x175x8.3mm • **WEIGHT** 745g (with keyboard) • **OPERATING SYSTEM** Windows 10 Home • **WARRANTY** One year RTB • **DETAILS** www.microsoft.com • **PART CODE** SUA-00002 • **FULL REVIEW** Sep 2020



SAMSUNG Galaxy Tab S6



£559 • www.johnlewis.com



The Tab S6 is no simple slate. Samsung's DeX interface turns it into a viable 2-in-1 laptop alternative, something that's further enabled by its powerful processor and glorious, high-resolution touchscreen.

PROCESSOR Quad-core 2.84GHz Qualcomm Snapdragon 855 • **SCREEN SIZE** 10.5in • **SCREEN RESOLUTION** 2,560x1,440 • **REAR CAMERAS** 15 megapixels, 3 megapixels • **STORAGE** 128GB • **WIRELESS DATA** No • **DIMENSIONS** 245x160x5.7mm • **WEIGHT** 420g • **OPERATING SYSTEM** Android 9.0 • **WARRANTY** One year RTB • **DETAILS** www.samsung.com/uk • **PART CODE** SM-T860NZABTU • **FULL REVIEW** Apr 2020



APPLE iPad Pro 12.9in (2020)



£1,619 • www.apple.com/uk



Another powerful iPad Pro, now with a slick 120Hz display and iPadOS tweaks that make it even better as a laptop alternative. The keyboard attachment's trackpad is a welcome addition as well, though you'll need to buy this separately.

PROCESSOR Octa-core 2.4GHz Apple A12X Bionic • **SCREEN SIZE** 12.9in • **SCREEN RESOLUTION** 2,732x2,048 • **REAR CAMERAS** 12 megapixels, 10 megapixels • **STORAGE** 1TB • **WIRELESS DATA** Wi-Fi • **DIMENSIONS** 281x215x5.9mm • **WEIGHT** 643g • **OPERATING SYSTEM** iPadOS • **WARRANTY** One year RTB • **DETAILS** www.apple.com/uk • **PART CODE** iPad Pro 12.9in (2020) • **FULL REVIEW** Oct 2020



Choosing a... Soundbar

01 If you don't have space in your home cinema setup for a set of surround-sound speakers, a soundbar is the next best thing. Whether you opt for a soundbar (which typically sits in front of your TV stand) or a soundplate (which sits underneath your TV), you'll be getting significantly better audio than the weedy speakers today's flatscreen TVs provide.

02 If you want to cut down on cable clutter, look for a soundbar with multiple HDMI inputs and outputs as well as Audio Return Channel (ARC). Not all soundbars use HDMI, with many making do with digital optical audio connections instead. This means you'll have to connect Blu-ray players, games consoles and set-top

boxes to your TV and run all audio through a single cable. Also look for phono inputs for connecting older devices and 3.5mm audio jacks for tablets or smartphones.

03 As with any speaker, the number of speaker drivers inside a soundbar should give a good indication of its audio capabilities. Although this won't tell you everything about sound quality, you should still look out for separate mid-range drivers and tweeters, as these should be able to deliver a wider frequency range than full-range drivers alone.

04 Bluetooth support is a must if you want to listen to music from a smartphone or tablet without wires.

Most soundbars now include Bluetooth as standard but, if your device supports it, it's worth looking for a mobile soundbar that includes aptX. This less-lossy codec is capable of higher-quality streaming than the standard A2DP profile.

AirPlay streaming is less common, but iPhone owners should keep an eye out for it.

05 For a little extra bass, be sure to look for a soundbar with a separate subwoofer. Many soundbars include a wired sub, but for extra convenience you should look for a model with a wireless subwoofer instead. These can be placed anywhere in a room near a power socket, without having to run a cable back to the soundbar itself.

HOME CINEMA

HISENSE

R50B7120UK



£349 • www.argos.co.uk



This VA-based smart TV isn't just cheap for a 4K model; it's a collaboration with Roku, which means it has the most well-serviced smart streaming platform built right in.

SCREEN SIZE 55in • NATIVE RESOLUTION 3,840x2,160 • VIDEO INPUTS 3x HDMI • TUNER Freeview HD • DIMENSIONS 1,127x720x256mm • WARRANTY Two years RTB • DETAILS www.hisense.co.uk • PART CODE R50B7120UK • FULL REVIEW Jul 2020



VIZIO SB36512-F6E

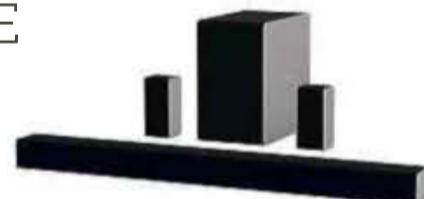


£593 • www.amzn.to/2ALZJxi



A full 5.1.2 surround-sound system at this price sounds unlikely, but the SB36512-F6E isn't just a cheap soundbar/subwoofer/speaker package: it's a genuinely great-sounding one, and with loads of side features, too.

SPEAKERS 5+1+1+1 • RMS POWER OUTPUT Not stated • DIMENSIONS 914x81x64mm (soundbar), 290x177x290mm (subwoofer), 145x68x65mm (speakers) • WEIGHT 2.5kg (soundbar), 4.6kg (subwoofer), 397g (speakers) • DOCK CONNECTOR None • NETWORKING 802.11ac Wi-Fi, Ethernet • WARRANTY One year RTB • DETAILS www.viziosoundbar.uk • PART CODE SB36512-F6E • FULL REVIEW Aug 2020



PANASONIC TX-40GX800B



£503 • www.panasonic.com



This is a good match for anyone who can live without OLED or QLED tech, but wants a good mix of features and connectivity. It's a fairly basic VA panel, but this is enough for high picture quality, with support for HDR10+ and Dolby Vision.

SCREEN SIZE 40in • NATIVE RESOLUTION 3,840x2,160 • VIDEO INPUTS 3x HDMI, Composite • TUNER Freeview Play • DIMENSIONS 901x573x236mm • WARRANTY Five years RTB • DETAILS www.panasonic.com • PART CODE TX-40GX800B • FULL REVIEW Sep 2020



LG OLED65C9



£1,989 • [petertynson.co.uk](http://www.petertynson.co.uk)



It's only natural that this high-end OLED TV delivers outstanding picture quality, but it goes further with a wide range of HDMI 2.1 features, high gaming performance and effective HDR implementation.

SCREEN SIZE 65in • NATIVE RESOLUTION 3,840x2,160 • VIDEO INPUTS 4x HDMI • TUNER Freeview HD, FreeSat HD • DIMENSIONS 1,449x862x251mm • WARRANTY Five years RTB • DETAILS www.lg.com • PART CODE OLED65C9 • FULL REVIEW Jul 2020



POLK AUDIO Command Bar



£261 • www.amzn.to/33TdAv4



This is a genius combination of soundbar and smart speaker, and for a low price too. It's great for films, TV and music, and you can use Alexa as a voice-activated remote control.



SPEAKERS 3 • RMS POWER OUTPUT 260W • DIMENSIONS 1,091x102x51mm (soundbar), 367x188x368mm (subwoofer) • WEIGHT 2.3kg (soundbar), 3.9kg (subwoofer) • DOCK CONNECTOR None • NETWORKING 802.11ac Wi-Fi • WARRANTY Three years RTB • DETAILS en.polkaudio.com • PART CODE COMMANDUK • FULL REVIEW Oct 2019

SONOS Beam



£369 • www.amzn.to/2RjpMef



The Beam could join a home cinema setup on sound quality alone, but it's loaded with smart features, too. It can adjust sound output to the size and layout of a room, for example, and form a multiroom system with other Sonos speakers.



SPEAKERS 5 • RMS POWER OUTPUT Not stated • DIMENSIONS 651x100x69mm • WEIGHT 2.8kg • DOCK CONNECTOR None • NETWORKING 802.11ac Wi-Fi, Ethernet • WARRANTY One year RTB • DETAILS www.sonos.com • PART CODE BEAM1UK1 • FULL REVIEW Apr 2019

Choosing a... Bluetooth speaker

01 Bluetooth speakers come in all shapes and sizes, so you'll need to decide what you want to do with the speaker before you buy. If you don't plan to take your music outdoors or around the house, look for a wired speaker. These are typically cheaper than speakers with built-in batteries.

If you do want a portable speaker, however, pay particular attention to how much it weighs. Ruggedised models should be able to survive accidental drops, water spills and unexpected rain showers.

02 Many of the cheapest Bluetooth speakers use the lossy A2DP Bluetooth protocol, which is prone to compressing your music and discarding detail compared with the original recording.

It's hard to tell the difference when listening to pocket-sized speakers, but if you're looking for a speaker to fill a room, an aptX-compatible device is a better option. This Bluetooth protocol retains more detail than the A2DP profile, although you'll need to use it with a compatible smartphone in order to get the benefits.

03 As with any audio product, the number and size of speaker drivers can have a significant impact on the quality of sound you get from a Bluetooth speaker. Typically, the presence of multiple drivers enables the manufacturer to tune each one for specific frequencies, directing high-end sounds towards a tweeter and sending the mid-range frequencies to the main driver.

Single-driver speakers with larger driver cones can be just as capable of producing fantastic audio, however.

04 Most Bluetooth speakers have at least one auxiliary input for a wired 3.5mm audio jack, in case you want to listen to music from a device that doesn't have Bluetooth.

There are other extra features to look out for, though. Speakers with built-in batteries may have a USB port for charging your smartphone, or a built-in microphone to turn it into a speakerphone when a paired smartphone receives a call. Not all speakers have physical controls; many rely on your paired device's controls for adjusting the volume or muting playback.

AUDIO

CREATIVE Outlier Air



£55 • uk.creative.com



A marvellous set of true wireless



headphones, the Outlier Air combine a lively and dynamic sound with a comfy (if large) design and long battery life. Bluetooth aptX support is worth the money in particular.

HEADPHONES SUBTYPE In-ear headset • PLUG TYPE None • WEIGHT 10g • CABLE LENGTH N/A • WARRANTY Two years RTB • DETAILS uk.creative.com • PART CODE Outlier Air • FULL REVIEW Jul 2019

SONY WH-1000XM3



£229 • www.amzn.to/2HHUG1



Bose's QuietComfort headphones have at last been toppled from the ANC throne. The WH-1000XM3 headphones don't just sound outstanding, with very effective noise cancellation, but they're smartly designed and come with a host of extras.



HEADPHONES SUBTYPE Over-ear headset • PLUG TYPE 3.5mm jack plug (optional) • WEIGHT 255g • CABLE LENGTH 1.2m • WARRANTY One year RTB • DETAILS www.sony.co.uk • PART CODE WH-1000XM3 • FULL REVIEW May 2019

IKEA Symfonisk



£99 • www.ikea.com



Ikea, with a little help from Sonos, has produced two great-sounding wired speakers. The cheaper 'bookshelf' model is slim and subtle, but it's worth paying extra for the 'lamp' model, which both sounds fuller and doubles as a working lamp.

SPEAKERS 2 • RMS POWER OUTPUT Not stated • WEIGHT Not stated • NETWORKING Wi-Fi • WARRANTY One year RTB • DETAILS www.ikea.com • PART CODE Symfonisk • FULL REVIEW Nov 2019



SONOS Move



£399 • www.sonos.com



Although this is much bigger and less portable than most Bluetooth speakers, it's worth taking with you when you can. It sounds absolutely superb, and supports Trueplay, so can automatically adjust its output to fit the acoustics of its surroundings.



SPEAKERS 2 • RMS POWER OUTPUT Not stated • DOCK CONNECTOR None • NETWORKING 802.11n Wi-Fi, Bluetooth • DIMENSIONS 240x160x126mm • WEIGHT 3kg • WARRANTY One year RTB • DETAILS www.sonos.com • PART CODE MOVE1UK1BLK • FULL REVIEW Jan 2020

NAIM Mu-so Qb 2nd Generation



£749 • www.johnlewis.com



For a Bluetooth speaker this is immensely expensive, especially as it's mains-powered and thus not fully wireless. Nevertheless, its sound output is as expansive as it is customisable, and it can automatically adjust to its physical surroundings for the best tone.

SPEAKERS 5 • RMS POWER OUTPUT 300W • DOCK CONNECTOR None • NETWORKING 802.11ac Wi-Fi, Bluetooth • DIMENSIONS 1210x218x212mm • WEIGHT 5.6g • WARRANTY Two years RTB • DETAILS www.naimaudio.com • PART CODE MUSO2QB • FULL REVIEW Jun 2020



CREATIVE T100



£110 • uk.creative.com



These are no standard stereo desktop speakers. You can connect additional devices via 3.5mm or Bluetooth, or control them at range with the included remote. However you use the T100, they'll always sound rich and detailed, with plenty of bass for a 2.0 system.



SPEAKERS 1 • RMS POWER OUTPUT 80W • WEIGHT 2kg • NETWORKING Bluetooth • WARRANTY Two years RTB • DETAILS uk.creative.com • PART CODE T100 • FULL REVIEW Jul 2020

Choosing an... Action camera

01 Action cameras are typically much smaller than a regular camcorder, as they are designed to be mounted to a bike, board or car, or worn on your person. As the name suggests, they are designed primarily for shooting action footage, but because of their small size they are ideal for strapping on to your pet's collar or your children's toys for a different perspective.

02 Even basic action cameras will shoot Full HD video, and many will even shoot 4K, but frame rate is arguably more important than resolution when it comes to action video. Higher frame rates will mean smoother clips, and super-high frame rate videos can be played in slow motion to emphasise exciting shots.

Keep an eye out for 4K/30, 4K/60, 1080p/60 and 720p/120 models for the widest possible choice of resolutions and frame rates.

03 Most action cameras rely on flash memory for storing your video, letting you swap out memory cards on the fly when you fill one up with clips. More expensive devices can have integrated flash memory as well as a card slot, but it's typically cheaper to buy the basic version of a camera and pick up memory cards separately.

04 Not all action cameras have LCD displays; in fact, many don't include a screen in order to extend battery life.

If you want to be able to see exactly what you're pointing the lens at, keep an eye out for cameras with companion smartphone apps, or wrist-mounted viewfinders that also let you start and stop shooting remotely.

05 Action cameras typically have a huge range of accessories, with specific mounts and harnesses for different activities and sports. If the camera itself isn't water resistant, a weatherproof case will protect it from the elements, while a tripod mount will let you lock it firmly in place.

Spare batteries are essential for longer shoots, and some decent video-editing software will help you to produce a more polished result.

VIDEO

AMAZON Fire TV Stick 4K



£50 • www.amzn.to/2Y6q8wh

COMPUTER SHOPPER
RECOMMENDED From set-top box to dangling dongle and now an ultra-compact stick, Amazon's 4K media streamer gets sleeker with every generation. It's also been updated with a new remote, which includes a microphone for Alexa voice commands.

VIDEO OUTPUTS HDMI 2.0 • **NETWORKING** 802.11ac Wi-Fi • **DIMENSIONS** 108x30x14mm • **STREAMING FORMATS** UPnP, AirPlay, DLNA, Plex • **INTERNET STREAMING SERVICES** Amazon Video, Netflix, BBC iPlayer, ITV Hub, All 4, My5 • **WARRANTY** One year RTB • **DETAILS** www.amazon.co.uk • **PART CODE** Fire TV Stick 4K • **FULL REVIEW** May 2019



DJI Osmo Pocket



£329 • store.dji.com

COMPUTER SHOPPER
RECOMMENDED A cleverly made alternative to action cameras, the DJI Osmo Pocket isn't intended for extreme sports, but its mechanical stabilisation ensures smooth, great-looking footage for life-logging videos.

SENSOR 1/2.3in CMOS • **SENSOR PIXELS** 12 megapixels • **MAXIMUM RECORDING RESOLUTION** 4K (60fps) • **AV CONNECTIONS** USB Type-C • **DIMENSIONS** 122x37x38mm • **WEIGHT** 116g • **WARRANTY** One year RTB • **DETAILS** www.dji.com • **PART CODE** CP.ZM.00000097.01 • **FULL REVIEW** Apr 2019



ROKU Streaming Stick+ (2nd Gen)



£50 • www.roku.com

COMPUTER SHOPPER
BEST BUY No other media streamer offers the same vast range of integrated services as the Streaming Stick+, and all that content is presented in a wonderfully user-friendly interface with universal voice support.

VIDEO OUTPUTS HDMI 2.0 • **NETWORKING** 802.11ac Wi-Fi • **DIMENSIONS** 94x20x12mm • **STREAMING FORMATS** DLNA, Plex • **INTERNET STREAMING SERVICES** BBC iPlayer, Netflix, Google Play Movies & TV, Amazon Video, YouTube, ITV Hub, All4, My5, Now TV, Apple TV • **WARRANTY** One year RTB • **DETAILS** www.roku.com • **PART CODE** 3810EU • **FULL REVIEW** Aug 2020



APPLE TV 4K



£179 • www.apple.com/uk

COMPUTER SHOPPER
RECOMMENDED This big update adds 4K content (including, for the first time, Amazon Video support). The best part is that if there's a 4K version of content you've previously purchased in HD, Apple will upgrade it free of charge.

VIDEO OUTPUTS HDMI 2.0a • **NETWORKING** 802.11ac Wi-Fi, 10/100/1,000 Ethernet • **DIMENSIONS** 35x98x98mm • **STREAMING FORMATS** AirPlay, others via apps • **INTERNET STREAMING SERVICES** iTunes, Apple Music, Netflix, Amazon Instant Video, Now TV, BBC iPlayer, ITV Hub, All 4 • **WARRANTY** One year RTB • **DETAILS** www.apple.com/uk • **PART CODE** Apple TV 4K • **FULL REVIEW** Jan 2018



GOPRO Hero 8 Black



£280 • gopro.com

COMPUTER SHOPPER
BEST BUY Instead of completely rewriting the Hero 7 Black's formula, the Hero 8 Black focuses more on smaller improvements, such as to its stabilisation and timelapse features. To GoPro's credit, this approach works: this is a truly brilliant action camera.

SENSOR 1/2.3in CMOS • **SENSOR PIXELS** 12 megapixels • **MAXIMUM RECORDING RESOLUTION** 4K (60fps) • **AV CONNECTIONS** None • **DIMENSIONS** 49x66x28mm • **WEIGHT** 126g • **WARRANTY** One year RTB • **DETAILS** www.gopro.com • **PART CODE** CHDHX-801-RW • **FULL REVIEW** Mar 2020



GOPRO Max



£458 • www.amzn.to/2xbbAmb

COMPUTER SHOPPER
BEST BUY At last, a 360° camera that is all things to all users. The GoPro Max manages to be both usable for beginners and sufficiently advanced for more experienced videographers, shooting super-smooth footage with plenty of extra features to try.

SENSOR 2x 1/2.3in CMOS • **SENSOR PIXELS** 2x 16 megapixels • **MAXIMUM RECORDING RESOLUTION** 5.6K (30fps) • **AV CONNECTIONS** None • **DIMENSIONS** 64x69x40mm • **WEIGHT** 163g • **WARRANTY** One year RTB • **DETAILS** www.gopro.com • **PART CODE** CHDHZ-201-RW • **FULL REVIEW** Feb 2020



Choosing a... Digital camera

01 A basic digital camera will suit someone who wants to take pictures to view on their computer and create 7x5in prints. It should cost around £80, but there may be hidden downsides such as slow performance and very basic user controls.

02 Spend a little more and you'll get a higher resolution. A 16-megapixel sensor has the potential to produce sharp prints up to A3 size, but only if it and the lens are of a suitably high quality. Very high resolutions in compact cameras tend to boost noise more than detail levels, so many of the best models strike a sensible balance by using a 12-megapixel sensor.

Back-illuminated CMOS sensors tend to produce less noise than CCDs, but

check our reviews to find out how a particular model performs.

03 A 3x zoom lens provides you with reasonable scope for framing your shots, but a larger range can do wonders for your photography. Most compact cameras can manage a 5x zoom, while pocket-size ultra-zoom cameras can provide 24x zoom ranges.

Numbers such as 28-105mm tell you the wide-angle and telephoto limits of the zoom range. Big zooms require optical image stabilisation to avoid blur due to camera shake when zoomed right in.

04 Most cameras now have a 3in screen. Look out for 900,000-dot resolutions

or higher for a sharper picture. A touchscreen is useful for moving the autofocus point.

05 Leave some room in your budget for a memory card, as the bundled memory provided with a camera is never enough. A 16GB card costs less than £10. You may also need to buy batteries.

06 Don't forget that a camera's specification tells you very little about its image quality. You'll need to read our reviews for that. With a compact camera, we believe the user shouldn't have to grapple with complicated controls in order to take great pictures in a range of lighting conditions.

PHOTOGRAPHY

CANON EOS R



£2,049 • www.johnlewis.com

COMPUTER SHOPPER **RECOMMENDED** This is Canon's first mirrorless full-frame camera, but you wouldn't know it. Image quality is among the very best, and the included kit lens does a fantastic job. You can also get it body-only and attach your own RF-mount lenses.



SENSOR RESOLUTION 30.3 megapixels • **SENSOR SIZE** 36x24mm • **FOCAL LENGTH MULTIPLIER** 1x • **VIEWFINDER** Electronic (3.6 million dots) • **LCD SCREEN** 3.2in (2,100,000 dots) • **VIEWFINDER MAGNIFICATION (35mm-EQUIVALENT, COVERAGE)** 0.76x, 100% • **WEIGHT** 580g • **DIMENSIONS** 98x136x84mm • **WARRANTY** One year RTB • **DETAILS** www.canon.co.uk • **FULL REVIEW** Sep 2019

CANON EOS 250D



£579 • www.johnlewis.com

COMPUTER SHOPPER **RECOMMENDED** This is an ideal camera for first-time DSLR buyers. Excellent user-friendliness combines with high image quality for a very good-value shooter. Videos also look great, but there's definitely more of a focus on stills.



SENSOR RESOLUTION 24.1 megapixels • **SENSOR SIZE** 23.5x15.6mm (APS-C) • **FOCAL LENGTH MULTIPLIER** 1.6x • **VIEWFINDER** Optical • **LCD SCREEN** 3in (1.04 million dots) • **VIEWFINDER MAGNIFICATION (35mm-EQUIVALENT, COVERAGE)** 0.87x, 95% • **WEIGHT** 449g • **DIMENSIONS** 93x122x70mm • **WARRANTY** One year RTB • **DETAILS** www.canon.co.uk • **FULL REVIEW** Jun 2020

NIKON Z6



£1,649 • www.johnlewis.com

COMPUTER SHOPPER **RECOMMENDED** If you can't quite afford the exemplary Z7, then the Z6 is the perfect alternative. It's every bit the mirrorless all-rounder, and while it has a lower-resolution sensor than the Z7, this allows it to shoot at a faster rate.



SENSOR RESOLUTION 24.5 megapixels • **SENSOR SIZE** 35.9x23.9mm CMOS • **VIEWFINDER** Electronic (3.69 million dots) • **LCD SCREEN** 3.2in (2 million dots) • **VIEWFINDER MAGNIFICATION (35MM-EQUIVALENT, COVERAGE)** 0.8x, 100% • **WEIGHT** 1,175g • **SIZE (HDXD)** 101x134x68mm • **WARRANTY** One year RTB • **DETAILS** www.europe-nikon.com • **FULL REVIEW** Jul 2019

POLAROID Originals OneStep 2



£73 • www.amzn.to/2DQhr05

COMPUTER SHOPPER **RECOMMENDED** The OneStep 2 brings back the simple joys of instant photography. Although the stock can get quite pricey, your shots will look just as they would on a classic Polaroid – perfect for sharing or simply sticking to the fridge.



PHOTO SIZE 3.1x3.1in • **BATTERY LIFE** 15-20 packets of film • **PORTS** 1x Micro USB • **WARRANTY** One year RTB • **DETAILS** www.polaroidoriginals.com • **FULL REVIEW** Jan 2018

NIKON D780



£2,199 • www.parkcameras.com

COMPUTER SHOPPER **BEST BUY** Possibly the best top-tier DSLR we've ever tested, the D780 shines with outrageously good picture quality, easy usability and brilliant ISO performance. Battery life is a highlight, too, with 2,260 shots available from a single charge.



SENSOR RESOLUTION 24.5 megapixels • **SENSOR SIZE** 35.9x23.9 mm (CMOS) • **FOCAL LENGTH MULTIPLIER** 1x • **VIEWFINDER** Optical • **LCD SCREEN** 3.2in (2.36 million dots) • **LENS MOUNT** Nikon F-mount • **WEIGHT** 840g • **DIMENSIONS** 116x144x76mm • **WARRANTY** One year RTB • **DETAILS** www.nikon.co.uk • **FULL REVIEW** Jul 2020

SONY RX100 VII



£1,199 • www.wexphotovideo.com

COMPUTER SHOPPER **RECOMMENDED** We've never used a compact system camera that shoots as well as the RX100 VII. Stills look superb, and video support is even better, with smooth footage and fast, silent autofocus.



SENSOR RESOLUTION 20.1 megapixels • **SENSOR SIZE** 13.2x9.8mm • **FOCAL LENGTH MULTIPLIER** 2.7x • **VIEWFINDER** Electronic (2.4 million dots) • **LCD SCREEN** 3in (921,000 dots) • **WEIGHT** 302g • **DIMENSIONS** 58x102x43mm • **WARRANTY** One year RTB • **DETAILS** www.sony.com • **FULL REVIEW** Apr 2020

Choosing a... Wearable

01 Wearable tech can include anything from chest-strap heart-rate monitors to augmented reality glasses, but the two most common types are smartwatches and fitness trackers. Both are designed to sit unassumingly on your wrist, and are almost always meant to be used in tandem with a paired smartphone.

02 Smartwatches are typically more complex and expensive, though more closely resemble a traditional wristwatch. You can use them to receive and reply to text messages and emails, quickly check maps and even play games – like a smartphone, most smartwatches allow you to install your own choice of apps.

03 Fitness trackers are much more dedicated to healthy pursuits.

Step counters, heart-rate monitors and even sleep tracking are all common, and the data collected is fed back to you so you can see how your workout routine or calorie intake is going.

Many smartwatches also contain health-tracking features, but fitness-specific wearables tend to be cheaper, smaller and lighter.

04 When it comes to battery life, it's important for any wearable to last a full day, but if it's a smartwatch then you can get away with having to charge it overnight. With fitness trackers, it's better if it lasts for several days off

a single charge, so you can wear it to bed and benefit from sleep tracking.

05 Look out for waterproofing as well. Wearables that don't mind a few lengths of the pool can be used for swimming or just timekeeping, and at the very least we expect a fitness tracker to be able to deal with rain or sweat.

06 Different smartwatches use different operating systems, which determine which apps you can install on your device, as well as compatibility with smartphones. Android Wear and Tizen smartwatches will work with both Android and iOS phones, but Apple's watchOS will only pair with an iOS handset.

WEARABLES

HONOR Band 5



£28 • www.amzn.to/36nRxNz

COMPUTER SHOPPER
RECOMMENDED This is a perfect fitness band if you're just starting out on an exercise routine. It's light, long-lasting between charges and accurate at measurements, a combination you won't often see on something so cheap.

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 0.95in • RESOLUTION 240x120 • OS SUPPORT Android, iOS • BATTERY LIFE Two weeks • WARRANTY One year RTB • DETAILS www.hihonor.com • PART CODE KYG3649645453002TV • FULL REVIEW Feb 2020



APPLE Watch Series 5



£399 • www.apple.com/uk

COMPUTER SHOPPER
BEST BUY The latest Apple Watch is, once again, not a major overhaul, but the always-on display is a nice little upgrade. The new compass also helps with navigation, and the Health app redesign helps display fitness stats more clearly.

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 1.78in • RESOLUTION 448x368 • OS SUPPORT iOS • BATTERY LIFE 18 hours • WARRANTY One year RTB • DETAILS www.apple.com/uk • PART CODE Apple Watch Series 5 • FULL REVIEW Jan 2020



GARMIN Vivoactive 4



£259 • www.currys.co.uk

COMPUTER SHOPPER
BEST BUY One of the best fitness watch series gets another great instalment. The Vivoactive 4 is well designed, tracks an eclectic mix of activities and introduces some unique new features, including animated guides to workouts.

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 1.3in • RESOLUTION 260x260 • OS SUPPORT Android, iOS • BATTERY LIFE Five days • WARRANTY One year RTB • DETAILS www.garmin.com • PART CODE 010-02174-02 • FULL REVIEW Mar 2020



FITBIT Inspire HR



£75 • www.johnlewis.com

COMPUTER SHOPPER
BEST BUY There's no better sub-£100 fitness tracker for casual users than this. The Inspire HR's simplicity and stylishness give it immediate appeal, and you'll stay for the top-quality mobile app.

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 0.7in • RESOLUTION 128x72 • OS SUPPORT Android, iOS • BATTERY LIFE Five days • WARRANTY One year RTB • DETAILS www.fitbit.com • PART CODE FB505RGPK-EU • FULL REVIEW Jul 2019



GARMIN Fenix 5 Plus



£411 • www.amzn.to/2YjPAjC

COMPUTER SHOPPER
BEST BUY You'll have to pay a pretty penny for it, but the variety of features on the Fenix 5 Plus is without peer. One of the most exclusive is its support for full-colour maps, along with the ability to create routes straight from your wrist.

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 1.2in • RESOLUTION 240x240 • OS SUPPORT Android, iOS • BATTERY LIFE 18 hours • WARRANTY One year RTB • DETAILS www.garmin.com • PART CODE 010-01988-11 • FULL REVIEW Nov 2019



MOBVOI TicWatch E2



£117 • www.mobvoi.com

COMPUTER SHOPPER
RECOMMENDED At this price, there's simply no better smartwatch/fitness tracker hybrid than the TicWatch E2. Built-in GPS, IP67 waterproofing and an upgraded battery are all on board, and it's more responsive than most Wear 2100 wearables.

PEDOMETER Yes • HEART-RATE MONITOR Yes • DISPLAY SIZE 1.4in • RESOLUTION 400x400 • OS SUPPORT Android, iOS • BATTERY LIFE Two days • WARRANTY One year RTB • DETAILS www.mobvoi.com • PART CODE TicWatch E2 • FULL REVIEW Jun 2019



SOFTWARE

ADOBE Premiere Pro CC 2019

★★★★★

£20 per month • www.adobe.com



This strong update of Premiere Pro CC adds improved Lumetri Color controls and neat integration with the Premiere Rush mobile app, among other tweaks.

OS SUPPORT Windows 10 version 1703 and later, macOS 10.12 and later (10.13 required for hardware acceleration) • **MINIMUM CPU** Intel 6th-gen and later, AMD equivalents •

MINIMUM GPU Integrated graphics • **MINIMUM RAM** 8GB • **HARD DISK SPACE** 8GB •

DETAILS www.adobe.com • **PRODUCT CODE** Premiere Pro CC • **FULL REVIEW** Jul 2019

Video-editing software

NORDVPN (2020)

★★★★★

£3 per month • www.nordvpn.com



NordVPN has spent two years making its VPN more secure than ever, and with high performance and supreme ease of use, there's really nothing bad to say about its current iteration.

OS SUPPORT Windows, macOS, Linux iOS, Android • **DETAILS** www.nordvpn.com •

PRODUCT CODE NordVPN • **FULL REVIEW** Sep 2020

Virtual private network

MCAFEE Internet Security 2019

★★★★★

£15 • www.amzn.to/2X5sQBL



Impressively, the 2019 version takes McAfee Internet Security from an industry damp squib to one of the most reliable security suites on the market. Malware detection is vastly improved and performance is better, too.

OS SUPPORT Windows 7/8/8.1/10, macOS 10.12 and later; Android 4.1 and later, iOS 10 and later • **MINIMUM CPU** 1GHz • **MINIMUM GPU** DirectX 9 • **MINIMUM RAM** 1GB • **HARD DISK SPACE** 500MB • **DETAILS** www.mcafee.com • **FULL REVIEW** Apr 2019

Security software

KASPERSKY Internet Security

★★★★★

£25 • www.amzn.to/3aOISqj



Not only is this one of the most fortified security suites on the market, it's also one of the best designed, and there are loads of extra features.

OS SUPPORT Windows 7/8.1/10, macOS 10.12 or later, Android, iOS • **MINIMUM CPU** 1GHz • **MINIMUM GPU** None • **MINIMUM RAM** 1GB (32-bit), 2GB (64-bit) • **HARD DISK SPACE** 1.5GB • **DETAILS** www.kaspersky.co.uk • **PRODUCT CODE** Internet Security • **FULL REVIEW** Mar 2020

Security software

CYBERGHOST VPN

★★★★★

£2.10 per month • www.cyberghostvpn.com



In addition to safeguarding your privacy, CyberGhost VPN is particularly well suited to unblocking content on different streaming services. Connecting to new servers could be a bit faster, but once you're connected, everything is nice and stable.

OS SUPPORT Windows, macOS, iOS, Android • **DETAILS** www.cyberghostvpn.com •

PRODUCT CODE CyberGhost VPN • **FULL REVIEW** Nov 2019

Virtual private network

GAMING

NINTENDO Switch Lite

★★★★★

£200 • www.argos.co.uk



The Switch Lite can't be used with a TV like the standard Switch, nor can you detach its controllers, but with a lower price, more compact design and all the same power, it's still a great handheld console.



PROCESSOR Octa-core 1.9GHz Nvidia Tegra X1 • **RAM** 4GB LPDDR4X • **FRONT USB PORTS** None • **REAR USB PORTS** 1x USB Type-C • **STORAGE** 32GB • **WARRANTY** One year RTB • **DETAILS** www.nintendo.com • **PART CODE** Nintendo Switch Lite • **FULL REVIEW** Jan 2020

Handheld games console

NINTENDO Labo VR Kit

★★★★★

£70 • www.studio.co.uk



This addition to the cardboard-based Labo series turns your Nintendo Switch into a platform for a myriad of inventive VR minigames. Kids in particular will enjoy constructing the goggles and controllers themselves.



AVAILABLE FORMATS Nintendo Switch • **DISK SPACE** Not stated • **DETAILS** labo.nintendo.com •

PART CODE Nintendo Labo VR Kit • **FULL REVIEW** Aug 2019

OCULUS Go

★★★★★

£189 • www.johnlewis.com



No longer do you need a decked-out PC or premium smartphone to enjoy VR. The Oculus Go crams all the hardware you need into the headset itself, making virtual reality entertainment as immediate and accessible as it's ever been.



VR headset

DISPLAY LCD • **RESOLUTION** 2,560x1,440 • **REFRESH RATE** 72Hz • **PROCESSOR** Octa-core 2.4GHz Qualcomm Snapdragon 821 • **RAM** 3GB • **WEIGHT** 467g • **DETAILS** www.oculus.com/go • **PART CODE** Go 32GB • **FULL REVIEW** Sep 2018

VR headset and games

NVIDIA GeForce Now

★★★★★

£5 per month • www.nvidia.com



Google Stadia gets more headlines but GeForce Now, with its ability to dip into your existing library of PC games, is the best game-streaming service right now.



Game-streaming service

SYSTEM REQUIREMENTS Windows 7, 8.1, 10; Android 5.0, macOS 10.10; Nvidia Shield TV; 4GB RAM (Windows); 2GB RAM (Android) • **DETAILS** www.nvidia.com • **PART CODE** GeForce Now • **FULL REVIEW** June 2020

Free software guide

It's easy to access your free software. Just go to www.shopperdownload.co.uk/393 and register with the code printed on the spine of the magazine cover

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You may need to register a user account for our software store and enter your coupon code more than once.

The registration process varies from program to program, so read the instructions carefully – they explain exactly what you need to do for each program.



ANY PROBLEMS?

If you need help with any of the software this month, please send an email to support@creativemark.co.uk. We check this inbox regularly. Please include the issue number of the magazine and your coupon code.

NO CODE?

In order to use the unique code printed on the spine, you must buy the £4.99 'Free Software' print version of the magazine. If you have this edition and still don't have a code, please contact letters@computershopper.co.uk.

REGISTER YOUR SOFTWARE BY 15th OCTOBER 2020

F-Secure SAFE 2020

F-SECURE SAFE 2020 is a mid-range security suite, which can protect Windows and Mac desktops, as well as up to two Android and iOS devices.

While the range of tools it includes is relatively lightweight, this isn't necessarily a bad thing as it means you receive a fast security suite that focuses on protecting your devices. The program uses minimal system resources, and is extremely simple to use.

Independent testing shows that F-Secure's protection is worth having, too. The previous engine is ranked third out of 25 at AV-Test, just behind Bitdefender and Avira. With F-Secure developed in Finland, you can be assured that its servers are locked down and audited by the European Union if recent news about other security manufacturers has left you feeling nervous and seeking a brand-new solution.

SAFE 2020 includes powerful parental controls, enabling a parent to configure security for the entire family. You can configure SAFE for yourself or allocate a device to another user (or child) and then,



using a secure online account, configure the time they can access the internet or pick and choose the types of website you want them to visit.

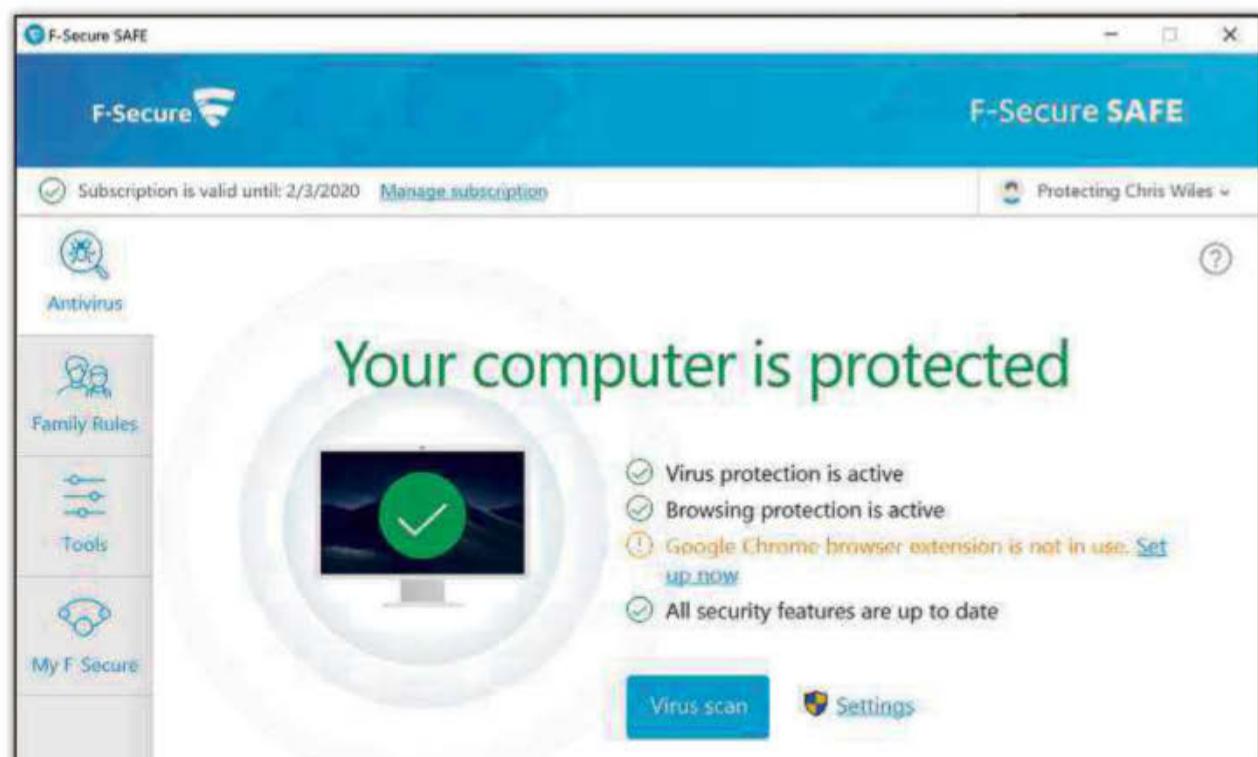
There's improved mobile support, too, in particular with the program's simplified anti-theft tools. Android and iOS users can now remotely locate, lock, reset, wipe or sound the alarm on a lost or stolen device, all from F-Secure's own web portal.

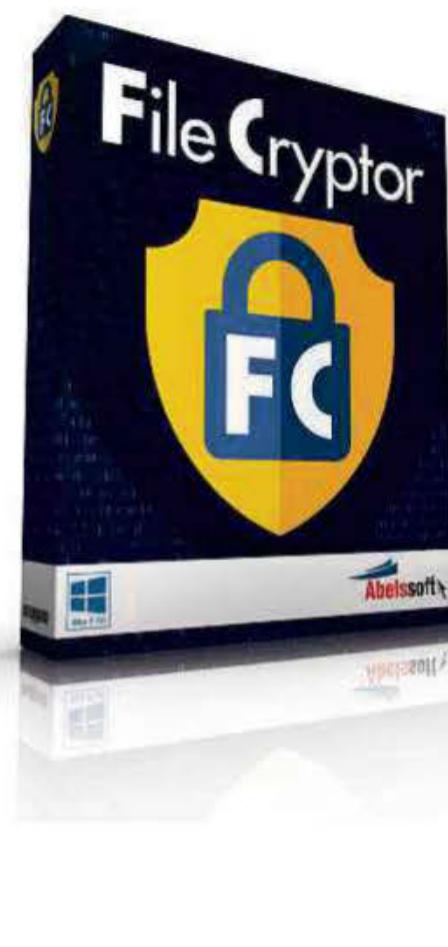
It's worth noting that F-Secure SAFE has a flexible licensing policy. You can choose which devices you want to protect (up to two in total with this licence), but unlike rival security suites, you can allocate a licence to another person entirely of your choosing. This could be another family member or simply a friend – the choice is yours.

REQUIREMENTS Windows 7, 8, 10, macOS, iOS, Android; 150MB hard disk space

WEBSITE www.f-secure.com

NOTES Register at safe2020.disc.computershopper.co.uk. Be sure to read the instructions in full. Includes a two-device, one-year licence





Abelssoft FileCryptor 2020

YOUR COMPUTER almost certainly contains files you would rather no-one else saw, and it's possible that you are not the only person who has access to your machine. Whether you're at home or in the office, you may not necessarily share your computer with others, but it's possible that someone could use it and see something you would rather they didn't. This is where file encryption can help.

Whether you're trying to protect financial data, personal information, or just something you would prefer to keep secret, FileCryptor 2020 lets you encrypt files and folders with AES-256 encryption. Unless the correct password is entered, the encrypted files will remain scrambled and inaccessible.

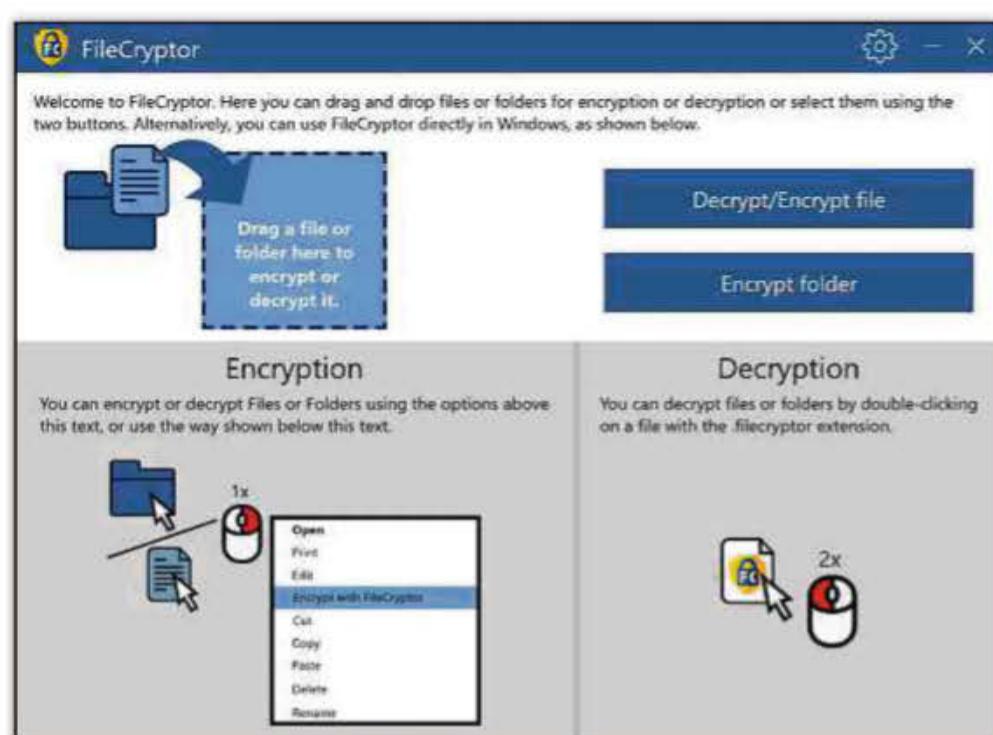
Importantly, FileCryptor 2020 makes the whole process of encryption incredibly simple, and there are two ways you can approach things. The first option is to drag and drop the files or folders you'd like to protect onto the program window, while the second is to use the context menu.

REQUIREMENTS Windows 7, 8, 10;

100MB hard disk space

WEBSITE www.abelsoft.net

NOTES Get your registration code within the application



Using this method, you can simply select a number of items, right-click, and select the FileCryptor option.

In either case, you will then be asked to enter and confirm a password, and the encryption process will be completed in a flash, although just how long it takes will depend on the amount of data you are encrypting. If you're struggling to think of a strong password, there's a built-in password generator that can take care of things for you. Just be sure to use a password manager so you don't forget it.

ASCOMP Secure Eraser 5

DELETING FILES FROM your hard drive doesn't mean that they're gone forever. Even when you empty the Recycle Bin there are still tools and techniques that can be used to recover deleted data.

As your deleted files could well have contained private or sensitive data, this could

represent a security risk. If you're considering selling or passing on your computer or hard drive, for instance, there's the risk that the new owner would be able to recover your files and learn a great deal about you.

ASCOMP Secure Eraser helps out here, as not only will it remove the files and folders

you choose, it will also employ high-level security techniques to overwrite the deleted data numerous times, rendering it completely unrecoverable. For maximum security this can be done up to 35 times, but if you're in a hurry you can also set the process to run once with random data.

There's also a second component that lets you wipe out entire drives or partitions. As well as wiping out the data stored on the drive, the process will also kill the Master File Table (MFT) and the USN Change Journal, both of which can be very revealing.

The third and final option is free space deletion. The areas of your hard disk that are not currently used to store files may have been used to do so in the past, and there is the potential for these files to be restored. The free space deletion option gives you the ability to wipe this free space completely to prevent recovery from being possible.



REQUIREMENTS Windows 7, 8, 10;
50MB hard disk space
WEBSITE www.ascompsoftware.com
NOTES Get your registration code within the application



REQUIREMENTS Windows 7, 8, 10;

250MB hard disk space

WEBSITE www.ashampoo.com

NOTES Get your registration code within the application

Ashampoo Music Studio 2020

MUSIC STUDIO 2020 is a suite of tools that will help organise even the messiest of music collections.

If, for example, you're still in the process of digitising your music collection, you can use the integrated ripper to convert CDs to the format of your choice. You can also use this component to copy audio CDs and create your own MP3, WMA or regular CD using music from your hard drive. If you have a collection of records or cassettes, there's a separate Record component that can be used to record music to your computer and save it in your preferred format.

To help you improve the quality of your music collection, there's also a music editor that can be used to normalise tracks, trim unwanted sections



and edit filetags. You can even convert files between formats so you have everything saved as the same file type.

Then there's a tool for ripping the audio from music videos, so you can save this as an MP3 file to add to your collection. And, as your collection grows, Music Studio 2020 offers a flexible organisation tool to help keep things in order.

Other features include a playlist generator and a mix tape creator, both of which are great for creating the perfect audio experience for parties or workouts. Rounding off the package is a tool for creating covers and inlays for your discs, which is a nice option if you've created a mix tape, burned it to disc and would like to give it to someone as a present.

SoftOrbits Privacy Protector for Windows 10

DESPITE THE MANY improvements Microsoft has made to Windows 10, one aspect remains problematic: telemetry. This is data collected about how you use your computer in general and Windows specifically. Microsoft uses this information to learn more about how people

interact with the software and what could be changed or added. It's very helpful for driving the development of Windows 10, but it's also something that some people see as an invasion of privacy.

With Privacy Protector for Windows 10, you can block the telemetry features of Windows 10 and Microsoft Office in a few clicks, as well as lock down a number of other privacy-related features. You can, for instance, block access to your messages, camera and calendar, or disable Defender, OneDrive and Cortana.



You can use a series of tickboxes to indicate which privacy settings you would like to implement, and before committing to them, you have the option of creating a restore point. In this way, in the unlikely event that something goes wrong, you have a safety net.

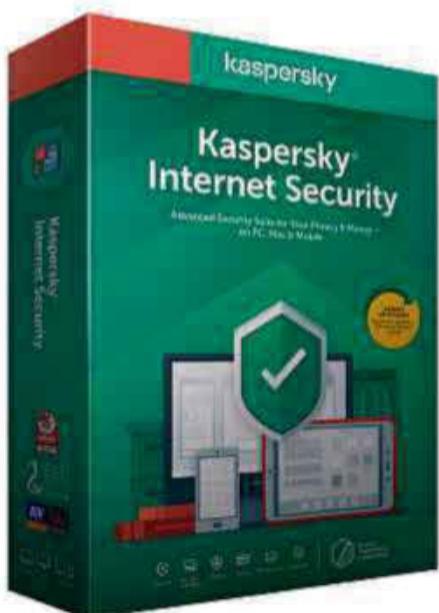
But the program goes beyond this, giving you even more control over Windows 10. It can also be used to uninstall apps and components that could otherwise not be installed, such as Photos, Solitaire and even the Windows Store. There are also tools that can be used to disable User Account Control, disable Windows Update and edit the HOSTS file.

These particular options should be used with a degree of caution, but in the right hands they are powerful control tools.

Kaspersky Internet Security 2020

KASPERSKY INTERNET SECURITY 2020 is a powerful suite of malware-hunting, anti-hacker web safety tools. There's antivirus, browsing protection, a firewall, exploit protection, a vulnerability scanner, parental controls, webcam and audio protection, online transaction protection, and even more tools designed to keep both your privacy and personal information safe.

These features have real value, too. Independent testing labs such as AV-Comparatives typically rate Kaspersky as offering some of the best protection around; it's been one of the highest-scoring anti-malware providers for several years now, and is quick to update its protections when new threats arise.



REQUIREMENTS Windows 7, 8 or 10;

2GB hard disk space

WEBSITE www.kaspersky.co.uk

NOTES No need to activate. Includes three months of free updates



The Software Updater checks for updates to common applications (including Adobe Reader, Flash, Java, Chrome and Firefox, among others), and can optionally install them without you having to see or do anything at all.

The Secure Connection feature is a privacy-oriented virtual private network, automatically kicking in when you use Wi-Fi hotspots, internet banking sites and other potentially sensitive services.

The program's Installation Assistance tool also looks out for adware and other pests that can get silently installed with certain free software, while the Software Cleaner helps you decide what to remove.

Chat and Communication

Evernote 6.25.1.9091 Store your notes, ideas and plans in the cloud, and synchronise them between computers.

UPDATED Mailbird 2.8.30.0 A free desktop email client for Windows.

Miranda IM 0.10.80 Chat with friends across multiple messaging platforms, including AIM, Facebook, IRC and MSN, all from one simple interface.

UPDATED Skype for Windows 8.63.0.76 Make internet voice and video calls for free, and buy credit to make calls to mobiles and landlines.

UPDATED Telegram 2.3.0 This free IM app syncs your conversations across multiple devices, and can spruce up chats with stickers and GIFs.

UPDATED WhatsApp Desktop 2.2033.7 A PC and Mac version of the messaging app, letting you chat from your desktop.



Customisation

iolo System Mechanic Free 20.5.0.1

Speed up your system with iolo's PC optimisation suite.

Rainmeter 4.3.1

Customise the desktop with your choice of tools and shortcuts.

Windows 8 Transformation Pack 9.1

Emulate the look of Windows 8 on an earlier version of the operating system.

Windows 8 UX Pack 9.1

Get a glimpse of the Windows 10 UI without committing to a full OS upgrade.

Windows 10 Transformation Pack 7.0

Bring some of Windows 10's new features to your current operating system.

Winstep Xtreme 19.2

Freshen up your system with this suite of desktop and UI replacement applications.



General

Genie Timeline Free 2017 10.0.1.100

Protect your most valuable files with this easy-to-use backup tool.

Paragon Partition Manager 16 Free

Create, format, split, merge and reorganise all your hard disk's partitions.

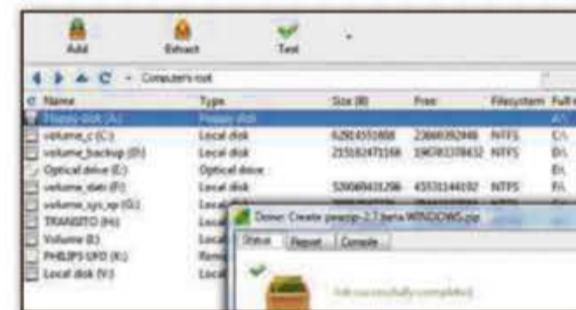
PeaZip 7.3.2

An extremely powerful archive-management tool.

Screenshot Captor 4.36.2 Create and manage screenshots the easy way.

UpdateScanner 2.2.0.0 Scan all the software on your PC, find out if an update is available, then install it immediately.

ZipGenius 6.3.2.3116 A flexible file-compression tool with support for a huge number of compressed file formats.



Internet and Network

CaroDAV 1.15.9

Manage all your online storage services with one simple application.

UPDATED Cyberduck 7.5.0

A powerful but easy-to-use FTP client for uploading and downloading your files.

Glasswire 2.2.210.0

Keep tabs on your network usage with this simple monitor.

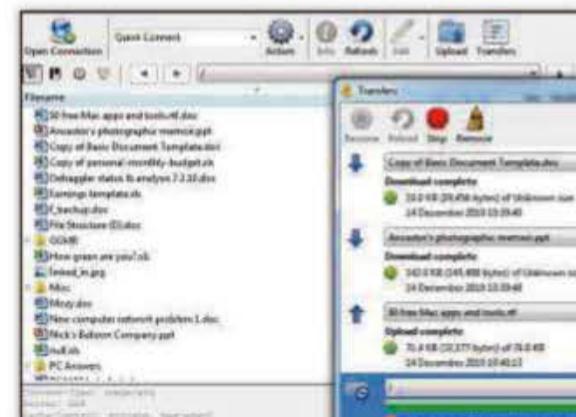
UPDATED FileZilla 3.49.1 A fast and reliable FTP client with lots of useful features.

UPDATED NetBalancer 10.1.2

Make the most of your internet connection by assigning download and upload priorities to web applications.

UPDATED TeamViewer 15.7.7

Remotely control your computer from anywhere in the world.



Tweaking and Performance

UPDATED CCleaner 5.70 Remove unwanted information, temporary files, browsing history, huge log files and even the settings that uninstalled software leaves behind.

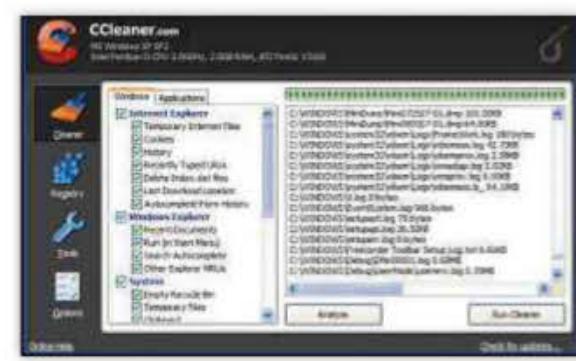
Defraggler 2.22 Ensure that your system is defragmented properly and improve its performance.

Finestra Virtual Desktops 2.5.4501 Set up four or more virtual desktops on your PC.

IObit Advanced SystemCare Free 13.6.0.291 A complete computer security, maintenance and optimisation suite.

UPDATED Revo Uninstaller Free 2.1.7 Remove installed applications completely, including all their folders, system files and Registry entries.

Simple Performance Boost 1.0.5 Tweak the Windows Registry to give your PC a performance boost. 





HIGHER CALLING

Smartphones

Everyone staying indoors hasn't slowed the annual onslaught of updated (and brand new) mobile phones. Read on for your guide to choosing and using one of the latest Android and iOS handsets

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IF YOU'VE RECENTLY been unable to meet up with friends, return to the office or even leave the house, a new smartphone – indeed, any portable technology – might not seem like the smartest investment. However, thanks to messaging and entertainment apps, smartphones have remained a stalwart tool in these trying times, not to mention the fact that for basic browsing they're far more affordable 'computers' than most laptops.

There certainly hasn't been much slowdown on the supply side. New handsets continue to arrive at a spirited pace, and a lot of them are downright superb. To find out which of these you should consider for your next upgrade, as well as which ones to avoid, we've pitted 18 recent handsets against each other – and because these span both Android and iOS operating systems, and a wide range of budgets, there's sure to be something that will make for your perfect partner.

There's no objective 'better' choice between Android or iOS; there's a much

wider choice of Android handsets available compared to the single-digit total of current-generation iPhones, but then some consider Apple's 'walled garden' approach more secure than open-source Android as it's less susceptible to malware.

Not all Android devices will have the exact same software either, as most smartphone manufacturers like to layer on their own custom UI skin and potentially add their own pre-installed apps. Personally we're more fond of the clean Android you get on Motorola and Google's Pixel smartphones.

Be wary, also, that the most recent Huawei and Honor models will lack support for Google apps such as Gmail and YouTube, even though they're Android-based. This is due to the US government's ban on American companies, including Google, working with Huawei and its subsidiaries.

WHAT YOU'RE MADE OF

Despite a recent obsession among manufacturers with making smartphone screens gigantic, most handsets will be comfortably slim and light, so when it comes to design, your attention should be more on materials and features.

Naturally, cheaper models will be largely plastic, with metal and glass bodywork reserved for upper-mid-range and premium smartphones. Be careful when choosing a glass-backed device, however. They can feel nice and luxurious in the hand but, even with hardened Gorilla Glass, they can crack just like a screen if dropped.

Elsewhere, look out for fingerprint sensors for fast and easy signing in; this is a common feature even among budget handhelds, though the iPhone 11 notably lacks a sensor in favour of exclusively using facial recognition sign-in via a camera on the front. Expandable storage slots, usually for microSD cards, are helpful, too. They're arguably not necessary if the phone itself provides hundreds of gigabytes' worth of integrated storage, but on cheaper smartphones with only 32GB or 64GB of space, adding a memory card is an inexpensive method of making room.

Waterproofing capability can also be worth paying for if you want extra peace of mind, though this varies quite a lot. We've seen dirt-cheap phones have total ingress protection, top-tier flagships with no IP rating at all, vice versa and everything in between. No modern smartphone will be destroyed by a spot of rain, thankfully, but you'll need more than splash protection to ensure it survives an accidental drop in the sink.

For an idea of how big smartphone screens have become, take a typical size of 6.3in across the diagonal – that's enough space to fit an entire Google Pixel 2, bezels and all.

There are still a few smaller options for those who prefer a compact design, although more screen space tends to mean less scrolling and clearer video playback. Size, however, is only one piece of the puzzle: the bigger the screen, the higher resolution it

needs to look sharp and crisp, so try not to dip below 1080p unless it's a very cheap phone.

As always, our smartphone tests include display quality measurements taken with a colourimeter device. These include values such as how much of the sRGB colour gamut it can re-create – which denotes how vibrant the screen will be – as well as the maximum brightness and contrast. Higher is better for all of these, but with average delta-E, which measures the accuracy of colour reproduction, you want as low a result as possible.

WORKING THE MUSCLES

Another area we test is performance. Although mobile CPUs have progressed as much as desktop processors in recent years, there's still a huge difference between budget and flagship speed. That's especially true when you're multitasking with several apps at once, so generally it's better to have a processor with more cores and a healthy amount of RAM.

Our CPU benchmarks include Geekbench 4 and its more demanding update, Geekbench 5, which measure single-core and multicore performance separately. When possible (on some phones, it can't be installed), we'll also look at gaming performance using the GFXBench Manhattan 3 test. This measures the onscreen and offscreen performance of 3D graphics: onscreen results are how the phone runs the benchmark, taking into account its display resolution, while the offscreen result assumes a 720p resolution, creating a level playing field that can be handy for comparing the GPU power of different devices.

The Manhattan test is fairly demanding, so phones scoring 30fps or above in the onscreen test should manage most actual games comfortably; any lower than that doesn't make gaming a lost cause, but it might mean the phone is only suited to less graphically intensive or 2D games.

Some users might not ever need the maximum power that a smartphone processor is capable of, but everyone benefits from longer battery life. This is another point where larger screens have had a knock-on impact, as extra inches and higher resolutions put added strain on the battery and can cut down the time you get between charges.

The good news is that manufacturers have generally responded correctly: namely by giving their batteries gigantic capacities, not uncommonly reaching 5,000mAh. This alone isn't a guarantee of top-notch stamina, but long-lasting smartphones aren't a thing of the past, either.

Our battery test involves playing a looped video, with flight mode engaged and screen brightness set to 170cd/m², and measuring how long a full battery takes to run dry. Any result above 15 hours is decent, but if a phone can reach the 20-hour mark, that's a good sign that it will keep going for even a couple of full days on normal use.

SNAP BATTLE

Smartphone cameras can take a surprising amount of different forms. The traditional single-lens approach has been largely – though not entirely – replaced by multi-sensor arrays, with extra lenses performing specific roles alongside the main snapper. Some might include a depth sensor to produce a stylish bokeh effect on portrait shots, for instance, while wide-angle and even macro lenses provide a wider range of shooting modes.

That said, don't simply be drawn in by the number of lenses or, especially, the megapixel count; a bigger image doesn't necessarily mean better details. We take a variety of test shots using each camera setup and report on the most reliable measure of quality: the end product, its photos. The same goes for video capture, too.

4G vs 5G: should you switch?

This time last year, there were only a tiny handful of 5G-compatible smartphones, and coverage in the UK was severely limited. Now, however, there are ... a few more 5G-compatible smartphones, and coverage is severely limited.

In fairness, coverage has expanded from London to other major cities such as Cardiff, Manchester and Birmingham, but the vast majority of the UK remains limited to 4G only. Rollouts to other areas remain slow, if dated at all, and while conspiracy theories about 5G's impact on health are without evidence, there is some to suggest that as it uses higher frequencies than 4G, it's more prone to slowing down through buildings and even in rainfall. So does that mean that you should ignore 5G entirely?

Not strictly, no. Although most UK denizens can stick with 4G knowing they won't have 5G access anyway, if you're lucky enough to be receiving coverage now or imminently, it could be worth taking advantage of: our limited testing suggests throughput speeds are much higher than 4G. More affordable 5G handsets are finally appearing too, such as the OnePlus Nord.

However, as you're unlikely to receive top speeds all the time, if you do take the plunge on a 5G smartphone make sure it's one that's good on the whole. Then, even if you do find yourself dropping to 4G speeds, at least you won't have wasted your money.





HOW TO SYNC YOUR SMARTPHONE AND PC

Don't like writing lengthy text replies on a tiny keyboard? Tired of needing to dig out a USB cable or email yourself to move content between devices? By syncing your phone to your computer, you can access both at once

HAVING FINALLY COME to terms with the defeat of the Windows Phone concept, Microsoft has recently made it much easier to sync Android and iOS smartphones to Windows 10 – and what you can do with a linked handset has expanded, too. While you still connect via a USB cable to move music, photos and video files, it's easier than ever before to perform previously phone-only actions with a mouse, keyboard and much larger monitor.

In this guide we'll be focusing on Windows 10 and its dedicated Your Phone app, Microsoft's hub for accessing phone features from the comfort of your PC,

↳ Microsoft's Your Phone app makes accessing your phone from your PC simple

but see 'Syncing with macOS' (opposite) for details on how to hook up both Android and iOS devices to a Mac or MacBook.

To set up Your Phone on Windows, follow these steps:

- In Windows' main Settings menu, select Phone, then Add a Phone. This will open the setup wizard and present you with the option to connect either an Android or iOS device.
- Select the appropriate OS option and click Continue. You'll be prompted to visit a web page on your phone: www.aka.ms/yourpc for Android, or www.aka.ms/linkyourphone for iOS.
- This will lead you to either the Your Phone Companion app (for Android) or the Continue on Windows app (for iOS), both of which can also be found in each OS's respective app store. Install the appropriate

app on your phone, allowing permissions to access any content you might want to sync. On iOS, you'll also be asked to install the Microsoft Edge browser.

- Progress through the app setup until you have the ability to scan a QR code. Back on your PC, click Generate a QR Code, then use your phone camera to scan it on your PC's monitor. This should link the two devices and take you to the main Your Phone application in Windows.
- You may be asked if you want to allow the mobile app to run in the background. Allowing this isn't necessary, and selecting Deny will save on battery consumption, but letting it run in the background will mean the photos and notifications that appear on your PC will automatically refresh.

From there, Your Phone should be pretty much good to go, but you can always enter its own

Syncing with macOS

Connecting your phone to a Mac or MacBook won't provide as many different utilities as it would with Windows, but you can sync a much wider range of files and media – music, photos, videos and more – so that your content libraries are shared between devices.

If you're using an Android smartphone, start by simply downloading the official Android File Transfer application (www.android.com/filetransfer) on your macOS device. Then, connect your phone via a USB cable, open Android File Transfer and you should be able to drag and drop files easily between the two.

The process for iOS devices is, surprisingly, a little more complicated, but will eventually let you sync data wirelessly after an initial cabled setup. If you're using an iPhone, follow these steps:

- Connect your smartphone to your Mac or MacBook via USB/Lightning cable.

Find your phone in the Finder sidebar and click on it.

- Select General from the options toolbar to bring up an options list. Click on the tickbox for 'Show this iPhone when on Wi-Fi'.
- Select your sync settings and click Apply. As long as your two devices are on the same Wi-Fi network, this should mean your iPhone will appear in the Finder sidebar under Wi-Fi.
- Select the file or media type you want to sync from the same toolbar you clicked General on earlier. Confirm by clicking the first tickbox – for example, 'Sync audiobooks onto [name]'s iPhone' – and use the second tickbox to decide whether you want to sync all the available content or only certain files. Note that if you use iCloud Photos and/or Apple Music, these



options won't appear for photos and music as all respective content will be synced automatically.

- Repeat the process for any other content types you want to sync, and click Apply. Once complete, selected content will automatically sync between your two devices, provided they're either connected by cable or are on the same Wi-Fi network.
- If connected via a cable, disconnect your phone safely by clicking the Eject button in the Finder sidebar.

settings menu to change whether the app is allowed to download or otherwise access specific content from your phone. To use the calling feature (more on this later), you'll also need a working Bluetooth connection between your PC and smartphone.

READ AND RESPOND TO NOTIFICATIONS

Provided you've given permission for it during setup, Your Phone will display smartphone app notifications – whether it's a new email, calendar reminder or news bulletin – in its Notifications tab. For some apps, such as WhatsApp, you can also receive a desktop notification, so you don't need to constantly check Your Phone for updates.

If it's a notification that permits replies, you can also type and send your response directly from the Notifications page. You can

also archive Gmail messages, although this particular app is an exception to the reply feature: if you click on the Reply button, it opens Gmail on your phone rather than allowing for a direct response.

Otherwise, however, it's a neat time-saver, especially if you have a lot of mobile apps but don't want to install all their desktop versions – such as WhatsApp or Slack – on your PC.

WRITE AND REPLY TO TEXT MESSAGES

In a similar vein to Your Phone's notification responses, visiting Messages will let you reply to SMS messages, as well as write new ones and send them to your phone's contacts.

Like on your smartphone's own messenger app, you're not just limited to typing text. Emojis, GIFs and photos can all be attached by clicking their respective icons below the text,

or by dragging and dropping them into Your Phone from Windows Explorer.

SYNC YOUR CAMERA PHOTOS

This is the meat of syncing media content on Windows: any photos taken on your phone's camera will be made accessible in Your Phone's Photos tab, and within only a few seconds if you've set it to refresh automatically.

Although it sadly doesn't work with videos, this instantly simplifies the usually laborious process of getting your phone pictures backed up on a PC. Click on a photo in the grid view and a few options will appear in the top right: you can either view a larger version, copy it to the Windows clipboard, save a copy locally or share it with your Windows contacts.

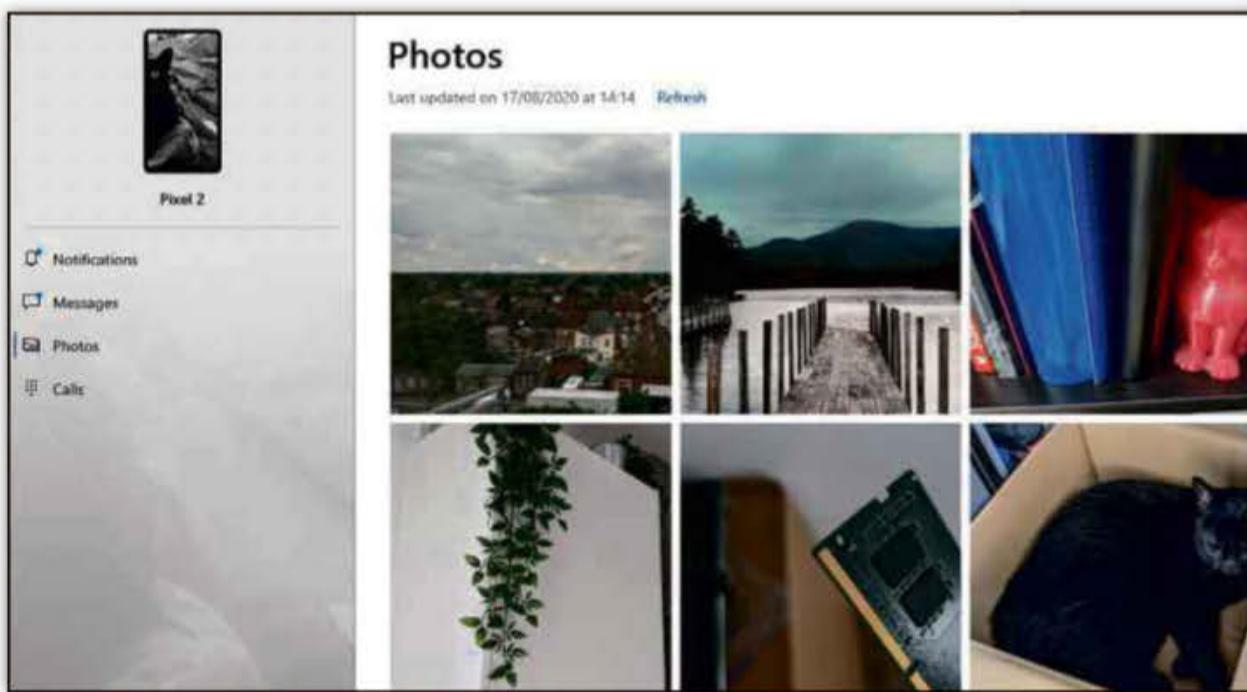
Clicking the Share option also lets you open the photo in certain applications, such as the Snip & Sketch picture editor. To just save the image on your PC, click Save as... and choose a folder to keep it in.

MAKE AND RECEIVE CALLS

The final tab in Your Phone, Calls, doesn't need much explanation – but again, you'll need your handset connected by Bluetooth as well as Wi-Fi. The desktop app should, as long as your PC has Bluetooth connectivity, try searching for your phone automatically, and you'll need to confirm a PIN that appears on both devices is a match to complete the connection.

Then, back in Your Phone, click Get Started and follow the onscreen instructions to continue setting up calls. You'll also need to allow a permission on your phone, a prompt for which will appear at this stage.

Once that's all sorted, you can dial numbers or search through phone contacts to make a call, as well as answer any that come your way.



Syncing your smartphone with your computer takes all the pain out of backing up photos

APPLE iPhone 11

**COMPUTER
SHOPPER**
BEST BUY



£729 • From www.apple.com/uk

VERDICT

While not quite as fabulous as the iPhone 11 Pro, the standard model is still superb

DITCHING THE PREVIOUS generation's XR model, the iPhone 11 sees Apple bringing its cheapest smartphone back into the fold. The look and feel of the phone, though still distinct, is definitely a lot closer to the iPhone 11 Pro and iPhone 11 Pro Max than the XR was to the XS and the XS Max.

Case in point, it has the same rear camera plinth as its more expensive siblings, and once again the entire rear is made from one piece of glass, so there's no ugly trim surrounding that square. However, it's also not quite as pretty: the only part that's matt glass is the camera bump, and instead of a polished stainless steel frame like the Pro and Pro Max, the iPhone 11 has anodised aluminium running around its perimeter.

DEPTH PERCEPTION

Waterproofing is also inferior, albeit not to the extent it would effect everyday use. The iPhone 11 can survive depths up to two metres for 30 minutes, whereas the iPhone 11 Pro manages four metres for the same time.

The more impactful points of divergence are the lack of a telephoto camera and the display. There's no OLED panel here: the iPhone 11 has a more basic IPS screen, at a sub-Full HD 1,792x828 resolution. It performs well in itself – we measured a peak brightness of 625cd/m², sRGB coverage of 95.8% and contrast of 1,563:1 – but next to the iPhone 11 Pro, vibrancy and detail are visibly lower, particularly when watching HDR video content.

Happily, however, the iPhone 11 is just as powerful as the rest of the range, thanks to it having the same Bionic A13 processor. Its Geekbench 5 results of 1,334 in the single-core test and 3,417 in the multicore test put it among the best of the best across iOS or Android, and it maxed out the screen's 60Hz refresh rate with 60fps in the GFXBench Manhattan onscreen test.

Battery life is reasonably good, too. Surprisingly, this has a larger battery than the iPhone 11 Pro (3,110mAh vs 3,046mAh), and thus lasted over an hour longer in our video playback test, only running dry after 18h 36m. That's a big improvement on the iPhone XR, too.

The lack of a telephoto lens doesn't hurt much either, as the iPhone 11 has a brilliant camera

regardless. The main lens and ultrawide-angle lens – both 12 megapixels – can capture fully stabilised 4K video at 60fps, and the A13 chip has the grunt to enable a pseudo-HDR effect by having the sensor record at 120fps, capturing each alternate frame at different exposure levels and combining them. It's very clever.

It's outstanding for stills as well, especially with the new night mode, and in unzoomed images there's no difference in quality whatsoever between the iPhone 11 and the 11 Pro.

FILM SCHOOL

It's a similar story for video, although you do need to take some of Apple's marketing claims with a hefty pinch of salt. While zooming in, video is smoother than on any other smartphone we've used, but it's been that way on iPhones for a while now. The difference between the iPhone 11 and the 11 Pro is that you can enable in-zoom lens switching in 4K 60fps video. On the XR and XS, you could only enable this up to 4K 30fps.

Once you do this, you'll see a small jump when transitioning from one camera to the next – from 0.9x to 1x zoom and back again – and you'll also see a noticeable difference in quality between the two cameras. Again, this isn't a problem for Apple per se, particularly in comparison to other smartphones whose video zooms are significantly more steppy than the one on the iPhone 11 models.

And it's not just the image quality that has been improved with the iPhone 11. As part of the update to iOS 13, the camera UI has also been updated. There's a new zoom wheel, some of the core options

(flash, Live Photo, timer and filter effects) have been moved and are now accessed by swiping up on the mode switcher, and you now get a preview of the ultrawide angle view to the left and right of the main preview window. You can also have the camera capture images from both ultrawide and primary cameras simultaneously, giving you the chance to recompose in the revamped Photos app post-capture.

ELEVENTH HEAVEN

While the iPhone 11 sits well behind the iPhone 11 Pro in some respects – the display, the general design, the less comprehensive waterproofing – it's still a very good handset, and there's certainly far less of the 'ouch' factor of the £1,000-plus Pro models. Yes, while you certainly can buy an Android phone that can do most of what this can do with better battery life and more camera lenses for the same or less, the iPhone 11 still holds its own when it comes to outright performance and camera quality.

It's also worth noting that the new iPhone SE has the same Bionic A13 processor, and therefore comparable power, in a much cheaper and more compact package. This might make the standard iPhone 11 less compelling if you want to maximise the value for money of your next iOS smartphone, but then its larger, higher-resolution display and longer battery life make it feel like much more of a contemporary flagship champion. On those terms, it's worth splashing out for.



APPLE iPhone SE (2020)

**COMPUTER
SHOPPER**
RECOMMENDED



£419 • From www.apple.com/uk

VERDICT

The iPhone SE gets an upgrade at long last, and it's now as powerful as the iPhone 11

IF YOU WANT a reference point for the new, 2020 edition of the iPhone SE – the cheapest of Apple's current-generation handsets – then look no further than Apple's own iPhone 8. The iPhone SE essentially duplicates the physical appearance of the iPhone 8, right down to identical dimensions and even the same 138g weight.

REPEAT BUSINESS

When you've spent the past two years looking at phones with edge-to-edge displays, a handset with clearly visible bezels at the top and bottom comes as something of a shock. While many prefer a smaller smartphone, and for good reason – many contemporary phones struggle to fit in a pocket – there's no denying that a bigger screen is so much better for watching TV and movies and playing games on, and that dinky screen makes it fiddlier to type out emails and social media messages.

Still, what's here is pretty good. It's an IPS panel measuring 4.7in across the diagonal, and it has a Retina-class resolution of 1,334x750 with a pixel density of 336ppi. That, incidentally, is the same as the original iPhone SE's 4in screen, as well as the 6.1in iPhone XR.

It's sharp enough, then, and it's also pretty good from a technical standpoint. We found that peak brightness settled at 571cd/m² and contrast at 1,427:1, both strong figures. Colour performance is as good as ever from Apple, with sRGB coverage hitting 95.5% and the average delta-E at a healthy low of 0.96.

Performance is the real kicker, however. With 3GB of RAM and the same Apple A13 Bionic chip under the hood as its more expensive iPhone 11 siblings, the iPhone SE sprints past similarly priced Android devices. In Geekbench 5, the iPhone SE scored 1,330 in the single-core test and an outstanding 3,291 in the multicore test, both more than double what the Google Pixel 4a scored.

Unfortunately, we couldn't get our usual GFXBench Manhattan graphics test to work, but we substituted the GFXBench Metal benchmark and it topped out at 60fps in the onscreen test.

That's quite something for a small phone costing £419, and makes the

iPhone SE the most powerful hardware in a sub-£500 smartphone by quite some distance. This means that you'll be able to run any app or game on the App Store today without having to worry about slowdown or stutter. Perhaps more importantly, such fast performance means that the SE will still feel fast even three or four years further down the track.

Sadly, there's one crucial area where the iPhone SE 2020 can't match up with its competitors, and that's battery life. With the same tiny 1,821mAh power pack as the original iPhone 8, stamina suffers badly. Indeed, the SE lasted only 11h 35m in our video rundown test, which is better than the iPhone 8 but worse than the standard iPhone 11 and the original iPhone SE (*Shopper* 341).

STRAIGHT SHOT

Perhaps there's better news from the cameras, comprising one 7-megapixel front-facing camera and a single-lens, 12-megapixel main camera at the rear. The specifications are the same, you won't be surprised to learn, as the iPhone 8, although it's important to note that with the power of the A13 Bionic behind it, image quality is much improved.

Interestingly, there's no Deep Fusion low-light mode or night mode, but the photos we've grabbed with the iPhone SE 2020 were good across the board. Apple's portrait mode brings out the best of the 12-megapixel sensor, providing all the same lighting effects as you get in the pricier iPhones. That said, it can't quite match the iPhone 11 Pro Max's incredibly sharp images, but it's more than a match for comparably priced handsets.

All in all, the iPhone SE 2020's main camera

performs remarkably well. It isn't as good as the iPhone 11/Pro/Pro Max's multi-lens camera arrays, but that's to be expected. What's surprising is how well it holds up across the board, producing images and portraits that generally look great in good light and bad.

The front camera, however, settles for less. It's pretty low in resolution, with 7 megapixels compared to the iPhone 11's 12 megapixels, even

though the aperture is the same at f/2.2. The result is that selfies snapped with the iPhone SE's front camera look considerably less striking than portraits captured with the main camera at the rear, generally looking softer and more washed out than the front-facing snaps of the iPhone 11 Pro Max.

Fortunately, video capture is much better. This is where the phone's A13 Bionic chip really comes into play, enabling Smart HDR to keep exposures nice and even, and able to apply image stabilisation to 4K footage recorded at 60fps.

Video quality is simply sumptuous, too, with plenty of detail, stabilisation that's smooth without looking overly artificial and a smooth frame rate that ensures your home movies will look great in most situations.

SOMETHING OLD, SOMETHING NEW

On the face of it, the iPhone SE is little more than a warmed up iPhone 8, a hodge-podge of parts old and new that shouldn't really work together. It has a tiny display and it looks frankly old-fashioned with those comparatively enormous bezels. And yet, there are many reasons you might consider it.

It has a great camera and amazing performance, it's smaller and lighter than most phones released today and it's the cheapest current-generation iPhone by quite a distance.

Battery life takes the shine off a bit, but if you only have £419 to spend and you just don't get on with bigger phones, or you simply must own an Apple handset, the iPhone SE is well worth considering. It may be the cheapest iPhone, but it's still mighty impressive.



CUBOT Kingkong Mini



£100 • From www.amazon.co.uk

VERDICT

Tough, lightweight and dirt cheap, the Kingkong Mini is an ideal backup smartphone

THE THREE BIG problems with a lot of modern smartphones is that they're big, delicate and expensive. Definitely not the kind of things you'd want to risk dropping in the mud at a festival, or having bounce out of your pocket during a run.

One solution is to have a backup phone: one that's smaller, lighter, cheaper and much more rugged. A phone like the Cubot Kingkong Mini.

HARD CASE

This is the smallest 'durable' smartphone we've tested. A lot of rugged phones have massive screens, but the Kingkong Mini only has a dinky 4in display, and it's much more pocketable as a result. Importantly, of course, if it does happen to fall out of your pocket, it will be well protected. Measuring 119x58x12mm and weighing only 100g, the Kingkong Mini is minuscule compared to most of its contemporaries, and it's a lot tougher, too.

The top, bottom and four corners of the phone are protected by thick, deeply profiled rubber bumpers, while the sides boast screwed-on alloy protection bars. The two halves of the device are held together by eight Torx screws and the back is coated with rubberised matt-finish paint.

All that rubber, combined with the square profile, has a secondary function: you can easily keep a good, firm grip on it, even when the Kingkong Mini is wet. There's also a lanyard attachment point on the right side of the phone to further reduce the chances of dropping it.

The big lump of rubber at the bottom of the phone houses a small cover for the USB Type-C charging port. Opening it is a bit of a faff if you've got short fingernails, however, and it feels quite uncharacteristically flimsy.

Strangely, the Kingkong Mini doesn't have an official IP rating, so to test how rugged it is we dropped it from two metres on to a concrete patio, buried it in a bowl of self-raising flour and threw a cup of coffee over it, finally rinsing it off under a tap. None of this produced any ill effects, so it's definitely got some fairly robust ingress protection. The toughened glass on the front also resisted an intentional attempt to scratch it with keys.

Remember, however, that this is a budget phone, and certain concessions are to be expected. There's no NFC chip or fingerprint scanner, for instance, and

we'd be extremely surprised if this ever saw an update to Android 10.

The lack of a 3.5mm audio jack is more easily explained by the need to remove a potential path of water ingress. On the positive side, there's a full suite of sensors, including dual-band Wi-Fi, an FM radio and support for all the 4G wireless bands used in the UK.

Using a 4in screen feels odd when you're used to larger Android handsets; the Android keyboard seems a little cramped, for one. Size aside, however, this display has a lot going for it. The 1,080x540 resolution is fine for such a compact size, while the maximum brightness of 585cd/m², sRGB colour gamut coverage of 89.6% and contrast ratio of 1,128:1 are all pretty good at this price point.

LOW GRAPHICS

Inside the Kingkong Mini you'll find a MediaTek Helio A22 processor. Launched in mid-2018, it combines a 2GHz A53 quad-core CPU with a PowerVR GE8300 GPU and 3GB of RAM. Storage only stretches to 32GB, but you can add another 128GB via microSD.



That all amounts to a perfectly decent little system that can run Android 9.0 – mostly in vanilla form, apart from some unnecessarily ugly revised app icons – and even quite demanding apps, without many problems.

We say 'many' and not 'any' because our usual Geekbench 4 benchmark simply wouldn't run on the Kingkong Mini.

GFXBench Manhattan did, and returned an

onscreen test result of 15fps and offscreen test result of 6fps; those sound low, and we wouldn't suggest playing 3D games on a 4in screen, but the low resolution actually means a lot of games can run at decent frame rates.

If only the battery life had such an upside. In our video playback test, the Kingkong Mini ran dry in a disappointing 6h 35m, which might not be the worst thing if you're using it as a backup, but is just too short for main phone duties.

There's also nothing remotely fancy about the cameras. You get a single 13-megapixel camera at the back and an 8-megapixel unit at the front, along with the stock Android camera interface. The second lens cover that you can see between the LED flash and the actual camera is purely cosmetic; there's nothing behind it.

In good light, however, both images and video (footage records at 1080p and 30fps) are perfectly acceptable for a phone this cheap. Colours look natural and reasonably well saturated with a decent amount of detail. The autofocus also does its job quickly and reliably, though the delay between touching the shutter button and the picture being taken is a little long.

SECONDARY SOURCE

There are better budget options to use as a primary handset, such as Motorola's Moto E6 Plus, but as a backup, the Kingkong Mini does a respectable job. It's cheap and rugged enough that you won't worry too much about damaging it, and with the exception of battery life it functions smoothly enough as a grown-up Android handset.

FAIRPHONE 3



£400 • From shop.fairphone.com

VERDICT

The Fairphone 3 is a noble project, but in pure hardware terms it charges more for less

IT'S AN OPEN secret that phones are environmentally costly, especially with so many manufacturers aiming for a one- or two-year upgrade cycle. The Fairphone 3 takes a different approach, adopting a user-upgradable design with recycled and recyclable components that won't produce as much waste.

Admirable as this approach is, if you're thinking that the result won't be cutting-edge technology, then you're 100% correct. The Fairphone 3's specs are distinctly middle of the road: namely, the Qualcomm Snapdragon 632 processor and 4GB of RAM.

SHOW YOUR WORK

The Fairphone 3 also has a somewhat dated look from the front. It has the kind of bezels that haven't been seen on a smartphone for quite some time, especially at the top and bottom of the 18:9 screen. It comes with a thick rubberised bumper around the outside to protect from drop damage, but this can be easily removed if you like.

Flip it over and it looks a lot more distinctive – and largely in a good way. It's a translucent plastic case, so you can see exactly what makes it tick. The word 'Fairphone' is embossed in all caps, and the slogan 'change is in your hands' is visible, printed on the battery underneath.

There's also a good mix of hardware features. It uses USB Type-C charging, has a 3.5mm headphone jack, supports NFC, has two SIM-card slots and an additional microSD card slot supporting cards of up to 400GB in size.

By far the most distinct trait, however, is the Fairphone 3's repairability. Nowadays it's rare for smartphones to even let you take out the battery, but this handset can be disassembled with a tiny screwdriver that's included in the box.

Fairphone has instructions and tutorial videos on how to replace four modules in addition to the screen and battery, each of which is available from the official website's spare parts shop. It's important to state that while this makes it a modular phone, this isn't about upgrades: all of the components in the shop are just

replacements for the existing hardware, should it fail.

And the prices vary wildly. A new screen costs £77, which feels fair enough, but the asking price of £21 for a replacement back cover – itself a flimsy plastic thing – raises an eyebrow. Still, affordability isn't the real point. It's absolutely brilliant that Fairphone has made the Fairphone 3 as fixable as it is, and demonstrates a company willing to walk the walk on ease of repair, as well as talk the talk.

The Fairphone 3's 5.65in IPS screen has a resolution of 2,160x1,080, which is more than enough for a screen of this size. Less positively, thick bezels at the top and tail of it gives it a certain retro feel, and colour performance doesn't do it many favours either: 95.3% coverage of the sRGB gamut is good, but these colours are reproduced inaccurately, so everything looks oversaturated.

However, brightness is high, with a measured peak of 503cd/m², and contrast is a very respectable 1,649:1, but all things considered it's a pretty middling screen.

FAIR PLAY

Day-to-day performance is also reasonable, if unspectacular. The Fairphone 3's Geekbench 4 scores put it behind other mid-rangers such as the Google Pixel 4a and OnePlus Nord: it scored 1,274 in the single-core test and 4,858 in the multitasking test.

The difference is even starker with games. The Fairphone 3 managed only 10fps in both the onscreen and offscreen portions of GFXBench Manhattan, so it will struggle with more visibly complex 3D games.

In terms of battery life, it's about par for the course, with a total running time of 14h 20m in our video test. That's

less than the Pixel 4a, but more than the iPhone SE.

The Fairphone 3 has a single 12-megapixel rear camera, using the same Sony IMX363 sensor as last year's Google Pixel 3a. At a glance, the Fairphone 3 does well with outdoor shots, even if some of our test shots came out looking a little underexposed. Sadly, put up against the Pixel 3a, it's not even close: Google's phone captures much finer detail, likely due to its

specialised processing software.

In tricky low-light conditions, the Fairphone 3 again appears to cope, but it just can't compete with the Pixel 3a, with lots of visual noise creeping in around the edges of objects. The Pixel 3a has some of this – almost all smartphone cameras struggle in darkness – but nowhere near as much.

There's also no sugar-coating the fact that the Fairphone's video recording is poor. It looks good on paper, offering support for 720p, 1080p or 4K video capture at 30fps (with 60fps for 1080p, which is weirdly listed as 120fps in the software due to a bug), but the footage is grainy and the camera struggles to maintain focus while panning. Both 720p and 1080p footage should be stabilised – there's a toggle to enable stabilisation – but the video bounces all over the place. Colour accuracy is poor, and footage can turn out murky.

GREEN INITIATIVE

In fairness to Fairphone, this smartphone doesn't try to be the fastest one ever, or to have the best camera; the focus is primarily on minimising its own environmental impact, and employing better working conditions for the people making it. On these grounds, the Fairphone 3 has better credentials than anything.

These values might be enough for prospective buyers to ignore anything else we say here and go for the Fairphone 3 on ethical grounds. That's fair enough as the Fairphone 3 is – relatively speaking – a very ethical product, but as a smartphone per se, its repairability is the only thing it does better than similarly priced alternatives.



GOOGLE Pixel 4a

**COMPUTER
SHOPPER**
BEST BUY



£349 • From store.google.com

VERDICT

A fabulous streamlined smartphone that competes fiercely with the iPhone 11 and OnePlus Nord

IT'S ARRIVED IN the UK couple of months after its US launch, but the Pixel 4a – a cheaper, more pocket-friendly spin-off from Google's Pixel 4 – is worth waiting for.

Like the Pixel 3a before it, the 4a has a simple polycarbonate body and opts for a processor one rung below the top-end Qualcomm Snapdragon chips powering Google's flagships. In this case, it's the octa-core Snapdragon 730G, accompanied by 6GB of RAM and 128GB of storage.

There's also no 5G support, although a Pixel 4a 5G is expected to launch alongside the Pixel 5 later this year. That still might seem like a questionable omission when the similarly cut-price OnePlus Nord offers 5G, but even so, it's easy to fall in love with this handset.

CARBON BASED

Despite the use of plastic instead of a glass or metal chassis, the Pixel 4a looks great, and doesn't feel cheap at all. It barely picks up fingerprints and it's filled with nice user-friendly touches, such as the fingerprint reader that blends seamlessly into the backplate, or the white-coloured lock button, which is clearly distinct from the volume buttons right next to it.

It's also small enough to operate with one hand without being so small that you'll yearn for something bigger. Indeed, at 144x68x8.2mm, the Pixel 4a is only a fraction larger than the iPhone SE, which has a much smaller screen: 4.7in to the 4a's 5.8in.

The only real disappointments are the lack of proper waterproofing and of any expandable storage slot, although with 128GB you do get twice as much internal storage as on the iPhone SE.

That body-filling display is, itself, another great feature. With a resolution of 2,240x1,080 it's pretty sharp, and it supports HDR content too. The hole-punch selfie camera is mercifully unobtrusive, too.

As you'd expect of an AMOLED display,

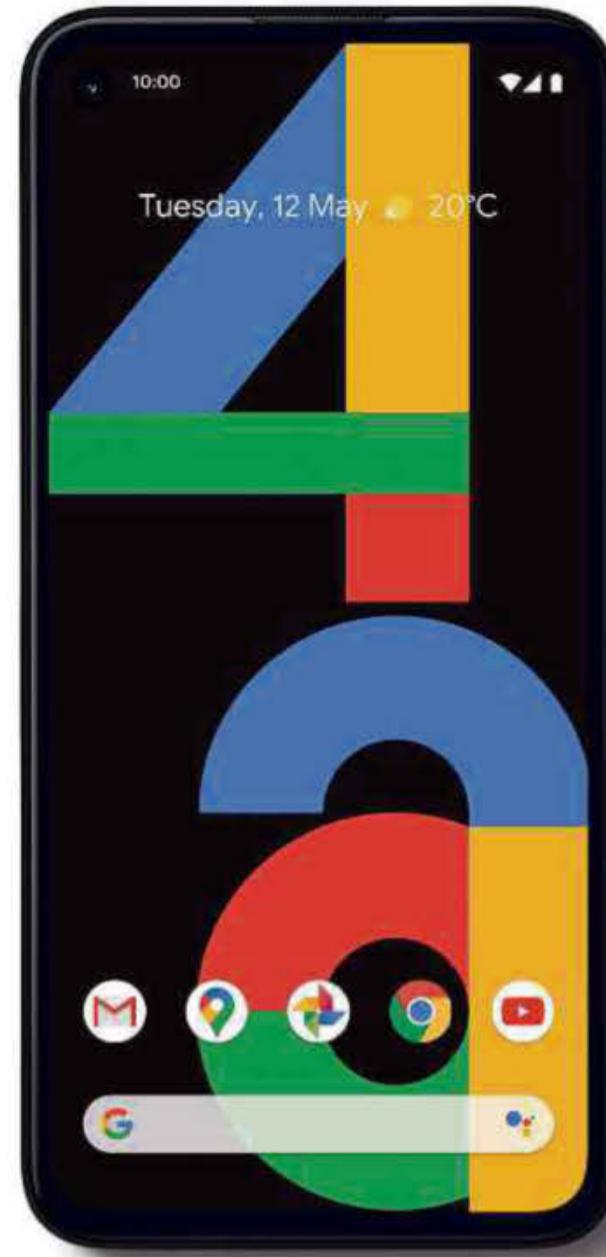
the contrast ratio is effectively perfect. Brightness is excellent, too, peaking at 437cd/m². It isn't the brightest display we've seen in a smartphone, but it's bright enough to ensure readability on all but the sunniest of days. It can also reach a respectable sRGB colour gamut coverage of 93.7%, in the Natural colour profile, along with an even better delta-E of 1.05.

PICTURE PERFECT

The Pixel 4a's camera is much more impressive. There may only be one 12.2-megapixel camera at the rear – with no ultrawide angle sensor, no zoom or macro, and no depth sensor for portrait shots – but that doesn't really matter. This one sensor, combined with Google's computational photography genius, is capable of serving up some truly astonishing results without the need for all those extra beady eyes. The phone's Super Res Zoom feature, for example, is amazing at providing convincingly sharp digital zoom shots without requiring a separate zoom lens.

Likewise, portraits shot on the Pixel 4a look simply brilliant. Whether in good light or bad, backlit or indoors, every portrait we captured came out looking sharp and crisp, with lovely neutral colours, flattering skin tones and a creamy, simulated bokeh background with the subject isolated in sharp relief in the foreground.

Never mind the likes of the iPhone SE or OnePlus Nord, the Pixel 4a is even better at stills photography



than the £1,149 iPhone 11 Pro Max. And, although you're only able to shoot 4K video at 30fps (you have to drop to 1080p for 60fps), it's stabilised effectively and with marginally fewer glitches than on the Nord.

OnePlus's rival handset does have an advantage in its ultrawide sensors, but generally, the Pixel 4a is the best of the bunch for point-and-shooting.

Although the Nord's CPU is better on paper, the Pixel 4a also does a good job of keeping up with it on performance. Its Geekbench 5 scores of 552 in the single-core test and 1,591 in the multicore test are lower than the Nord's respective 606 and 1,945, but not by enough that there's a massively noticeable difference in normal use. Both are outgunned by the blazing iPhone SE, in any case.

The Pixel 4a turns the tables for battery life, however, lasting 18h 43m in our video loop test. That's over seven hours longer than the iPhone SE, even though the latter has a smaller, lower-resolution display. On the other hand, the Pixel 4a's battery is much smaller than that of the OnePlus Nord, allowing it to reach an even better 20h 22m, but you shouldn't have problems getting a full day out of Google's phone.

A FOR EFFORT

If you're after a compact phone that won't make too much of a dent in your pocket, then the Pixel 4a is a fantastic choice. Although it isn't as fast as the Apple iPhone SE (2020), it's a better all-rounder, with a bigger screen, superior portrait photography and far superior battery life.

Between this and the OnePlus Nord, it's a more nuanced decision. The Nord's 5G capability, bigger screen and longer battery life are all compelling strengths, but the Pixel 4a also has a charm of its own. With its superlative camera and considered design – not to mention, like all Pixel smartphones, a complete lack of bloatware on its Android software – there are plenty of reasons to pick one up.

HONOR 9X



£200 • From www.johnlewis.com

VERDICT

An elderly CPU overshadows the good work Honor has done with this handset's design

IF THERE WAS ever a phone designed to catch the eye, it's the Honor 9X. On the surface, our glittering blue review model appeared to tick all the boxes, with a great-looking screen, no notch in sight, a 3.5mm headphone jack and somewhere to stow a memory card to expand its already reasonable 128GB of memory. For £200, falling for its charms is easy.

Even beyond the exterior, there are still plenty of things to like. The 9X supplies a massive 4,000mAh battery and a 48-megapixel camera, while the 16-megapixel selfie camera pops out of the top of the handset with a friendly mechanical whir. As is so often the case, however, there's a catch: the Kirin 710F processor, which is functionally identically to the Kirin 710 that powered 2018's Honor 8X.

OOH, SHINY

We'll get to that issue shortly, but suffice to say performance doesn't match the design. The 9X is tall, slim and elegant, with softly curved edges that make it comfortable to hold and give it the illusion of costing much more than it does.

It charges via a USB Type-C port at the bottom, which sits alongside the 3.5mm headphone jack. A volume rocker and power button are situated on the right side, and on the top of the phone there are compartments, sealed flush with the side panels, which hide the selfie camera and the SIM/microSD slot. It lacks NFC, however, so you can't use it for contactless payments.

The display on the 9X is a generous 6.6in, 2,340x1,080 LTPS panel. In our testing it covered 90.2% of the sRGB colour gamut, which is a typical score for a phone of this price. We also recorded a maximum brightness of 428cd/m², which is bright enough to see on a sunny day, and the measured contrast ratio of 1,269:1 helps to mitigate jagged-looking edges around text and images.

On to that problem processor, then. The 2.2GHz Kirin 710F – paired with 4GB of RAM here – has been a stalwart of Honor and Huawei phones for a while now, and this

cost-saving tactic is becoming increasingly dated as both manufacturers continue to use this low-powered chipset.

This is especially obvious if you look at the results of our performance tests. It's not slow in general, but by scoring 1,533 in Geekbench 4's single-core test and 5,493 in the multicore test, the 9X is no faster than the old 8X; in fact, it scored slightly lower than the 8X's respective results of 1,611 and 5,668. In terms of more recent budget competition, the Oppo A5 scored a comparable 1,515 in the single-core test and 5,508 in the multicore test, despite being about £50 cheaper.

Honor has at least managed to squeeze a little more out of the graphics hardware, with the 9X slightly improving on the 8X's performance in the GFXBench Manhattan tests. Here, the new model produced a 19fps onscreen result and a 21fps offscreen result, whereas the 8X produced 18fps in both.

However, the £140 Motorola One Macro beats it here, with 42fps in the onscreen test and 23fps offscreen.

HEADED FOR A FALL

Disappointingly, battery life has also decreased between generations. In our video rundown test, the 9X lasted 12h 41m going from full charge to zero. That's 15 minutes less than the 8X, so it's not drastically different, but still a step backwards.

The main camera on the Honor 9X is a 48-megapixel unit with a 1/2in sensor. It's backed up with a 2-megapixel depth-assist camera to help improve portrait



shots and an 8-megapixel wide-angle lens with a 120° field of view. All three cameras sit vertically aligned in a slightly raised section on the upper-left area of the back of the phone, which doesn't protrude far enough to unbalance your typing and swipes if you're resting it flat on a table.

Taking pictures on a bright, overcast day left the colours looking a bit flat and washed out. The detail is surprisingly sharp, however; we zoomed in and compared the detail

taken on a bright day with Huawei's more expensive Nova 5T, and the results were similar. We preferred the colour on the images taken with the wide-angle lens, but there's much less detail on these when you zoom in, as you'd expect from an 8-megapixel sensor.

The same was true when taking photos indoors in low light. There's nothing missing from the detail of the 9X compared to the camera on the Nova 5T, but the images lack vibrant, punchy-looking colours.

The camera can shoot 1080p video at 60fps in a standard 16:9 ratio, but can expand to 19:2:9 (the full ratio of the screen) if you drop to 30fps. 720p resolution can only be shot at 30fps, but at this level the image stabilisation is much improved.

STUCK IN THE PAST

The Honor 9X is a phone that's filled with positives: it's nicely premium-looking, the display is pretty good and storage is expandable. Unlike its powered-up bigger brother, the 9X Pro, the standard 9X also comes with the usual suite of Google Apps, having managed to slip out into the wild before Honor and Huawei cut support for political reasons.

Underneath that slick exterior, however, is a processor that should really have been retired by now. Without even incremental improvements in core performance or battery life, most of this phone's other benefits feel a tad superficial.



HONOR 9X Pro



£250 • From www.amazon.co.uk

VERDICT

Great hardware, but without Google apps the Honor 9X Pro is seriously hobbled

THE FIRST THING you need to know about the Honor 9X Pro is also the most worrying: thanks to an ongoing set-to between the United States and China, this phone has been blocked from using Android as you know it, falling back on the open-source version.

That doesn't sound too bad, even if it's not good news for security updates, but the devil is in the details. The ban on US companies dealing with Huawei (Honor is a sub-brand of the Chinese giant) means Google can't provide its apps to go with it. That means no Gmail, no YouTube and no Google Maps; there isn't even a Play Store so you can fill in the gaps.

CLEAN LINES

This is an enormous shame, because not only does this phone avoid the standard Honor 9X's problem of an outdated processor, it's also only modestly pricier and is just as sleek and stylish. A side-mounted fingerprint sensor and pop-up front camera maintains a nicely unbroken look, and Honor has included a number of consumer-friendly extras. The 3.5mm headphone jack is still in place, and the already generous 256GB of internal storage can be expanded by a microSD card of up to 512GB in size.

At the same time, there aren't many more premium features such as wireless charging, waterproofing or even NFC, but then you wouldn't be able to install Google Pay anyway.

The Honor 9X Pro's 6.6in screen uses IPS tech and has a resolution of 2,340x1,080, enough to ensure good sharpness on such a large display. And it's a good screen, too, once you turn off the overwhelming Vivid default colour setting. Using our colorimeter, we found the Honor 9X Pro covered 96.1% of the sRGB gamut in Normal mode, with a contrast ratio of 977:1.

It could be brighter, only reaching 371cd/m² in our test. That's not a disaster in the greater scheme of things, but it does mean you may struggle on a particularly bright day. Still, for the price, this is a very fine display indeed.

The Honor 9X Pro is powered by the 2.27GHz octa-core Kirin 810 processor, which dutifully provides a huge upgrade on the Honor 9X's Kirin 710F. Together with 6GB of RAM it pushed the Pro model to Geekbench 4 scores of 2,775 in the single-core test and a particularly strong 7,716 in the multicore test.

The advantage is even more stark in the graphics tests. The Honor 9X Pro is an absolute powerhouse for the price, achieving an astonishing 48fps in the GFXBench Manhattan test onscreen, and 55fps in the offscreen test.

SHUT UP SHOP

The catch, of course, is that you won't be able to download any games from the Play Store. In its place is Huawei's AppGallery, but it's a weak substitute. Its 45,000 apps sounds like a lot, but only if you forget that the Play Store offers around 2.7 million, and big names such as WhatsApp, Instagram, Facebook and Netflix are nowhere to be found.

Yes, if you can find an APK file for the app you want to install you can potentially sideload it – as indeed we had to with our regular benchmarking tests – but this is risky and a real pain.

Battery life, meanwhile, is a slight improvement on the Honor 9X, but not massively so. In our test, it lasted 13h 26m before giving up – decent enough, but nothing to trouble the likes of the Motorola Moto G8 Power Lite.

The Honor 9X Pro has the same camera setup as the standard 9X,

where the main 48-megapixel sensor is supported by two extra lenses: an 8-megapixel wide-angle camera and a 2-megapixel depth sensor.

As a result, its photos share the same lack of punchy vibrancy, but the 9X Pro still punches above its weight in terms of image quality and detail. It manages to avoid overexposure in conditions where other cheap phones might fall victim, and it holds on to fine details when zoomed.

The front-facing 16-megapixel selfie

camera is technically very impressive in a £250 phone, too. The way it pops up out of the casing when you switch camera modes, accompanied by a satisfying whirr, never fails to raise a smile.

Performance, however, doesn't quite meet the promise of the specs. Not only does it seem to apply some pretty aggressive beautification settings, even when the settings are pushed to zero, skin tones take on a very light appearance.

As for video, the Honor 9X Pro is capable of recording 720p or 1080p, and at frame rates of up to 60fps. Quality is pretty good but, in our test, upping the frame rate to 60fps disabled the (normally very effective) stabilisation, making footage a shaky, unusable mess. Still, at 30fps it's pretty solid.

OFF LIMITS

In another universe, where the United States hadn't targeted Huawei with a trade ban, the Honor 9X Pro would have been a real contender. It's stylish, lightning fast and keenly priced to boot.

In reality, sadly, the loss of Google apps and especially the Play Store makes this phone almost impossible to recommend, even if the hardware is largely very good. Luckily, there's no shortage of great, fully featured Android handsets to choose from instead, from the long-lasting Samsung Galaxy A21s to the Xiaomi Redmi Note 9 and its feature-rich, quad-lens camera.



HUAWEI P40



£700 • From www.argos.co.uk

VERDICT

This phone's hardware is good, but Android without Google apps takes some serious getting used to

UNFORTUNATELY, THE Honor 9X Pro is far from the only smartphone to suffer from issues with US-China relations. Both the flagship Huawei P40 and its even more expensive upgrade, the P40 Pro, will run Android 10 but also completely lack native support for Google apps or the Play Store.

This might, understandably, be an instant dealbreaker for anyone already absorbed in Android, Google's services or both. If you think you can live without, however, you'll at least find the P40 a very competent smartphone.

STYLE AND SUBSTANCE

It's a hefty £200 cheaper than the P40 Pro, albeit due to a pared-down feature list. For example, it lacks the P40 Pro's exotic 'quad-curve' design, instead favouring a standard flat front, combined with straight-ish sides.

Regardless, it's a good-looking handset. Its mirrored, metallic edges softly glisten in the light, and the display bezels are slimmer than ever. On the back, the camera housing has a striking new square shape, although it sticks out further than the equivalent on the previous model, the P30, making the phone rock side to side when you prod it on a flat surface. The 3.5mm headphone jack has been removed, too.

The P40's 6.1in OLED screen is smaller than the P40 Pro's, but it's just as nice to look at. Its resolution of 2,340x1,080 is perfectly sharp, and in the Normal setting, it can cover 97% of the sRGB gamut.

It doesn't quite match the iPhone 11 in the vibrancy stakes – HDR content looked a bit muted by comparison – but, rest assured, most content looks fabulous. The only real downside is that the P40's screen is limited to a refresh rate of 60Hz, as opposed to the buttery-smooth 90Hz offered by the P40 Pro and OnePlus 8.

Internally, there's not a jot of difference between the P40 and P40 Pro. Both are powered by the latest and greatest of Huawei's home-grown

Kirin range: the Kirin 990. This is a 5G-enabled chipset that consists of three core clusters: two cores running at 2.86GHz, another two running at 2.36GHz, and a low-power set of four running at 1.95GHz, all manufactured with a 7nm fabrication process. There's 8GB of RAM on tap, too.

This setup scored 3,881 in the Geekbench 4 single-core test and 12,247 in the multicore test, so while it's slightly behind the Snapdragon 865-powered OnePlus 8 and more clearly behind the iPhone 11, it's not exactly slow. It also matches these phones by averaging 60fps in the GFXBench Manhattan onscreen test.

Its offscreen result of 113fps again suggests the Kirin 990's GPU is slower than its Qualcomm and Apple equivalents, but we'd still say the P40 has enough power for a premium handset. It's certainly a significant step up in performance from the P30.

However, this comes at the cost of battery life. The older handset managed 18h 30m in our video playback test, but the P40 dipped to 17h 59m. We'd actually argue the increased speed is worth it, although this lack of improvement becomes far more noticeable next to the amazingly long-lasting OnePlus 8.

OUT OF TIME

The Huawei P40's primary camera sensor is a massive 50-megapixel number, just as it is on the P40 Pro. Again, however, there are some differences: the 8-megapixel telephoto

lens has a 3x optical zoom, not 5x, and while the P40 has a 16-megapixel wide-angle sensor it lacks the Time of Flight (ToF) sensor of the P40 Pro.

Fortunately, the P40 takes great shots in spite of these differences. Whatever the lighting conditions, the P40 captures intricate details without kicking up a fuss, such as stormy clouds, complex brickwork, window reflections and lush tree foliage.

However, pictures on the iPhone 11 have a touch more punch to them, and a little more detail and texture. The iPhone is very slightly better in low light, too, but not by much.

The iPhone 11 also has a wider field of view, but the P40's ace in the hole is its 3x telephoto zoom camera. Notably absent on the iPhone, Huawei's zoomed-in images are nothing short of exceptional, and allow you to snap distant objects – including moving ones, such as birds and helicopters – with ease.

Another positive is that the P40 can finally record video at 4K resolution at 60fps. An area where Huawei has been lagging behind its iPhone rival for a few years, both optical and electronic image stabilisation are enabled in this mode by default for super-stable video and the footage looks very good indeed.

AND NO PLAY

The P40's hardware, then, is up to standard. It's impossible to play down the absence of Google apps, however; if you're used to checking Gmail on the train, watching YouTube in bed or using Google Maps for navigation, the culture shock of this phone will be immense.

Perhaps circumstances will change and Huawei will eventually be allowed access to Google apps again, or – and this admittedly seems even less likely – the App Gallery could expand to the point it becomes a genuine Play Store rival. Until then, the P40 is a physically capable smartphone that must nonetheless be approached with caution.



MOTOROLA Moto E6 Plus

**COMPUTER
SHOPPER**
BEST BUY



£80 • From www.argos.co.uk

VERDICT

There are better smartphones than the Moto E6 Plus, but not without spending a fair bit more

MOTOROLA HAS ONE of the most illustrious histories of all companies in the budget smartphone market. The Moto G series has consistently delivered, with the sole exception of the overly conservative Moto G5, and with recent generations it's expanded the range considerably to include models dedicated to larger displays or longer battery life.

Just below the Moto G series, however, sits the Moto E series, and this too has been ripe with success stories, the latest of which is the Moto E6 Plus.

E MARKS THE SPOT

Launched recently alongside the even cheaper Moto E6 Play, the Moto E6 Plus doesn't really stand out on looks, though that also means it can pass for a more premium handset. The screen bezel may be a little thicker than most flagships, but it's still thin enough to necessitate a little half-notch for the front-facing camera.

Flip it over and you'll find a shiny and unapologetically plastic backplate. The dual-camera array is neatly contained in the top left-hand corner, and a small circular Motorola logo doubles up as a fingerprint reader in the middle. At the bottom is a decidedly old-school Micro USB port for charging – there's no Type-C here – but you get a headphone jack at the top, and the rear cover is removable, so you can swap out the battery yourself.

This removable back cover also means that there's no SIM or microSD tray – you have to open it up to put them in. Still, there is room for both a nano-SIM and a microSD card of up to 512GB in size.

The 6.1in screen is an IPS panel with a resolution of 1,560x720. That's lower than the ideal 1080p, but this is a good screen nonetheless: peak brightness hits a particularly high 511cd/m², and contrast is an equally respectable 1,463:1. Meanwhile, sRGB gamut coverage of 84% makes for acceptable

vibrancy as well, even if it's not particularly high in itself.

Internally, the Moto E6 Plus is powered by the MediaTek Helio P22 octa-core processor, with four cores running at 1.5GHz and four at 2GHz. This is backed by 2GB of RAM and 32GB of internal storage.

This is a departure from the Snapdragon chips of previous budget Moto smartphones, across both the G and E

ranges, but the Moto E6 Plus keeps pace regardless. Its Geekbench 4 scores of 822 in the single-core test and 3,648 are a clear step up from the Moto E5 Plus, and although the Moto G8 Power Lite is a little faster (as you'd expect, given the price difference), this phone competes well with other entry-level Android models such as the Vodafone Smart X9 and Xiaomi Redmi 7A.

It's also much more powerful than the Moto E6 Play, which is only £10 less but

scored less than half of the Moto E6 Plus's result in the multitasking test.

GAME ON

It's a similar story when it comes to graphics processing. In the GFXBench Manhattan 3 benchmark, the Moto E6 Plus averaged 16fps in the onscreen test and 10fps in the offscreen test. This ranks it significantly ahead of the Moto E6 Play, and interestingly, dead even with the Moto G8 Power Lite. At a glance, it seems to be well ahead of the Vodafone Smart X9, but resolution is important here: while the Redmi 7A and Moto

E6 Plus have 720p screens, the Vodafone handset has a 1080p panel – hence the numbers are level when the tests are done offscreen.

Sadly, in one key metric the Moto E6 Plus has gone backwards on last year's model. While the E5 Plus lasted 23h 2m in our rundown video test, the E6 Plus conked out at 15h 3m. That's still not a terrible result, but it's a very sizable regression, owing to the use of a 3,000mAh battery

instead of the older phone's 5,000mAh unit.

The Moto E6 Plus gets a handy upgrade in the camera department, however, switching to a dual-lens array. The main camera is a 13-megapixel f/2.0 affair, and it's supported by a 2-megapixel depth sensor for bokeh effects.

This arrangement performs well above expectations for £80. Outdoors, the main camera can pick out plenty of colour and detail even in heavily overcast conditions, and while it doesn't escape the common pitfalls of shooting in low light indoors, it's not too bad in this regard. The worst that happens is post-processing aggressively softening the edges of objects; throughout the rest of the image, there's a lot less visual noise than we were worried about seeing.

The front-facing camera is an 8-megapixel, f/2.0 unit, and it's pretty decent, too. Shooting and recording options are fairly simplistic, but it takes a good picture that's fine for selfies, even letting you blur the background for arty shots.

HARD BARGAIN

While the Moto G8 Power Lite remains a technically superior budget smartphone, especially when it comes to stamina, if you're keen to keep your spending budget below £100 then it's hard to find too much fault with the Moto E6 Plus. It's good looking, long-lasting and performs well enough for the price.

Should you spend more if you can afford to? Absolutely. But if you can't, the Moto E6 Plus won't let you down.



MOTOROLA

Moto G8 Power Lite



£150 • From www.amazon.co.uk

VERDICT

The Moto G8 Power Lite makes some deep cuts to save money, though its longevity is the real deal

EVEN AMONG THE widely-expanded Moto G series, the Moto G8 Power Lite is new territory for Motorola. Just like the Moto G7 Power, the current generation has a Moto G8 Power focused on battery life, but this time there's a new version that cuts the price even further.

The Moto G8 Power Lite sticks with a massive battery, then – 5,000mAh, to be exact – but swaps in a weaker MediaTek MT6765 Helio P35 processor and lowers the screen resolution. In exchange, it only costs £150, a full £70 less than the standard Moto G8 Power.

FINGERS CROSSED

For such a cheap handset, the Moto G8 Power Lite looks snazzier than you might expect. Its 6.5in display, pleasingly rounded edges and slimline bezels (for a budget phone, that is) are immediately striking. A teardrop notch that houses the selfie camera punctuates the otherwise smooth lines, and we like how the Royal Blue colour scheme fades from a darker to a lighter shade of metallic blue as you cast your eyes downward.

It feels cheap, however, with a plastic chassis that picks up fingerprints easily and only a Micro USB port instead of a USB Type-C port. The rear fingerprint sensor, while initially seeming like a nice inclusion for the money, is quite finicky in recognising inputs as well. You do, however, get a dual SIM slot, a headphone jack and a 'water-repellent' degree of protection, if not outright waterproofing.

The Moto G8 Power Lite's 6.5in IPS screen has a resolution of 1,600x720, which is visibly less sharp than the Moto G8 Power's screen, and its peak brightness of 426cd/m² is lower too. As for colour, the G8 Power Lite's display covers 81.9% of the sRGB colour spectrum, with a gamut volume of 92.3%. It's not markedly worse than any other Moto G8 smartphone, but it isn't fantastic either: some colours aren't as

vibrant as they ought to look, and certain hues – greens and yellows, blues and purples – are undersaturated. Images on the screen have a good amount of pop thanks to the display's reasonably high 1,409:1 contrast ratio, however.

The MediaTek processor and 4GB of RAM produced Geekbench 4 results of 910 in the single-core test and 3,931 in the multicore test. These are lower than those of the Moto G8 Power, as well as some other budget handsets such as the Xiaomi Redmi Note 9, but overall we'd say performance is fine. The Moto G8 Power Lite feels fast enough when jumping from app to app, and its version of Android 9 is clean and easy to use; there's no unwanted clutter here, unlike on Xiaomi's phones.

In the GFXBench Manhattan 3 test, the Moto G8 Power Lite managed an average onscreen result of 16fps, dropping to 10fps for the offscreen segment. It's a little harder to be satisfied with this, however, considering the Moto E6 Plus performed identically despite costing just £80.

LASTING IMPRESSION

The Moto G8 Power Lite at least pulls ahead of the competition when it comes to battery life. Its 5,000mAh battery lasted for 20h 6m in our video test, which is on a par with some of the longer-lasting premium smartphones on the market. That's only 2h 20m shy of the standard Motorola Moto G8 Power's result, which, for a £150 phone with a 6.5in display, is

very impressive, and pretty much guarantees all-day and all-night use.

The Moto G8 Power Lite's camera setup is also relatively impressive, packing in a 16-megapixel main sensor, a 2-megapixel macro lens and a 2-megapixel depth sensor. The camera software is straightforward and easy to use, too.

Even in shots taken on a gloomy day, you can still make out finer details on objects at range, and

the phone's HDR image processing does a good job at boosting saturation where appropriate, although some of the colours looked a bit overprocessed for our liking.

Low-light shooting is surprisingly good, too, and the macro camera is a lot of fun to play with. It's capable of capturing intricate details on the smallest objects from just 25mm away, and our test shots proved it does so cleanly and effectively.

Video capture is a lot more basic, only rising to 1080p footage at 30fps, but otherwise the Moto G8 Power Lite continues the Moto G tradition of impressing on photography. The Xiaomi Redmi Note 9 is even better in this regard, but then it costs £90 more.

LITE WEIGHT

As the most affordable member of the G8 family, the Moto G8 Power Lite might look like the obvious choice for buyers on a budget. It only costs £150, and has a nice 6.5in display, a solid camera setup and a giant battery that will last you all day long and then some.

That said, the Moto E6 Plus looks like more of a bargain for cash-strapped buyers; it's not as powerful or long-lasting, sure, but it's capable of at least nipping at the Moto G8 Power Lite's heels on most metrics despite being significantly cheaper.

Unless, then, you want something that will specifically last for a longer time between charges, the Moto G8 Power Lite is a reasonable enough handset, but not the Moto model you should buy.



ONEPLUS 8

**COMPUTER
SHOPPER**
BEST BUY



£599 • From www.amazon.co.uk

VERDICT

Despite its changes staying modest, the OnePlus 8 makes improvements where it needs to

WITH A £100 price jump on the OnePlus 7 (Shopper 380) and a £50 increase on the 7T (Shopper 383), you might argue that OnePlus's newest smartphone doesn't manage the same cut-throat value proposition of past handsets. Don't worry too much, however, as while the OnePlus 8 is a little more expensive than the 7T, it's also much, much better.

It all starts with the design. The OnePlus 8's rear triple-lens camera array is now arranged in a neat vertical line, a much more elegant touch than the 7T's large circular camera bump, especially as the lenses don't poke out as far. The front camera, which includes facial recognition support, has also been moved to a pinhole in the top-left corner instead of left as a central notch.

KEEP DRY

The usual mix of OnePlus-standard physical features make a return, including the three-position 'do not disturb' switch and oblong power button on the right edge. However, OnePlus has adopted an annoyingly unnecessary iPhone-like quirk this year: in order to turn the phone off, you have to hold down the power button in conjunction with the left-mounted volume rocker.

The phone's USB Type-C charging port, Dolby Atmos-certified speaker and dual-SIM tray can be found on the bottom of the handset, and a fingerprint reader is sensibly placed under the bottom portion of the Gorilla Glass-protected screen for secure unlocking and mobile payments. There's no full waterproofing, sadly – for that you'll need to upgrade to the £799 OnePlus 8 Pro.

The standard OnePlus 8's display is a 6.55in OLED panel running at 2,400x1,080, and its refresh rate is 90Hz instead of the usual 60Hz. This makes for smoother scrolling and games – at least in the apps that support it – but what's really impressive is colour performance. Besides covering 93.4% of the sRGB colour gamut, the OnePlus 8's delta-E measures at 0.9, so colours are reproduced as accurately as they'd be on a professional-quality desktop monitor.

Peak brightness also hits a high 775cd/m², and since all OLED screens have perfect contrast, there's really nothing to gripe about.

OnePlus has also stuck with top-end components for the SoC, namely the Qualcomm Snapdragon 865. There's a choice of 8GB or 12GB of RAM available – we tested the cheaper 8GB version – as well as either 128GB or 256GB of storage.

The Geekbench 4 benchmark returned scores of 4,240 for the single-core test and 13,396 for the multicore test, representing about a 20% performance improvement on the OnePlus 7T. It's also worth noting that the 8 Pro has the exact same processor, so you won't be getting any real speed benefit from the pricier variant.

SMOOTH GOING

The OnePlus 8 is among the best phones for gaming, scoring 60fps in the GFXBench Manhattan onscreen test and 127fps in the offscreen test. Apple's iPhone 11 (and its same-gen spin-offs) produce faster offscreen results, but in games that only support 60Hz,

you wouldn't be able to tell the difference.

Even better than this, however, is battery life. Playing a looped video from full to empty, the OnePlus 8 lasted an incredible 26h 47m before conking out. That's the second-longest time we have on record, only after the long-discontinued Lenovo P2. In other words, there's no other high-end smartphone currently on the market that lasts longer, and that includes the OnePlus 8 Pro. This lasted a respectable but comparatively short 20h 36m in the same test.



Layout aside, the rear camera setup is largely unchanged from the 7T: there's a 48-megapixel main sensor, a 16-megapixel ultrawide lens and a 2-megapixel macro camera. Luckily, OnePlus has ironed out most of the issues that plagued last year's handset, as there are no weirdly distorted images, while wide-angle footage looks much better, with straight lines actually remaining straight.

It's still not the best set of cameras on a smartphone; the

iPhone 11's shots, in particular, look more naturalistic. That said, the OnePlus 8 can take more detailed photos, and portrait shots exhibit better-judged exposure levels.

The macro lens remains something of a gimmick, but the zoomed-in pictures look quite good, so long as you have plenty of light and you're at least 2.5cm away from the object.

As for video capabilities, you can shoot at up to 4K resolution at 60fps, although you have to dial down the setting to 30fps if you want stabilised footage or HDR capture. The footage is both detail-packed and very stable, even without the Super Stable mode switched on.

GLORIOUS EVOLUTION

The more recently launched OnePlus Nord might tempt some away from the 8; it also has a 90Hz display, just like this more expensive device. However, the Nord is really more of a high-quality mid-range phone, whereas the OnePlus 8 aims for, and largely attains, true flagship quality.

Ultimately, the worst thing you could say about the OnePlus 8 is that it's another OnePlus phone that makes relatively safe tweaks to the formula – a new processor here, a repositioned camera there – instead of taking any bigger steps forward.

While we were slightly disappointed with the OnePlus 7T, however, the OnePlus 8's lack of meaningful faults overshadows its lack of successful risks. Sometimes, refinement really can be the best strategy.



ONEPLUS Nord

**COMPUTER
SHOPPER**
RECOMMENDED



£379 • From www.oneplus.com

VERDICT

OnePlus's return to the mid-range market is packed with enticing hardware

THE NORD IS the most reasonably priced phone OnePlus has produced for years, costing a mere £379 for the basic variant with 8GB of RAM and 128GB of storage, or £469 for the model with 12GB and 256GB. It's also a knowing attempt on OnePlus's part to return to its roots: high-spec components in affordable handsets, something it's drifted away from in favour of more conventional flagship design and pricing.

The iPhone SE and Google Pixel 4a provide tough competition, but immediately the Nord feels like less of a cut-back device than either of those phones. Both the front and back are clad in Gorilla Glass 5, and all the same buttons and ports as you get on the OnePlus 8 are present here, too.

There's no 3.5mm headphone jack or wireless charging, but you do get an in-screen optical fingerprint reader. All in all, it's a pleasant enough phone to look at and hold, if not particularly ground-breaking.

Underneath that attractive skin is a Qualcomm Snapdragon 765 SoC, which is a step down from the OnePlus 8's Snapdragon 865 but allows for 5G connectivity, something the iPhone SE and Pixel 4a both lack.

There's also a 4,115mAh battery, which kept the Nord going for a commendable 20h 22m in our video loop test. That's several hours longer than the iPhone SE, and pips the Pixel 4a's 18h 43m as well. In real-world use, that should translate to a comfortable day's worth of moderate use, and you might even be able to stretch it to two full days if you're careful with battery-sapping apps.

HIT REFRESH

Given the price, you might think there would be some form of compromise on the display front, but the Nord ticks most of the right boxes here as well.

Measuring 6.44in across the diagonal, it employs AMOLED tech, which delivers effectively perfect contrast and vivid colours. It even has the same high 90Hz refresh rate as the OnePlus 8, so scrolling through your Instagram feed feels silky smooth.

Resolution-wise, the OnePlus Nord's 2,400x1,080 is as sharp as it needs to be at this size

(it's the same as the OnePlus 8), and it performed well in our tests. We saw maximum brightness peak at 304cd/m² with a full white screen and up to 771cd/m² in video playback with a small patch of white against a black background. That suggests HDR performance will be great, too, and so it proved, with bright, eye-searing specular highlights and a rich colour palette.

Colour accuracy is pretty good. In both the phone's Display P3 and sRGB colour modes, the OnePlus Nord returned colour accuracy average delta-E scores of below 1.5, which means you won't see the difference between the colours on the screen and those intended.

MULTI TOOLED

With six camera sensors arrayed across the front and rear of the phone, the Nord also isn't short on options for the photo-obsessed. At the front, you have an 8-megapixel ultrawide camera with a 105° field of view, and a high-resolution 32-megapixel camera that can capture 4K video at 60fps.

At the rear, the main camera sensor is a 48-megapixel Sony IMX586 module with a 1.2in sensor that captures 12-megapixel stills by default. It's joined by 8-megapixel ultrawide and 2-megapixel macro lenses, as well as a 5-megapixel depth sensor.

That main sensor is actually shared with the OnePlus 8, and it's similarly effective in a range of conditions. In good light, images are packed with detail and colours are pleasingly neutral. Indoors, in low light, OnePlus's image processing softens images a little, but photographs still come out perfectly usable, and the Nightscape mode works very nicely to lift out a little extra detail and colour in dim or dark scenes.



Quality-wise, the Nord's rear camera setup is on a par with that of the iPhone SE, but given that you get extra ultrawide and macro lenses here, there's more you can do with the Nord. However, be warned that macro shots can often produce blurry, grainy shots, in contrast to the main sensor.

Something similar could be said regarding the single-lens Pixel 4a, though Google's phone beats the numbers to produce better shots if

you're only using the main sensor. In other words, the Pixel 4a is better for quick snaps, while the Nord is more flexible and will better cater to those who want to experiment with their smartphone photography.

Video quality is decent, but this is where the OnePlus Nord lets the side down somewhat. You can only shoot 4K at 30fps, so if you want 60fps footage you'll have to drop to 1080p. The stabilisation is as impressive as ever, however, and static footage is packed with detail, whether you're capturing in 4K 30fps or 1080p 60fps.

What about general performance? The Snapdragon 765G chipset certainly makes the Nord a speedy phone, scoring 606 in the Geekbench 5 single-core test and 1,945 in the multicore test. These put it slightly ahead of the Pixel 4a, though both pale in comparison to the iPhone SE's enormous power.

The Nord feels exceedingly responsive, with that 90Hz display contributing to a highly fluid feel all around. Don't forget about 5G, either: as long as you can find its elusive signal, you'll be able to enjoy much faster upload and download speeds compared to the Nord's 4G-only rivals.

COMING IN SCANDI

As we said in the Google Pixel 4a review, there's not much between the two phones: the Nord lasts longer and is a little more powerful, but the 4a is no slouch and its camera is truly exceptional. Ultimately we think the 4a edges it by virtue of being slightly more user-friendly, especially with its clean Android installation, but there's no shame in plumping for the Nord instead.



OPPO A5

£150 • From www.amazon.co.uk

VERDICT

This a decent budget Android phone, but you can do better while staying under £200

OPPO AND XIAOMI are both Chinese firms making inroads to the UK smartphone scene, and sometimes comparisons between the two run remarkably deep: the Oppo A5 budget handset is almost identical to the Xiaomi Redmi Note 8T on specs.

However, since the A5 was released, the Redmi Note 8T has been replaced by the Redmi Note 9. So can the A5 still stack up against Xiamoi's updated handset?

IN BULK

The first thing you notice about the Oppo A5 is that it's pretty chunky. That's not just down to it having to make room for a 6.5in display, as at 195g, it's only a gram lighter than the enormous Samsung Galaxy Note 10+.

It's less of a problem when you get used to it, however, and as for looks, it's no better or worse looking than the Redmi Note 9, with the possible exception of having a central camera notch instead of a pinhole design like the Xiaomi's front camera. It's well equipped for extras, too, including a rear fingerprint reader and room for two SIMs, as well as a microSD card and a headphone jack. This jack is positioned on the bottom edge, however, which takes getting some used to.

The screen uses an IPS panel with a resolution of 1,600x720, which is very much on the low side for a 6.5in display. The Redmi Note 9's screen is also 6.5in, but much sharper at 2,340x1,080. The A5 still has a decent screen on its merits, covering 89.7% of the sRGB colour gamut and achieving a high contrast of 1,375:1, not to mention an impressively high peak brightness of 512cd/m². Unfortunately for Oppo, the Redmi Note 9 is generally more pleasant to use, thanks to its sharper resolution and more vivid 93% sRGB coverage.

Powering the Oppo A5 is a Qualcomm Snapdragon 665 chip and either 3GB or 4GB of RAM, depending on the version; our test unit had 3GB.

That's the same chip that's found within the Redmi Note 8T, so you'd expect the newer Redmi Note 9 to pull ahead of

both. However, while that phone has a completely different processor in the MediaTek Helio G85, the Oppo A5 actually keeps up with it very well: in Geekbench 5, the A5's single-core and multicore scores of 312 and 1,349 are either just behind or slightly ahead of the Redmi Note 9's respective 318 and 1,300.

This is also a respectable budget option for mobile gaming. In the GFXBench Manhattan gaming benchmark, the A5 beat its rivals with 33fps in the onscreen test, although since it's a 720p phone, it was always going to have an advantage compared to 1080p models. However, it's also fine to opt for lower frame rates in exchange for a crisper image.

CHANGE OVER

It doesn't seem to affect performance much, but Oppo's ColorOS Android skin is certainly one of the more aggressive we've used. While

it's hugely customisable in terms of how you navigate, it's enough of a departure from the stock Android UI that you'll need to spend some time learning it. Still, there's not much in terms of bundled apps, barring a few of Oppo's own: AquaMail, Game Space and Music. You're also given Facebook and Opera, which you may or may not want.

There is one unqualified advantage to the A5, however, and it's a big one. Like the Moto G8 Power Lite, this phone contains a gigantic 5,000mAh battery, and it helped the A5 last for a superb



19h 47m in our video rundown test: well beyond the 14h 53m of the Redmi Note 8T and the 15h 33m of the Redmi Note 9. It's only a matter of minutes behind the Moto G8 Power Lite, too.

The A5 also matches the Redmi Note 9 in offering a four-lens rear camera at a lower than usual price. The A5's main 12-megapixel sensor is supported by an 8-megapixel ultrawide sensor and two 2-megapixel lenses to "provide artistic portrait

effects" – depth-of-field effects, in other words, although it's not clear why the A5 needs two of these lenses when similar setups manage with one.

In any case, photographic performance is mixed, though not in the way you might expect. Cheap smartphone cameras usually handle outdoor shots respectably then struggle indoors, but the A5 has a much tougher time than its competitors when trying to capture outdoor detail. Colours also appear weirdly smoggy.

In conventionally more difficult low-light conditions, however, the A5's shots are less blurred and more detailed than those of its rivals. That alone gives it some appeal, although overall, we'd still say the Redmi Note 9's camera array is the better one. Besides its far better detail capture in favourable lighting, its own fourth lens actually adds bonus capability in the form of a macro sensor, as opposed to being just one half of a portrait mode shooter.

BEATEN TO IT

There's nothing inherently wrong with the Oppo A5, but all things considered, its only big win over the Redmi Note 9 is battery life; on every other metric, Xiaomi's phone is either as good or better, even if you could argue that it should have improved on core performance compared to the preceding Redmi Note 8T. Either way, its sharper screen and far superior quad-lens camera are too much for the A5 to handle.

SAMSUNG Galaxy A21s

**COMPUTER
SHOPPER**
RECOMMENDED



£150 • From www.carphonewarehouse.com

VERDICT

One of Samsung's cheapest smartphones, the Galaxy A21s is a generally worthy pick

PROBABLY THE ONLY smartphone maker that matches Motorola in pumping out new models is Samsung, the latest Galaxy handset arriving in the form of the relatively low-priced A21s.

In design terms, the Galaxy A21s is just as eye-catching as Samsung's other recent releases. Sure, it's made of plastic and it isn't sandwiched between protective layers of glass, but the Galaxy A21s is still a sleek-looking phone with minimal screen bezels and an unobtrusive hole-punch notch in the top-left corner.

The back of the phone is slightly curved, with the four cameras and LED flash arranged in a tidy rectangle in the top-left corner. A rear-mounted fingerprint sensor also sits in the centre, which can be used to unlock the phone and authorise contactless payments. The selfie camera also allows for face unlocks.

Our review model came in the black colour scheme, which looks rather nice with its iridescent oil-slick finish. In fact, all three colours – black, white and blue – have this rainbow-like effect, and they each look far better than other phones at this price.

The Galaxy A21s uses a USB Type-C port for charging and syncing, which is found on the bottom edge and is flanked by a 3.5mm audio jack and solitary speaker grill. A volume rocker and power button sit on the right edge, with a shared nano-SIM and microSD tray – which can take cards up to 512GB in size – on the left.

LOWER AIM

To save a bit on costs, the huge 6.5in display uses a PLS panel, which is Samsung's take on IPS, instead of the company's usually favoured AMOLED tech. Unfortunately, it's all a bit underwhelming: the 1,600x720 resolution isn't very high for such a vast screen, especially when the Xiaomi Redmi Note 9 reaches a full 1080p.

And, because it covers only 73% of the sRGB colour gamut, it's not as vibrant as Xiaomi's handset. Colour accuracy isn't up to scratch, either, with a measured delta-E of 4.23. Some colours, such as light green and dark red tones, looked particularly dull.

Still, the Galaxy A21s's display excels in other areas. The display reached a gleaming maximum brightness of 553cd/m² on the adaptive brightness setting, the contrast ratio is rather good at 1,267:1, and viewing angles aren't too shabby, either.

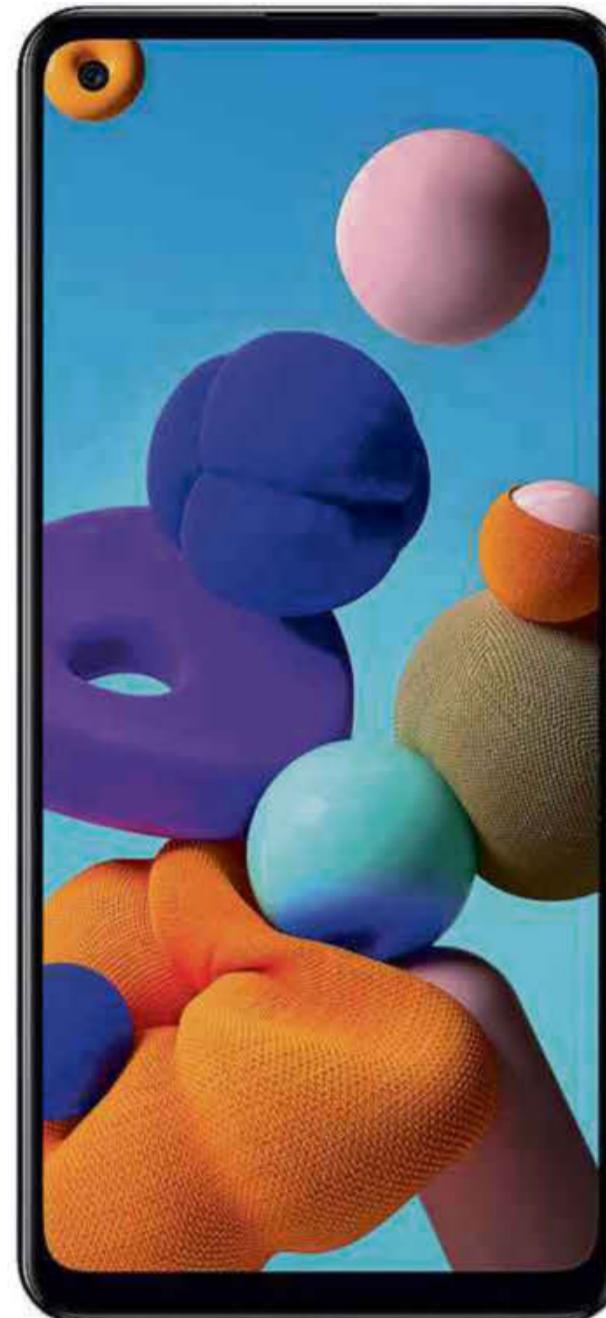
HOUR AFTER HOUR

The Galaxy A21s is powered by Samsung's homebrewed Exynos 980 chipset, with a maximum clock speed of 2GHz, backed by 3GB of RAM. For performance, this does the job in most cases, though you can go faster for similar cash. This was demonstrated by Geekbench 5, where the Galaxy A21s scored 183 in the single-core test and 1,096 in the multicore test. The Redmi Note 9 sits comfortably ahead on both counts.

It's a similar story when it comes to graphics processing. With 28fps in the GFXBench Manhattan onscreen test and just 15fps in the offscreen test, the Galaxy A21s doesn't even surpass the Oppo A5.

On battery life, however, the Galaxy A21s is a much better prospect. In our video loop test it lasted 22h 48m, even longer than the Motorola Moto G8 Power Lite. It also easily outlasted other lower-priced Android devices such as the Redmi Note 9 and Oppo A5, despite the latter's strong showing of nearly 20 hours.

The rear camera array comprises a main 48-megapixel lens, supported by an 8-megapixel wide-angle sensor, 2-megapixel macro lens and a 2-megapixel depth sensor. A 13-megapixel selfie camera sits on the front of the phone.



Aside from the slightly weaker aperture on the main camera, the Galaxy A21s's composition of cameras is identical to that of the Xiaomi Redmi Note 9. Due to lockdown restrictions we were unable to directly compare the two phones in the same scene, but the Galaxy A21s managed to take a pretty good picture, regardless.

It takes 12-megapixel images by default – the full 48-megapixel option is located in Pro mode – but in

good sunlight, both settings managed to produce wonderfully detail-rich images with plenty of vibrancy.

We were particularly impressed by the Galaxy A21s's Live Focus mode, which allows you to adjust the level of background blur either before or after you press the shutter button. The macro mode is also a lot of fun for extreme close-ups.

Then again, the Galaxy A21s's video features are slightly lacking. You can record in either Full HD or 720p on both the front and back cameras, but there's no option to bump up the frame rate to 60fps. You can change the aspect ratio from 16:9 to either 1:1 or full width, but the lack of any form of stabilisation makes for some pretty wobbly-looking footage.

LIGHT TOUCH

Video quibbles aside, the rest of the Galaxy A21s joins a happily growing list of quality cut-price Android devices. Samsung has carefully picked the right ingredients for budget greatness, and while you could find fault with comparative CPU performance, you're never going to get truly outstanding speeds from a sub-£200 handset anyway.

The Galaxy A21s is yet another fashionable choice for phone buyers that aren't keen to hand over flagship-sized sums for their latest upgrade. It will continue to compete against the bloated list of phones in Samsung's fleet, as well as from budget providers such as Xiaomi and Motorola, but the Galaxy A21s manages to exceed expectations.



SAMSUNG Galaxy S20

**COMPUTER
SHOPPER**
RECOMMENDED



£799 • From www.samsung.com

VERDICT

While not the best smartphone ever, the Galaxy S20 is the best-value of Samsung's latest lineup

THE GALAXY S20 is the smallest and cheapest of Samsung's 2020 flagship range, which says a lot about how the Galaxy S brand has progressed: with a 6.2in display it's not particularly small, and at £799 it's not very cheap.

Nevertheless, its relatively manageable dimensions allow it to sit very comfortably in the hand. It definitely looks and feels like a premium product, although there are some questionable changes that mean it doesn't look quite as good as the Galaxy S10: the rear camera sensors are squashed into an oblong in the top-left corner, and the front pinhole camera now sits in the middle, where it seems more in the way than when it was in the corner of the display.

SCREEN QUEEN

Conversely, the display itself is gorgeous. Its size of 6.2in is more than big enough and it has a native resolution of 3,200x1,400, but can be dipped down to FHD+ or HD+ in the display settings if you want to squeeze out a bit more battery life.

The main new addition is, of course, that 120Hz refresh rate, a doubling over the usual 60Hz. There are caveats to using it: it only works at FHD+ or below, and most games on the Play Store are capped at 60fps, so you won't always be getting a benefit. However, it adds a fluidity and responsiveness to scrolling that's tangibly more satisfying than it would be on a 60Hz display.

We found the Natural profile to be the most colour-accurate of the three available, although it suffered from noticeably oversaturated red tones and undersaturated pink and purple tones, so it isn't perfect. However, you can rest assured that the screen has a pin-sharp contrast ratio of Infinity:1, and it's also capable of reaching a searing maximum brightness of 748cd/m² and sRGB coverage of 94%.

The Exynos 990 processor is just as potent. This is a 7nm, octa-core chipset with a maximum clock speed of 2.73GHz, and is similar in architecture to last year's Exynos 9820, and comes with 6GB of RAM in the Galaxy S20.

As you might expect – or hope, given the price – the Galaxy S20 stormed through our usual suite of performance benchmarks, scoring 923 in Geekbench 4's single-core test and 2,779 in the multicore test. It doesn't quite match the superior levels of performance we've seen from the iPhone 11's A13 Bionic chip, but it's certainly fast enough that you shouldn't have to worry about a sluggish experience, no matter which application you decide to throw at it. As far as Android handsets go, it's as good as it gets.

What's more, if you can find a game that supports the full 120Hz refresh rate, you're in for a treat. The GFXBench Manhattan benchmark doesn't, hence its onscreen test result sticking at 58fps, but its offscreen test result of 122fps confirms you'll be able to run compatible games well above 60fps.

HOT RATES

The Galaxy S20 also gets things right when it comes to battery life, provided you make sure to choose the right settings. Fully draining the 4,000mAh battery from full in our video rundown test, the Galaxy S20 lasted 18h 28m before needing to recharge, which is rather good considering this was performed at the phone's default WQHD+ screen resolution, albeit only at 60Hz.

Oddly, if you stick with the same refresh rate but drop the resolution down to FHD+, you won't notice much of a change. Where you will find a drastic difference, however, is if you decide to switch on the 120Hz setting, which negatively affected the S20's battery life by five hours in the same test.



As for the camera setup, the Galaxy S20 lacks the fourth depth-sensing sensor found on the S20 Plus and S20 Ultra, but the remaining lenses – a 12-megapixel main lens, a 12-megapixel ultrawide sensor and a 64-megapixel telephoto zoom sensor – more than suffice.

However, while the Galaxy S20's suite of cameras excel in a few areas, they don't quite match the sheer excellence of the iPhone 11's image and video captures. It does slightly better at suppressing noise in outdoor shots, but our test photos also looked overexposed and strangely candy-coloured, especially next to the iPhone 11's more naturalistic shots.

Apple's handset also has the advantage in low light. Shots take with the Galaxy S20 look drab when placed side by side with the positively vibrant images from the iPhone 11.

Where Samsung really comes into its own, however, is in the S20's zooming capabilities. It may not have the 100x zoom of the S20 Ultra, but it's still capable of using a combination of optical and AI-digital techniques to magnify up to 30x. The resulting shots aren't anything you'd want to get printed on a cushion, but the technology is highly impressive.

WOBBLE MAKER

If only video recording was the same. The Samsung Galaxy S20 has the ability to record in 8K resolution – a first for smartphones – although this isn't stabilised in any way, and you need an 8K TV to view the footage in its original resolution anyway. If you want to stabilise your footage, you have to dip the resolution down to 4K at 30fps, which is a shame because the iPhone 11 can record stabilised 4K footage at 60fps.

Still, even if not all of the Galaxy S20's innovations work out well, its breadth of features ensures its eventual success. The iPhone 11 is better overall, if you're not tribal about the OS, but all things considered the Galaxy S20 gives even the Galaxy S20 Ultra – which is £500 more – a run for its money.



SONY Xperia 5



£700 • From www.amazon.co.uk

VERDICT

The Xperia 5 reproduces the Xperia 1's features for a lower price, and for the most part it succeeds

SONY'S 'COMPACT' SMARTPHONES used to offer flagship-grade features, more palatable prices and dinkier sizes. However, following the launch of the Xperia 1 (*Shopper* 380), it looked like Sony had ditched these smaller handsets in favour of pricier big-screened behemoths.

The Xperia 5, thankfully, partially resembles the Compact models of old; sure, it isn't much smaller than Sony's top-shelf handsets, but the Xperia 5 is cheaper while offering similar design functionality.

SAME AGAIN PLEASE

Very similar design, in fact. Physically, the Xperia 5 heavily cribbs from the Xperia 1: the screen (almost) fills the entirety of the front of the phone, it's water- and dust-resistant to the IP68 standard, it's sandwiched between protective layers of Gorilla Glass 6, and can be picked up in a variety of bold colours.

The 6.1in screen, too, is another HDR OLED display that benefits from Sony's Bravia X1 enhancement tech; this gives a colour and brightness boost to SDR content. The resolution doesn't match the Xperia 1's 4K, but 2,520x1,080 is still nice and sharp.

What's more, in its standard profile it can cover 99.1% of the sRGB colour gamut, not to mention 95.4% of the wider DCI-P3 gamut, so it's wonderfully vivid. Contrast is a perfect Infinity:1 too, although at 345cd/m² peak brightness could be better.

That's measured using a non-HDR white, but even when HDR content is playing, brightness still seems lower than on many other HDR-enabled smartphones.

There's plenty of power under the bonnet; at least as much as current-generation hardware permits. The Xperia 5 is fitted with Qualcomm's Snapdragon 855 mobile chipset, which is clocked at 2.84GHz and works with 6GB of RAM and 128GB of expandable storage. That's exactly the same setup as the Xperia 1.

As a result, performance is identical as well. The Xperia 5's Geekbench 4 scores – 3,450 in the single-core test and 11,490 in the multicore test – don't deviate from the Xperia 1's

in any meaningful way, and the Adreno 640 is just as capable of playing high-fidelity games. With 59fps in the GFXBench Manhattan onscreen test and 101fps in the offscreen test, nothing on the Play Store will give this phone trouble.

Usually, the biggest cause for concern with such a large screen is the phone's stamina. Thankfully, in dropping the resolution down to FHD+ and slightly reducing the screen size, Sony has managed to squeeze out an extra 38% of use on a single charge, according to our in-house battery rundown test, finally reaching an admirable 17h 55m before needing to recharge.

ALPHA PERSONALITY

Another shared feature with the Xperia 1 is the triple-lens camera array, which is also arranged vertically in the centre of the back panel. This incorporates a collection of three 12-megapixel camera sensors: one is a regular lens with an f/1.6 aperture, the one below it is a 2x telephoto zoom sensor, and the final one is a wide-angle sensor.

Triple-camera arrangements aren't new, of course, but what's particularly special about the Xperia 5 is the co-development with Sony's Alpha camera team. The rather effective eye-autofocus returns, allowing you to keep your subject in focus without too much effort on your part, and there's also the 10fps burst shooting mode, as well as more advanced noise reduction.

Sony's CineAlta video editing app also returns, which enables you to edit

your footage on the fly and apply cinema-grade colour profiles to your videos. Like the Xperia 1, you can record in 4K, but you're restricted to 30fps and 24fps frame rates.

It's obvious that the Xperia 5 is practically bloated with features, but how does the camera actually perform? The short answer is very well – there are plenty of fine details in images captured in bright environments, and in some instances, it significantly outperforms the OnePlus 7T Pro's

somewhat soft-looking images.

Colours don't look muted, even in gloomy weather, and aren't oversaturated and candy-coloured, either. We didn't spot much evidence of visual noise, even in low-light environments, with the Xperia 5's cameras doing a mighty fine job at brightening up the scene as the light dims.

In fact, the only issue with the camera is that object definition isn't particularly crisp. Some of the building outlines in our test shots didn't look particularly well defined, and we spotted a few issues with the video stabilisation, too. As you slowly pan across the scene, the Xperia 5's footage looked a bit too juddery, which is unfortunate, as the image quality is actually very good.

COMFORT ZONE

With an (almost) identical feature list to its bigger brother, it's certainly a smart move on Sony's part to bring the price of the Xperia 5 down a peg or two. You might be seeing double, but considering you can get a similar sort of experience as the Xperia 1 for just a little bit less, then the Xperia 5 is a good choice for anyone looking to upgrade.

At the same time, the Xperia 5 is an inherently 'safe' product, and for the money it's possible to buy something more ambitious. The iPhone 11, in particular, does a tremendous job at bringing a superb camera to the masses, and its HDR playback capabilities simply can't be matched either.



SONY Xperia L4



£170 • From www.amazon.co.uk

VERDICT

Another competent, affordable Xperia – but other budget phones do it better

IF YOU'VE BEEN following Sony's releases, then the budget-friendly Xperia L4 will be a breath of fresh air – and especially so if you can't stump up the funds for the £1,100 Xperia 1 II. While it might not have all the niceties of a flagship phone, Sony's newest budget blower is hardly light on features. The burning question, however, is whether it does enough to stand out from the rest of the sub-£200 crowd.

Despite the increase in screen size from the Xperia L3, Sony hasn't changed much when it comes to the Xperia L4's design. We were sent the rather drab black model for review (the blue variant is slightly more eye-catching), and it's quite simple, design-wise, with a robust plastic chassis and curved edges. The front of the phone is relatively bezel-free, with only a small chin underneath the display and a circular drop-notch at the top, which includes the 8-megapixel selfie snapper.

The triple camera array is laid out neatly in a vertical traffic light formation in the top-left corner on the back of the phone, and the side-mounted fingerprint sensor also returns, along with the 3.5mm headphone socket and USB Type-C charging port. As before, the Xperia L4 isn't IP-rated for dust or water protection, but it does have an NFC chip for contactless payments, which often fails to make the cut on cheap phones.

GREAT LENGTHS

The most important new addition is the 21:9 aspect ratio screen, which marks the first time such a long, tall display has made an appearance on such a low-priced handset.

As we've previously seen with Sony's flagship devices, Sony says this is ideal for multitasking – running two apps side by side – and viewing 21:9 aspect Netflix films without pesky black bars above and below the screen. As for the specifics, the IPS display measures 6.2in across the diagonal, with a resolution of 1,680x720.

Unlike the Xperia 1 II and Xperia 10 II, the Xperia L4 doesn't have multiple display profiles to choose from, and sadly what you do get isn't particularly noteworthy. Covering 80.8% of the sRGB colour

gamut, with a total volume of 89.2% and an average delta-E score of 3.16, the Xperia L4's display isn't very colour-accurate, nor is it particularly vibrant.

Maximum brightness was relatively weak, too, with a measured peak luminance of just 355cd/m². That's not too bad for gloomier days, but once we're allowed to travel to warmer climates again you'll likely be squinting at your screen while you're out and about. One saving grace, however, is that a measured contrast ratio of 1,637:1 is surprisingly high for a phone that costs this little.

As for the internals, here is where you start to see proper evidence of Sony's dramatic cost-cutting practices. The Xperia L4 is powered by a reasonably weak MediaTek MT6762 Helio P22 processor, which is exactly the same chipset as last year's Xperia L3. For the uninitiated, this is an octa-core SoC clocked at 2GHz, which isn't particularly noteworthy, although it just about did the job in our tests: 148 in Geekbench 5's single-core test and 869 in the multicore test.

That puts it close behind the Samsung Galaxy A21s, though considering the Xperia L4 is slightly more expensive, perhaps it should be the other way around. Moreover, the Xiaomi Redmi Note 9 is about 50% faster on average.

INTENSE THIRST

Just like last year's model, however, the Xperia L4 doesn't feel sluggish in operation, and it handles CPU-intensive applications such as Google Maps without juddering to a halt.

The similarities with the Xperia L3 don't stop there,

either, as the Xperia L4 also has 3GB of RAM, but Sony has doubled the internal storage to 64GB, which can also be expanded via microSD. The Xperia L4 also has a larger battery, at 3,580mAh, which is a sensible upgrade considering the increase in screen size.

Lasting 15h 39m in our battery rundown test, the Xperia L4 does end up with shorter longevity than the L3, though not by much considering its much more demanding screen. Its bigger problem is, again, the

non-Sony competition: it's no match for the Galaxy A21s or Motorola Moto G8 Power Lite if stamina is what you want.

The Xperia L4 has also seen a slight upgrade in the camera department. It now comes with a total of three rear cameras: there's a 13-megapixel (f/2.0) main camera unit, 2-megapixel (f/2.4) depth sensor and a new 5-megapixel (f/2.2) wide-angle camera for squeezing more stuff in the frame.

As long as you shoot in well-lit environments, there's plenty of detail, and visual noise is mostly kept to a minimum. The Xperia L4's night mode also does a good job of boosting the brightness of an image, though the detail is reduced and textures merged together.

OH, SHOOT

Likewise, the portrait mode didn't add as much background blur as we would have liked, and the camera software is a bit fiddly. The onscreen exposure and colour temperature sliders aren't labelled either, which isn't ideal.

You won't find much in the way of video settings, either. The recording resolution is maxed out at Full HD, the frame rate is locked at 30fps, and there's no image stabilisation of any sort, so the footage looks a bit choppy at times.

The Xperia L4 is another decent effort from Sony. It's not as praiseworthy as last year's Xperia L3, but it's still a dependable phone for the price.



XIAOMI Redmi Note 9

**COMPUTER
SHOPPER**
BEST BUY



£150 • From www.amazon.co.uk

VERDICT

Not only is this an accomplished follow-up to a great phone, it's easily among the best in its class

FOLLOWING ON FROM the Redmi Note 8T, the Redmi Note 9 starts off on surprisingly tenuous footing. The greyish-blue colour of its plastic chassis is rather dull, and the way the fingerprint reader and quad-lens camera are all rammed into a single box on the rear makes for a less appealing design than what came before.

The camera module isn't flush with the back, either, so it doesn't rest flush against a flat surface when placed face up. The body itself feels cheap to the touch, and it's quick to collect greasy fingerprints. That's less of an issue on the front, where the display is protected by a smooth layer of Gorilla Glass 5.

LOST WEIGHT

Fortunately, the Redmi Note 9 is far from a step backward. The front camera moving from the middle of the screen to the corner makes it less intrusive, and although the 6.5in screen is 0.2in bigger than the Note 8T's, the whole thing is a gram lighter at 199g.

It's good for controls and features, too. There's a combined dual-SIM and microSD tray on the left edge, while on the right side you'll find the power button and volume rocker. The bottom edge houses a 3.5mm audio jack, a lone speaker and a USB Type-C charging port. Wireless charging isn't on the cards, though NFC very much is.

As we've mentioned a few times in other reviews, the Redmi Note 9 doesn't settle for 720p like many cheap handsets. Its IPS display runs at 2,340x1,080, enough for decent sharpness even on such a massive panel.

There are three display modes, or 'colour schemes', on the Redmi Note 9: Auto, Saturated and Standard. We tested all three and found that the Auto and Saturated modes offer the best experience, both covering roughly 93% of the sRGB colour gamut.

Overall colour accuracy is actually slightly better in Saturated mode compared to Auto mode; we recorded average delta-E results of 3.04 and 3.74 respectively, meaning the Saturated setting comes closer to delivering natural colours.

To our eyes, however, the Auto setting – which adjusts colours 'based on the current lighting' – is easily the most appealing in terms of colour reproduction. It's the brightest mode too, producing a maximum luminance of just over 359cd/m², and it produces a high contrast ratio of 1,132:1.

The Note 8T was powered by a Qualcomm Snapdragon 655, but Xiaomi has changed tack entirely for its replacement by including the octa-core MediaTek Helio G85 CPU. This makes it only barely more powerful, judging by its Geekbench 5 scores of 318 and 1,300, but then that still stacks up well against similarly priced phones such as the Motorola Moto G8 Power Lite, Samsung Galaxy A21s and Sony Xperia L4. Its 4GB of RAM seems perfectly adequate for everyday multitasking.

TIME LIMIT

The gaming capabilities of the Redmi Note 9 are certainly up to scratch, too. For some

reason we couldn't successfully run the usual GFXBench software, but we could play demanding 3D titles from the app store – such as Call of Duty: Mobile and PUBG Mobile – with workable frame rates.

The ample size of the display also comes in handy for enjoying games and films, although the cost comes in battery life. The Redmi Note 9 isn't troublesomely short-lived, but next to the Moto G8 Power Lite and Galaxy A21s, its benchmark test result of 15h 44m looks like



a rare blemish. Then again, it lasts a little longer than the Note 8T despite its larger screen, so some progress has been made.

This camera setup may have moved position since the Redmi 8T, but its specifications remain much the same: there's a 48-megapixel main sensor, an 8-megapixel wide-angle lens, a 2-megapixel depth sensor and a 2-megapixel macro lens.

The level of precision achieved by the 48-megapixel module is remarkable, just as it was on the Note 8T. Vegetation and brickwork come out clearly defined, even when shot from a considerable distance, and the colours look vibrant and realistic.

Xiaomi's camera software is straightforward and shoots in HDR at 12 megapixels by default. You need to switch shooting modes if you would rather capture 48-megapixel images. The Pro shooting mode is great fun to play around with, and it's useful too, allowing you to manually tweak the focus, ISO and shutter speed to your liking.

The macro lens also impresses. It probably won't see as much use as the other lenses, but it's capable of capturing plenty of detail on close-up objects without much fuzziness.

Video shoots in 1080p at 30fps on both the 13-megapixel selfie camera and main quad camera. There are no complaints here; quality is great for a budget phone and, on the rear snapper, it's helped along nicely with some effective image stabilisation.

WORKS FOR MI

The Xiaomi Redmi Note 9 is incredibly good value. It has a large, good-quality FHD display, a fantastic quadruple camera setup, and it delivers performance that's more than a match for its many budget competitors. Improving on the Note 8T was going to be tough, and Xiaomi hasn't always made perfect calls (in the design, for instance), but this ends up as a worthy successor that should definitely be considered alongside the Galaxy A21s.

SMARTPHONES



Award	BEST BUY	RECOMMENDED		
Manufacturer	APPLE	APPLE	CUBOT	FAIRPHONE
Model	iPhone 11	iPhone SE (2020)	Kingkong Mini	3
Rating	★★★★★	★★★★☆	★★★★★	★★★★☆
HARDWARE				
Processor	Hexa-core 2.65GHz Apple A13 Bionic	Hexa-core 2.65GHz Apple A13 Bionic	Quad-core 2GHz MediaTek Helio A22	Octa-core 1.8GHz Qualcomm Snapdragon 632
RAM	4GB	3GB	3GB	4GB
Screen size	6.1in	4.7in	4in	5.65in
Screen resolution	1,792x828	1,334x750	1,080x540	2,160x1,080
Screen type	IPS	IPS	IPS	IPS
Front camera	12 megapixels	7 megapixels	8 megapixels	8 megapixels
Rear camera(s)	12 megapixels, 12 megapixels	12 megapixels	13 megapixels	12 megapixels
Flash	Yes	Yes	Yes	Yes
GPS	Yes	Yes	Yes	Yes
Compass	Yes	Yes	Yes	Yes
Storage	64GB	64GB	32GB	64GB
MicroSD card slot	No	No	Yes	Yes
Wi-Fi	802.11ax	802.11ax	802.11n	802.11ac
Bluetooth	5.0	5.0	4.2	5.0
NFC	Yes	Yes	No	Yes
Wireless data	4G	4G	4G	4G
Dimensions	151x76x8.3mm	138x67x7.3mm	119x58x12mm	158x72x9.9mm
Weight	194g	138g	100g	189g
FEATURES				
Operating system	iOS 13	iOS 13	Android 9.0	Android 9.0
Fingerprint sensor	No	Yes	No	Yes
Battery size	3,110mAh	1,821mAh	2,000mAh	3,000mAh
BUYING INFORMATION				
Price	£729	£419	£100	£400
Warranty	One year RTB	One year RTB	One year RTB	Two years RTB
Supplier	www.apple.com/uk	www.apple.com/uk	www.amazon.co.uk	shop.fairphone.com
Details	www.apple.com/uk	www.apple.com/uk	www.cubot.net	www.fairphone.com
Part code	iPhone 11	iPhone SE (2020)	Kingkong Mini	Fairphone 3

Prices correct at time of going to press



BEST BUY				
GOOGLE	HONOR	HONOR	HUAWEI	MOTOROLA
Pixel 4a	9X	9X Pro	P40	Moto E6 Plus
★★★★★	★★★★☆	★★★★☆	★★★★★	★★★★★
Octa-core 1.8GHz Qualcomm Snapdragon 730G	Octa-core 2.2GHz HiSilicon Kirin 710F	Octa-core 2.27GHz HiSilicon Kirin 810	Octa-core 2.86GHz HiSilicon Kirin 990	Octa-core 2GHz MediaTek Helio P22
6GB	4GB	8GB	6GB	2GB
5.8in	6.6in	6.6in	6.1in	6.1in
2,240x1,080	2,280x1,080	2,340x1,080	2,340x1,080	1,560x720
AMOLED	IPS	IPS	OLED	IPS
8 megapixels	16 megapixels	16 megapixels	32 megapixels	8 megapixels
12.2 megapixels	48 megapixels, 2 megapixels	48 megapixels, 8 megapixels, 2 megapixels	50 megapixels, 8 megapixels, 16 megapixels	13 megapixels, 2 megapixels
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	No
128GB	128GB	256GB	128GB	32GB
No	Yes	Yes	No (has Huawei Nano Memory card slot instead)	Yes
802.11ac	802.11ac	802.11ac	802.11ax	802.11n
5.1	4.2	4.2	5.1	4.2
Yes	No	Yes	Yes	No
4G	4G	4G	5G	4G
144x68x8.2mm	164x77x8.8mm	164x77x8.8mm	149x71x8.5mm	156x73x8.6mm
143g	197g	202g	175g	150g
Android 10	Android 9.0	Android 9.0	Android 10	Android 9.0
Yes	Yes	Yes	Yes	Yes
3,140mAh	4,000mAh	4,000mAh	3,800mAh	3,000mAh
£349	£200	£250	£700	£80
Two years RTB	One year RTB	One year RTB	One year RTB	One year RTB
store.google.com	www.johnlewis.com	www.amazon.co.uk	www.argos.co.uk	www.argos.co.uk
store.google.com	www.hihonor.com	www.hihonor.com	consumer.huawei.com	www.motorola.co.uk
Pixel 4a	51094TTX	HLK-AL10	ANA-N29	PAGA0000GB

SMARTPHONES



Award		BEST BUY	RECOMMENDED		RECOMMENDED
Manufacturer	MOTOROLA	ONEPLUS	ONEPLUS	OPPO	SAMSUNG
Model	Moto G8 Power Lite	8	Nord	A5	Galaxy A21s
Rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
HARDWARE					
Processor	Octa-core 2.3GHz MediaTek MT6765 Helio P35	Octa-core 2.84GHz Qualcomm Snapdragon 865	Octa-core 2.4GHz Qualcomm Snapdragon 765G	Octa-core 2GHz Qualcomm Snapdragon 665	Octa-core 2GHz Samsung Exynos 850
RAM	4GB	8GB	6GB	3GB	3GB
Screen size	6.5in	6.55in	6.44in	6.5in	6.5in
Screen resolution	1,600x720	2,400x1,080	2,400x1,080	1,600x720	1,600x720
Screen type	IPS	AMOLED	AMOLED	IPS	PLS
Front camera	8 megapixels	16 megapixels	32 megapixels	8 megapixels	13 megapixels
Rear camera(s)	16 megapixels, 2 megapixels, 2 megapixels	48 megapixels, 16 megapixels, 2 megapixels	48 megapixels, 8 megapixels, 5 megapixels, 2 megapixels	12 megapixels, 8 megapixels, 2 megapixels, 2 megapixels	48 megapixels, 8 megapixels, 2 megapixels, 2 megapixels
Flash	Yes	Yes	Yes	Yes	Yes
GPS	Yes	Yes	Yes	Yes	Yes
Compass	No	Yes	Yes	Yes	Yes
Storage	64GB	128GB	64GB	64GB	64GB
MicroSD card slot	Yes	No	No	Yes	Yes
Wi-Fi	802.11n	802.11ax	802.11ac	802.11ac	802.11ac
Bluetooth	4.2	5.1	5.1	5.0	5.0
NFC	No	Yes	Yes	No	Yes
Wireless data	4G	5G	5G	4G	4G
Dimensions	165x76x9.2mm	160x73x8mm	158x73x8.2mm	164x76x9.1mm	164x75x8.9mm
Weight	200g	180g	184g	195g	192g
FEATURES					
Operating system	Android 9.0	Android 10	Android 10	Android 9.0	Android 10
Fingerprint sensor	Yes	Yes	Yes	Yes	Yes
Battery size	5,000mAh	4,300mAh	4,115mAh	5,000mAh	5,000mAh
BUYING INFORMATION					
Price	£150	£599	£379	£150	£150
Warranty	One year RTB	One year RTB	One year RTB	Two years RTB	One year RTB
Supplier	www.amazon.co.uk	www.amazon.co.uk	www.oneplus.com	www.amazon.co.uk	www.carphonewarehouse.com
Details	www.motorola.co.uk	www.oneplus.com	www.oneplus.com	www.oppo-uk.com	www.samsung.com
Part code	PAJC0004GB	IN2013	AC2003	CPH1931	SM-A217F

Prices correct at time of going to press



RECOMMENDED

SAMSUNG

Galaxy S20

★★★★★

SONY

Xperia 5

★★★★★

SONY

Xperia L4

★★★★★

BEST BUY

XIAOMI

Redmi Note 9

★★★★★

Octa-core 2.73GHz
Samsung Exynos 990Octa-core 2.84GHz
Qualcomm
Snapdragon 855Octa-core 2GHz
MediaTek Helio P22Octa-core MediaTek
Helio G85

8GB

6GB

3GB

3GB

6.2in

6.1in

6.2in

6.5in

3,200x1,440

2,520x1,080

1,680x720

2,340x1,080

AMOLED

OLED

IPS

IPS

10 megapixels

8 megapixels

8 megapixels

13 megapixels

12 megapixels,
64 megapixels,
12 megapixels13 megapixels,
13 megapixels,
13 megapixels15 megapixels,
3 megapixels,
2 megapixels48 megapixels,
8 megapixels,
5 megapixels,
2 megapixels

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

128GB

64GB

64GB

Yes

Yes

Yes

Yes

802.11ax

802.11ac

802.11n

802.11ac

5.0

5.0

5.0

5.0

Yes

Yes

Yes

Yes

4G

4G

4G

4G

152x69x7.9mm

156x73x8.6mm

159x71x8.7mm

162x77x8.9mm

163g

164g

178g

199g

Android 10

Android 9.0

Android 9.0

Android 10

Yes

Yes

Yes

Yes

4,000mAh

3,140mAh

3,580mAh

5,020mAh

£799

£700

£170

£150

One year RTB

One year RTB

One year RTB

One year RTB

www.samsung.com

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www.samsung.com

www.sonymobile.com

www.sonymobile.com

www.mi.com

SM-G980FLBDEUA

1320-4897

XQAD51L.UKCX

Redmi Note 9

VERDICT

YOU'D BE FORGIVEN for thinking we're living in some kind of golden age of smartphones. Even among the 18 we've looked at here, there are multiple standouts for almost every sized budget.

Starting from the bottom, the Motorola Moto E6 Plus is a huge amount of phone for well under £100. It's only really missing NFC functionality; everything else, from display quality to performance and even camera quality, matches or exceeds expectations.

Spend a little more, however, and you could have the Samsung Galaxy A21s or Xiaomi Redmi Note 9. Both are very well priced yet impressively specced devices, and each has its own particular strengths, such as the Galaxy A21s's long battery life or the Redmi Note 9's Full HD display. Xiaomi's phone is better overall, but neither will disappoint.

The mid-range is dominated by the triumvirate of the Apple iPhone SE, Google Pixel 4a and OnePlus Nord. While all of these are fine smartphones, and the Nord delivers 5G connectivity for relatively little cash, the iPhone SE does similar for flagship performance on iOS, and the Pixel 4a has one of the best cameras on any handheld, regardless of price or OS.

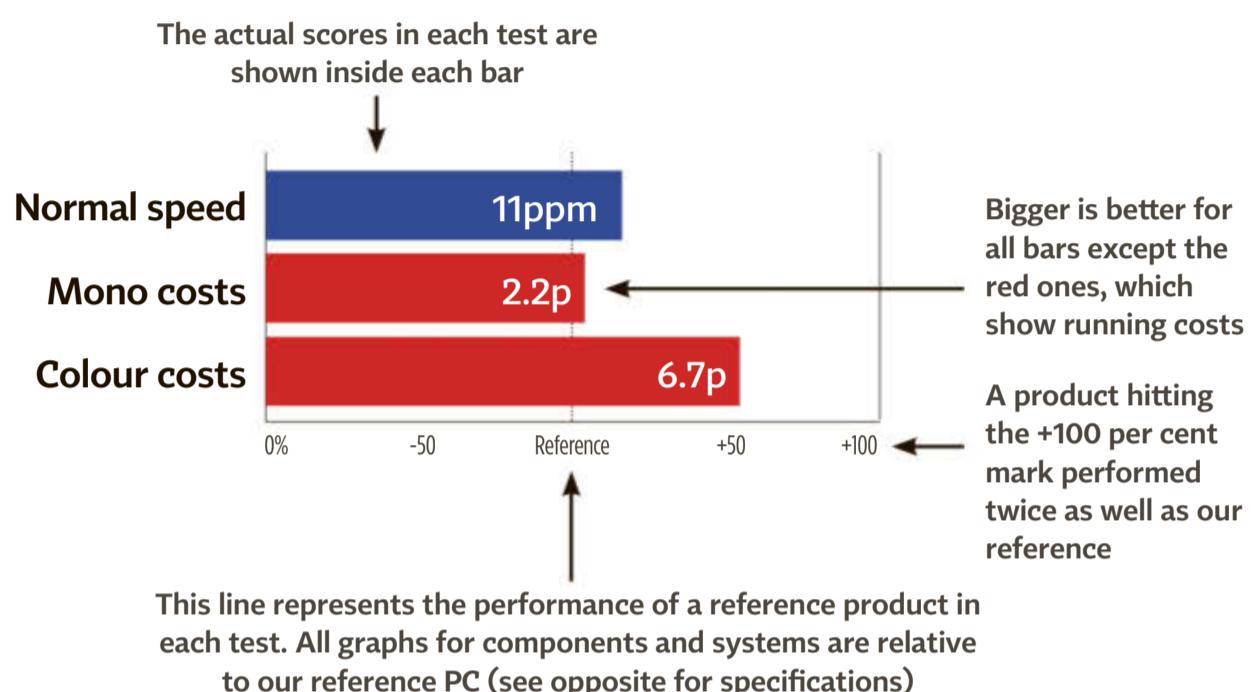
The OnePlus 8 is also great value. In most ways it's a proper flagship, only without the now-typical £700-plus price. That said, if you truly want the best, it can be worth splashing out, especially if it's on the Samsung Galaxy S20 or iPhone 11. The former is a real luxury item with top-notch Android performance and incredible camera zoom, and the latter is even faster.

How we test

Find out how well products perform with the help of Computer Shopper's comprehensive tests

COMPUTER SHOPPER'S REVIEWS use some of the most exhaustive testing procedures you'll find in any PC magazine. Every product is subjected to qualitative and quantitative tests that show how it performs in practical use. Graphs for performance, battery-life scores and costs are used in the Reviews section, as shown on the right. Look in the 'Summary of tests' table (below) for details of each test we run.

For PCs and laptops, we evaluate performance using our own custom benchmarking suite. See opposite for a description of our benchmarking software and game tests.



SUMMARY OF TESTS

PC SYSTEMS & GAMING LAPTOPS		DIGITAL CAMERAS		PROCESSORS	
Windows overall	Average speed across numerous demanding tasks	Battery life	Number of shots from full charge	Windows overall	Average speed across numerous demanding tasks
Multitasking	Speed when running simultaneous applications	CAMCORDERS		Multitasking	Speed when running simultaneous applications
Dirt Showdown (1080p)	Frames per second at 1,920x1,080, 4xAA, Ultra detail	Battery life	Run time in minutes for recording	Dirt Showdown (720p)	Frames per second at 1,280x720, 4xAA, High detail
Metro: Last Light Redux (1080p)	Frames per second at 1,920x1,080, SSAA, Very High detail	ROUTERS		MOTHERBOARDS	
LAPTOPS		Laptop 2.4GHz 5m	Mbit/s at 5m with 802.11ac laptop on 2.4GHz band	Windows overall	Average speed across numerous demanding tasks
Windows overall	Average speed across numerous demanding tasks	Laptop 2.4GHz 1 floor	Mbit/s 1 floor up with 802.11ac laptop on 2.4GHz band	Multitasking	Speed when running simultaneous applications
Multitasking	Processor-intensive multitasking test	Laptop 2.4GHz 2 floors	Mbit/s 2 floors up with 802.11ac laptop on 2.4GHz band	Dirt Showdown (1080p)	Frames per second at 1,920x1,080, 4xAA, Ultra detail
Dirt Showdown (720p)	Frames per second at 1,280x720, 4xAA, High detail	Laptop 5GHz 5m	Mbit/s at 5m with 802.11ac laptop on 5GHz band	Dirt Showdown (720p)	Frames per second at 1,280x720, 4xAA, High detail
Battery life	Run time in minutes for continuous video playback	Laptop 5GHz 1 floor	Mbit/s 1 floor up with 802.11ac laptop on 5GHz band	GRAPHICS CARDS	
SMARTPHONES/TABLETS		Laptop 5GHz 2 floors	Mbit/s 2 floors up with 802.11ac laptop on 5GHz band	Dirt Showdown (1080p)	Frames per second at 1,920x1,080, 4x MSAA, Ultra detail
Battery life	Run time in minutes for continuous video playback	NETWORK-ATTACHED STORAGE		Tomb Raider	Frames per second at 1,920x1,080, SSAA, Ultra detail
PRINTERS AND MFPs		Large files	Average MB/s for read/write of 100MB large files	Metro: Last Light Redux	Frames per second at 1,920x1,080, SSAA, Very High detail
Mono text speed	Pages per minute for correspondence-quality text	Small files	Average MB/s for read/write of 100MB small files		
Mixed colour speed	Pages per minute for presentable text and graphics	Huge files	Average MB/s for read/write of a single 2.5GB file		
Mono page cost	Running costs expressed as pence per page	Large files	Average MB/s for read/write of 2.5GB of large files		
Colour page cost	Running costs expressed as pence per page	Small files	Average MB/s for read/write of 2.5GB of small files		

Product Reviews

Your guide to all the products reviewed in this month's Computer Shopper

140
reviews

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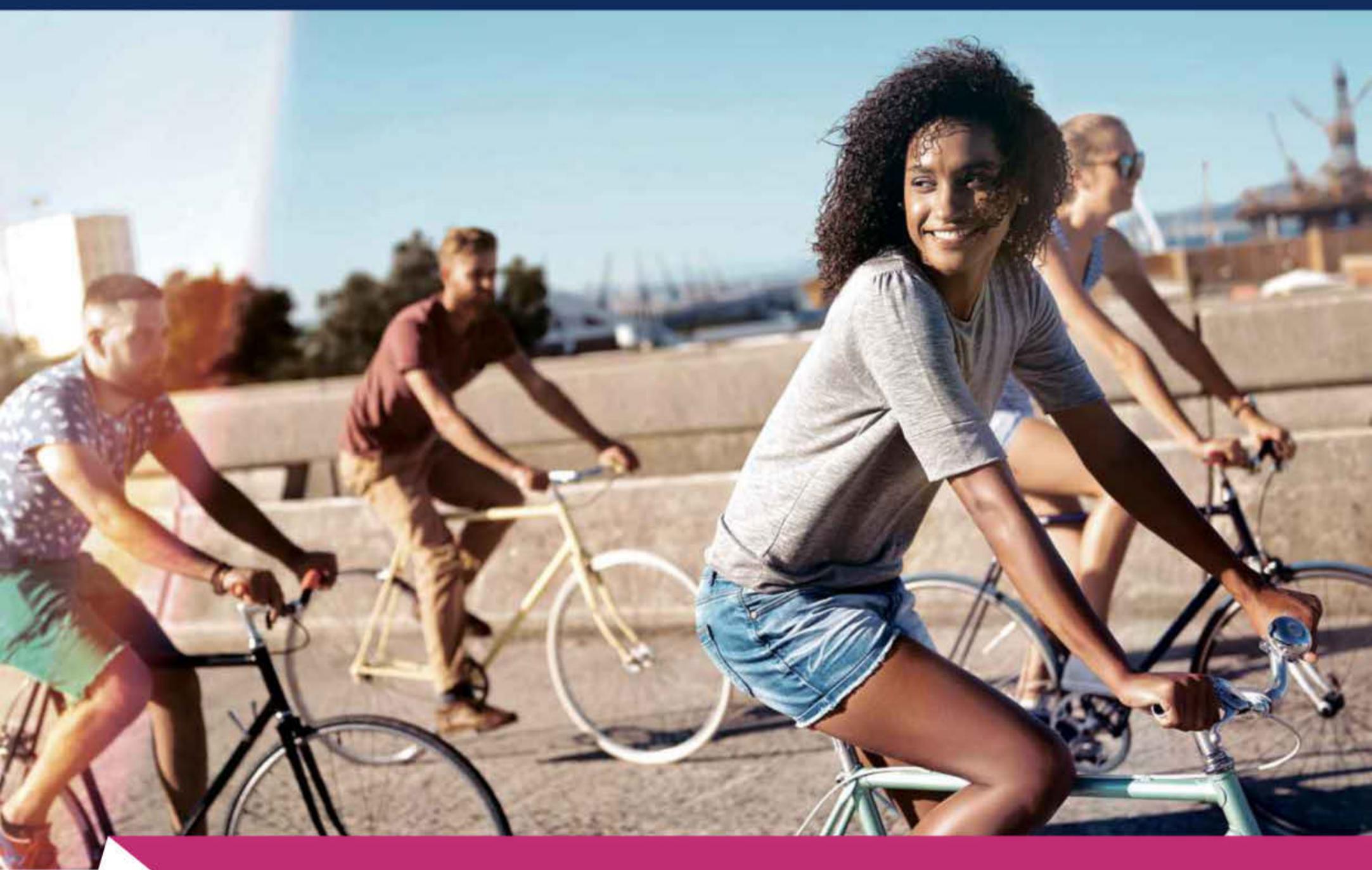
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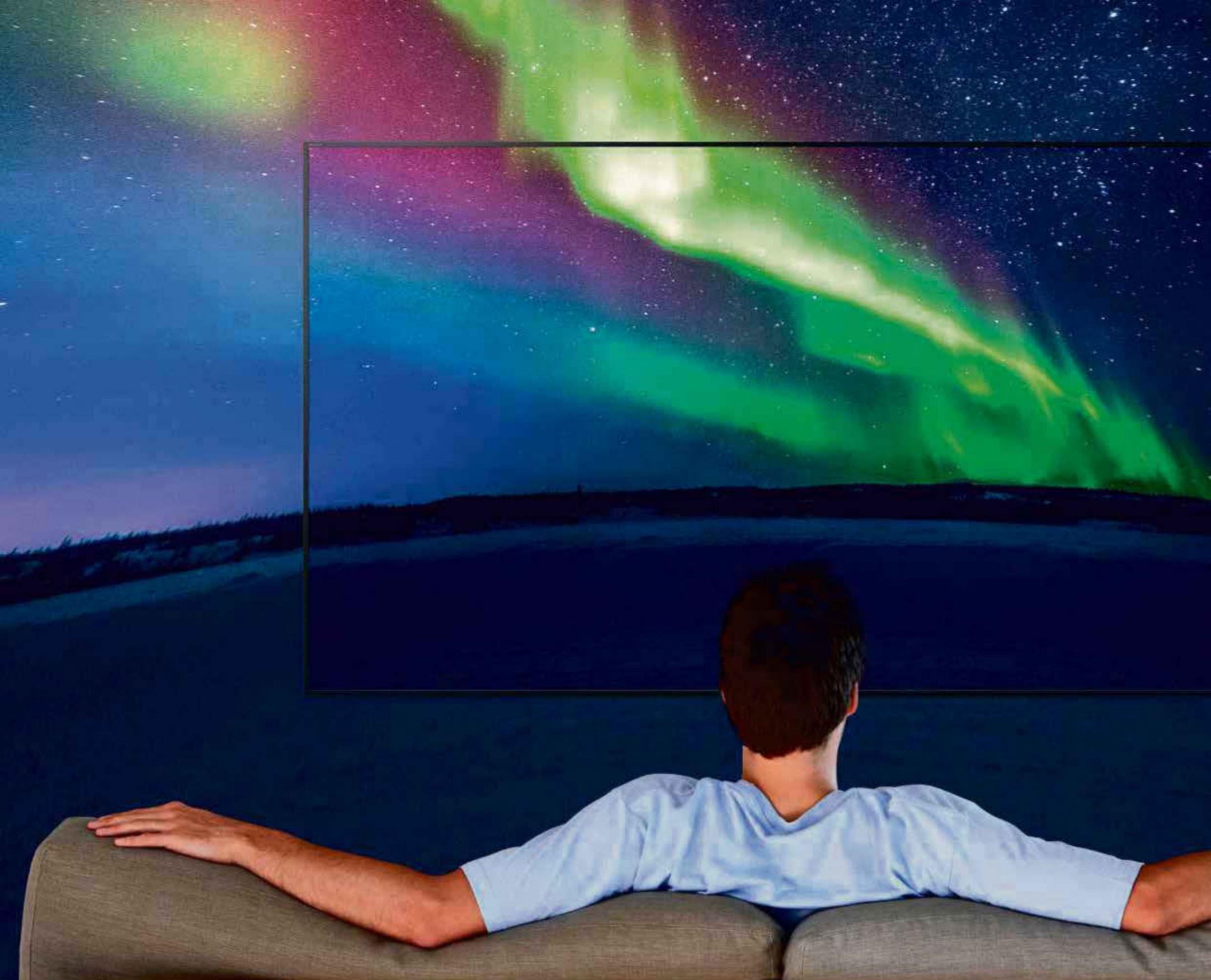


INSEA
REAL



RCH OF ITY

From vision to sound, and touch to smell, **Mike Bedford** investigates the technologies that are helping to make our computing experience ever more like the real world →



When we think back over almost half a century of personal computing, it seems hard to believe that users could have been satisfied with the hardware that was available in the 1970s and early 1980s. In the main, when we look back on those venerable machines, we focus on clock speeds measured in single digits of megahertz, memory capacities of just a few kilobytes, and storage provided only by 160K or 360K floppy disks that catch our attention.

However, while less commonly quoted, the displays of those early desktop computers were no less basic. Even if we ignore those computers that had only text displays, and move to the IBM PC in 1981, we find a graphics resolution of either 640x200 in two colours or 320x200 in four colours. Photorealistic it most certainly wasn't. Bear in mind the small screens that occupied only a small proportion of our field of vision,

and an audio capability that didn't go much beyond bleeps, and it would have been clear to those early computer users that emulating the real world would be some way off.

Today, even modestly priced screens are approaching 30 inches diagonally and are capable of displaying at least a couple of thousand pixels horizontally in millions of colours. Add to this sound cards capable of high-quality audio, and it might be tempting to think that the journey towards a real-world virtual experience is pretty much complete.

Yet this is surely a rose-tinted view. Even if we don a VR headset, few people will be

persuaded that they've really been transported from their living room in Birmingham to a beach in the Bahamas.

Our subject here is virtual reality, in the broadest sense of the phrase, so we're looking at far more than just VR headsets. In part, we'll provide guidance on what you really need in areas such as monitors and graphics cards, and in sound cards and associated speakers. However, we're also taking a futuristic view, with the aim of investigating the new technologies that are the focus of today's research and development. What's more, while some of these possible futures most definitely sound as if they belong firmly in the realm of science fiction, they are closer to science fact than many people might think.

COME THE RESOLUTION

When it comes to the pixel resolution of any digital device, it's all too easy to think that you can't have too



LEFT: VR headsets are just one aspect of virtual reality



ABOVE: Large screen sizes impose much greater demands on the pixel resolution, especially at close viewing distances, say for gaming

much; after all, this is the constant message from manufacturers. An important question, therefore, is what resolution you need to display an image that's indistinguishable from the real world.

The bottom line is that, for an onscreen image to look realistic, the resolution must be sufficiently high that our eyes don't see individual pixels as dots but, instead, they see an image that appears continuous with each pixel merging with its neighbours. Many computer users are aware that a measure of resolution – such as 1,920x1,080 – isn't enough to judge whether this criteria will be met. If the pixel resolution is the same, images on larger screens could look worse than on smaller screens because each pixel is larger. For this reason, a resolution measured in dots per inch (dpi) might seem more relevant; indeed, we're often taught that we need at least 72dpi for onscreen images, but this rises to 300dpi for prints.



ABOVE: Computer-generated holography involves calculating the interference fringes, which conventionally are produced using a complicated optical setup involving lasers, lenses and mirrors

Image: Roberto Michel Morales Rico

HOLOGRAPHY

3D image technology dates back to the Victorian era, even though adapting it to digital displays is somewhat more sophisticated. However, virtually all mainstream 3D displays add just a single element to the standard two-dimensional image, namely stereoscopy. This recognises the fact that an important element of depth perception is seeing the world from two slightly different viewpoints, and 3D displays simulate this by directing a different image to each eye.

However, this is only one aspect of depth perception, and many others are absent. Other key elements include being able to selectively focus our eyes on objects at different distances, and being able to see parts of objects that were obscured by closer objects by moving our heads.

Holography is an imaging method, first developed for use on film in 1962, that is able to reproduce every single way in which we are able to perceive depth. There are now lots of devices that claim to generate holographic images for use, for example, with a smartphone, but almost universally, they don't actually create a holographic image. Instead, they employ a variety of methods that fall well short of holography, commonly providing the illusion of an image floating in free space, as first popularised by the so-called holographic image of Princess Leia in *Star Wars*.

Real holographic electronic displays, on the other hand, are proving rather elusive, despite considerable research over many years. The main difficulty lies in the nature of a hologram. Strictly speaking, it's not an image but a sort of very complex lens that, when illuminated, reconstitutes every light ray that would have emanated from the scene it represents.

More accurately, it's an interference pattern caused by the interaction of light beams. This means that a display technology with a resolution of the same order of magnitude as the wavelength of light is required. That's a few hundred times that of today's PC monitors in both dimensions, which equates to around half a million times more pixels. This would be a much greater percentage change than we've seen from the first ever PC to the current day.

The other difficulty is a consequence of the much-increased resolution: some rather serious computing power would be needed to compute such high-resolution images in real time. While still a long way from providing a mainstream virtual-reality product, continuing research by Edinburgh-based Holoxica, in conjunction with Edinburgh and Heriot Watt Universities, is evidence of progress in this area.

We're not considering prints here, but that recommendation of a minimum onscreen resolution in dpi is not much more meaningful than one measured in pixels, especially if we consider TVs, tablets and smartphones as well as PC monitors. The reason for this is that the apparent size of a pixel also depends on how close we are to the screen.

A QUESTION OF DEGREES

The fact is that a useful way of thinking about the resolving power of the human visual system uses an angular measure.

Commonly, the quoted figure is 0.02 degrees. What this means is that if an object is 0.02 degrees wide and tall, we can just about perceive it. Consequentially, onscreen pixels should be smaller than this for photo-realism. The calculation is now a bit more involved than just dividing a horizontal resolution by the horizontal size, but it's not at all difficult. First of all, work out the horizontal size which, for a 16:9 screen, is the quoted screen size – the diagonal in inches – multiplied by 0.87. Now, work out the pixel size, by dividing the horizontal screen size by

the horizontal resolution. Finally, to calculate the angle, take half the pixel size, divide it by the viewing distance, which must also be in inches, take the ArcTan of that value, and then double it. ArcTan is the inverse of the trigonometric Tangent function, and is accessed on the Windows Calculator – which must be displaying its Scientific view – by pressing Inv followed by Tan (which will change to Tan-1 when you press Inv). Doing these calculations for a 28in 1,920x1,080 screen at a typical desktop viewing distance of 24 inches, we get an angle of 0.03, so an onscreen image won't quite be photorealistic, and you really ought to go for a 4K (3,840x2,160) resolution.

The reality of an image doesn't depend only on its resolution, but several other aspects have an effect, too. The number of colours is important, and the 16.7 million that most monitors and graphics cards can display might sound a huge number. However, that figure is somewhat deceptive since, for example, it includes only 256 shades of grey. Graphics hardware that can support 10 bits per colour, which increases the range of colours to 1.07 billion, is becoming available and, although it's not yet cheap, it's worth considering.

Another aspect of reality is the perception of depth but, although 3D TVs and monitors have been available, in some form or another, for years, they haven't



really taken off. We'll take a look at some current research into 3D displays a bit later.

FIELD OF VIEW

Even if a display provides sufficient resolution and enough colours, unless an image fills your entire field of view, in a way that TVs and computer monitors don't, you're not going to find a virtual experience fully convincing. Several potential solutions are available, although none is without its drawbacks.

Probably the best-known technology for providing a fully immersive experience is the virtual-reality headset. These contain two tiny LCD panels, one for each eye, with optics to make them fill your entire field of vision. But there's more. By feeding slightly different images to each eye, it's possible to give a sense of depth using the 3D display method

LEFT: While graphics resolution has come on in leaps and bounds since the IBM PC's CGA graphics in 1981, in other areas, emulating reality still poses big challenges

known as stereoscopy. Headsets sometimes include headphones, so the audio experience is also immersive, and they usually also have a head tracker. These inertial devices, much like the ones in smartphones, detect motion so that software can adjust the image depending on where the user is looking. This way, rather than providing a fully immersive experience in one direction only, it becomes possible to enjoy a full 360° virtual environment. You can even look behind you to see an entirely different view.

Despite all this, there are undoubtedly drawbacks, and not just the price, which is much higher than that of most monitors. For a start, the resolution is invariably lower than common monitor resolutions, yet the field of view is much greater. Common low-cost headsets have an angular resolution that works out at a very modest 0.05 to 0.06 degrees. Also, having to wear a bulky and heavy contraption on your head can be uncomfortable, and complaints of neck and headache aren't unusual.

Much more expensive, but overcoming some of the drawbacks of the VR headset while introducing others, is the CAVE, which, bizarrely, stands recursively for

A SENSE OF SMELL

In the main, this article has concentrated on vision and sound, although the sense of smell can't be ignored. It's not uncommon to hear people describe how a smell can bring back vivid memories, which suggests that it's an important element in our perception of reality.

Smell-o-Vision was a system designed to allow odours to be released into a cinema to match the onscreen action. It was used in the one movie, *Scent of Mystery*, which was released in 1960. Closer to the current day, it's a little-known fact that smell peripherals have been available for PCs.

Here's how DigiScents introduced their technology back in 1999: "iSmell digital scent technology brings the sense of smell to your computer. With iSmell software and devices, you can enjoy more immersive interactive games, realistic movies and atmospheric music. Send online greetings that smell like chocolate or roses. Enjoy your personal aromatherapy track while sitting at your computer. Smell groceries and cosmetics before purchasing online. Explore faraway worlds. Communicate and express yourself in ways you never thought possible. Just follow your nose!"

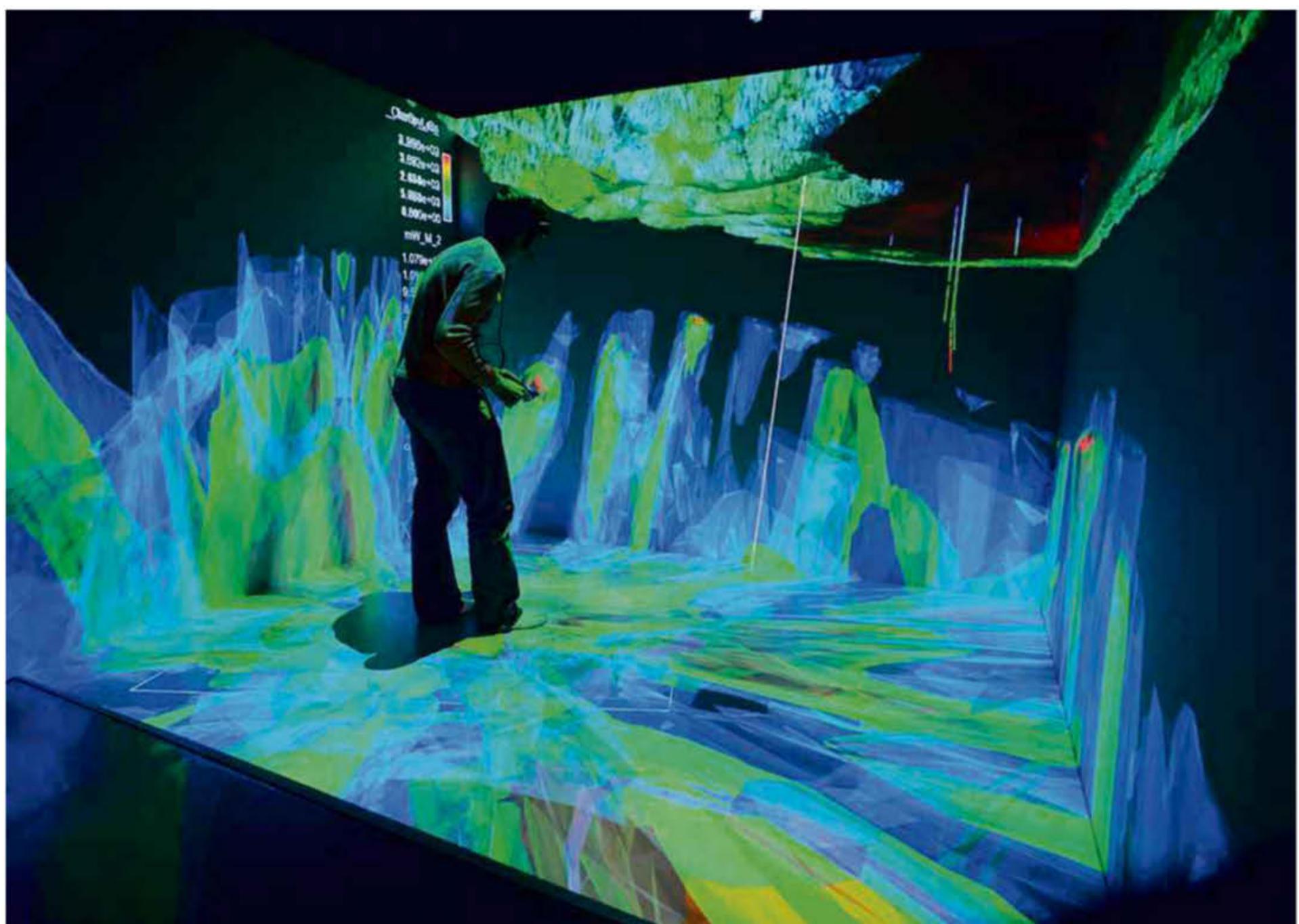
The technology, which used 128 so-called primary odours from which all smells could be mixed, wasn't criticised. However, iSmell counts as one of the biggest technological failures, supposedly because it was a technology that nobody

wanted. Subsequent innovations in odour release technology appear, by and large, to have been equally unsuccessful.

Having said that, it might just be worth keeping your eye on feelreal.com. Currently a crowdfunding campaign, the aim is to release an add-on for VR headsets that, as well as including odour technology, can also generate heat and vibrations, and even spray you with water vapour to simulate being caught in a rain shower.

RIGHT: Feelreal, with its internal scent cartridges, attaches to the bottom of a VR headset to make that virtual experience even more realistic





ABOVE: Commonly used for data visualisation, the CAVE Automatic Virtual Environment can also provide a fully immersive real-world experience

CAVE Automatic Virtual Environment. This type of virtual display takes the form of a complete room in which each wall, and perhaps even the floor and ceiling, are huge display panels.

A SOUND CHOICE

Monitors might provide the primary means

by which we interact with our PCs, but when we think in terms of virtual reality, sound also comes to the fore in a big way. For most applications, sound hardware integrated into the motherboard of ordinary laptops and desktops is probably adequate, often supporting sampling rates of up to 192kHz/24 bits, which allows sounds to be reproduced that exceed the capabilities of our ears. However, the little speakers that are found with many desktops, let alone the internal speakers in laptops, don't come close to matching the performance of the sound-generating hardware. For virtual

reality, and especially for music-related applications or games, the end result might be wholly inadequate.

The solution is fairly obvious: namely, to replace those poor quality speakers. You might choose to go for a surround-sound system, especially for gaming, although for less demanding applications, you might find a stereo system adequate, perhaps with the addition of a sub-woofer to boost the low frequencies.

The snag with deciding which speaker to buy is that the performance is not nearly as easy to sum up in figures as is the performance of a monitor. For this reason, manufacturers tend to characterise their speakers by the power of their built-in amplifier (such as 4W, 12W or 30W), even though this is more a measure of

loudness than quality. The implication of this is that, if sound quality is important, you should buy on the basis of expert reviews or, better still, after auditioning it yourself.

If you need a bigger improvement than replacement speakers will provide, external sound cards, commonly provided as USB devices, form the next stage, although this would be pointless without also investing in much better speakers. Again, consult expert reviews or take a listening test.

RECENT INNOVATIONS

What we've seen so far mostly concerns what ordinary PC users can achieve on a modest budget. That doesn't necessarily mean that our virtual experience will never surpass what's available with today's hardware, however. To whet your appetite, then, we looked at some interesting research into a new virtualisation technology, and spoke to an expert about his predictions for the future.

Two-dimensional displays are now capable of exceeding the capability of the human visual system, and methods are available for introducing depth perception. In the realm of the third dimension, however, there's still some way to go. Most 3D displays are enhancements of



LEFT: External speakers make a huge difference to the audio quality of PC-generated sounds

2D displays and only go as far as providing a partial impression of depth.

However, researchers at the University of Sussex have developed a novel volumetric display, which is truly three-dimensional, in generating the image in three-dimensional space, thereby allowing it to be viewed from all around. Sriram Subramanian is professor of informatics at the university, and an expert in display devices. We asked him how the new display works.

"The device works by acoustic levitation," he told us, before explaining what that means in practice.

"We use ultrasound - which is outside our human audible range - to hold a small polystyrene bead in place and update the ultrasound field so quickly that the polystyrene bead moves quickly. The bead moves so fast that we have persistence of vision, so we don't see the bead but rather see its whole path that creates the images."

Furthermore, as Subramanian went on to say, by illuminating the bead with coloured LEDs of varying intensity, the image can be in full colour.

This initial prototype is small; specifically, the image is held within a 10cm cube. However, it seems there are many potential ways of scaling up the system.

"One approach we are thinking about is making the device larger, but we are also looking at other ways such as exploring the use of multiple polystyrene beads", Subramanian told us.

But it doesn't end with just a genuinely three-dimensional image. Levitating an illuminated bead is just a start, as Subramanian went on to explain. "We also vibrate the bead so the bead then plays back that audio. And to create tactile feedback, we create a second virtual trap, that is a location where we could levitate another object, but we don't place a bead at that location. This is



ABOVE: Already we can get pretty close to a fully immersive virtual environment that includes motion, but at a not insignificant cost, as evidenced by the multi-million-pound price tag of professional flight simulators

placed right below the user's palm, so this trap stimulates the skin on the palm and creates a tactile sensation."

THE WAY FORWARD

We probably all have different views on the current state of play and how close our computers are to emulating reality. To get a more informed view, and find out what we can expect in the future, we consulted an expert, Professor Anthony Steed of University College London, who has worked on virtual reality and related technologies for over 25 years.

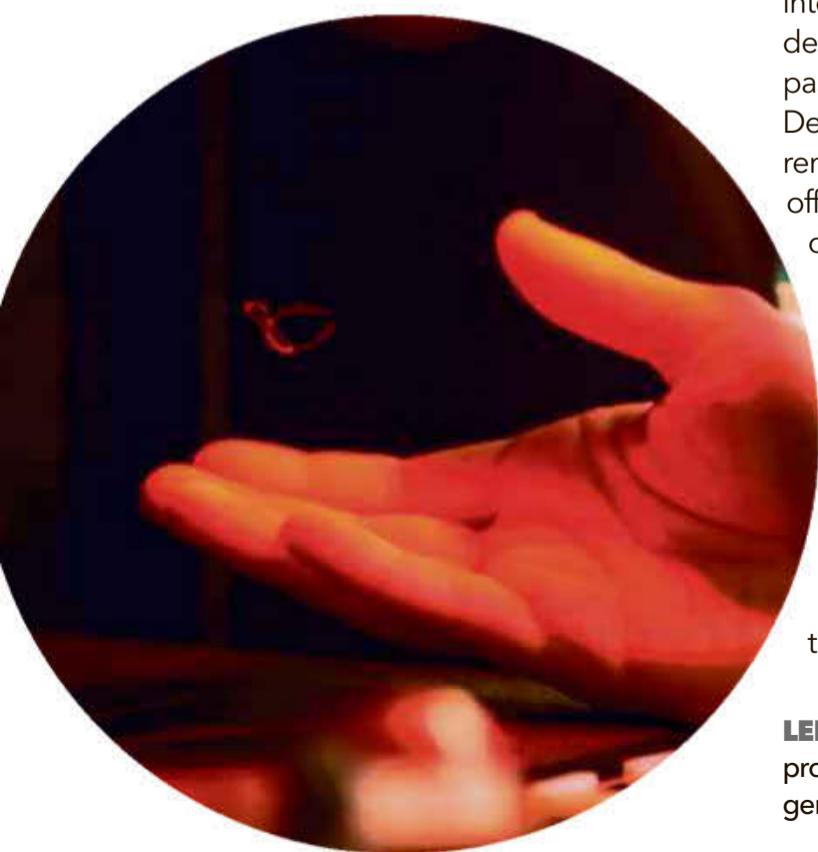
Steed started by giving his view of where we stand today. Interestingly, his assessment of equipment that we, as consumers, might aspire to, was quite favourable.

"The current consumer VR market is very interesting; it is largely game-driven, and the devices and platforms have evolved over the past five years towards a console-like model. Devices such as the Oculus Quest are remarkable developments that really show off what the field has been trying to achieve over the past 30-40 years. We use the consumer devices a lot in our work; they make the type of research that we do, on novel virtual-reality systems, software and platforms for immersive experiences, content development and so on a lot easier," he explained.

We asked what we might expect to see in the near and mid-term future, and Steed's response suggested that there's no shortage of ideas.

LEFT: Work at the University of Sussex has produced a true volumetric 3D display that also generates audio and tactile feedback

RIGHT



"Some obvious problems being tackled by R&D in companies and universities include head-mounted devices with a wider field of view, lighter optics, displays that support changing focal length and very fast displays," he added.

However, we were warned not to expect too much too soon.

"Some problems are harder, which is why I will be in this field for another 25 years. Haptic displays, including touch and force feedback, are probably 15-20 years behind the visual displays. We are also very early in the process of understanding how best to design immersive systems so that they are as easy to use as possible," he said.

Perhaps most interesting were Steed's thoughts on whether we'll ever have a fully immersive, fully convincing virtual experience like the HoloDeck of *Star Trek* fame.

"The paper that kickstarted this field was Ivan Sutherland's 'Ultimate Display' paper. In that, he points out that a virtual reality system that could reproduce reality could be deadly as reality can be deadly. The HoloDeck can move matter around to simulate all sorts of touch and force, and moving matter is dangerous; Sutherland used the example of a simulated bullet. That's an extreme example, but we had a discussion at a conference recently about display brightness: it is simply dangerous to build a display that could reproduce real reality as it would necessarily include light sources that could blind you. So how do you simulate some things such as snow blindness for training rescue workers?"

"While it would be foolish to say such technologies are impossible, they must be 50 years off. By the time we could build them, we probably wouldn't want to build them."

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↓ The ZX81 (below) was released at around the same time as the BBC Micro (left) and it was succeeded by the ZX Spectrum. The BBC Micro was snapped up by schools across the UK

Rivalry in the syntax era

Apple is switching to its own ARM-based chips for the Mac – a technology born from the legacy of the BBC Micro, a computer that caused a rift between two of Britain's leading tech companies, as **David Crookes** explains

It was Jack Tramiel, the founder of Commodore, who said business was war. But if you had to pick two men who brought that mantra to life, then you'd be looking at two of his rivals, Sir Clive Sinclair and Chris Curry.

As the respective bosses of Sinclair Research and Acorn Computers, they fought a corporate battle as fierce as any in the tech industry. Forget Apple versus Microsoft, Sega versus Nintendo or PlayStation versus Xbox, for this was top billing – a war that could not only bruise the egos of those involved, but also culminated in a now legendary punch-up.

At the heart of this row was a competition where much was at stake. Before that point, the two men spoke frequently and one even worked for the other. But the pair would end

up spending years in competition and tempers would sometimes boil over. Playground squabbles might suggest that Commodore was the main rival for Sinclair, but the reality was very different.

Before we look at why things changed, it's worth looking at just how similar these two men were in their early years. Both

Sinclair
Acorn

↑ Sinclair and Acorn were embroiled in a fierce rivalry in the 1980s

were certainly successful and intelligent, enjoying relatively privileged upbringings and a shared passion for technology.

Curry went to the independent Kimbolton School in Cambridgeshire, where he gained two A-levels in maths and physics. Sinclair, whose father and grandfather were both engineers, ended up being privately educated in Weybridge, Surrey, where he took A- and S-levels in physics, pure and applied maths.

Neither attended university. Curry got a job at the electronics company Pye in 1964 instead, before joining Royal Radar Establishment and WR Grace Laboratories. Sinclair decided against burdening his family with debt by spending three more years in education and decided to stick to his holiday job as editorial assistant for *Practical Wireless* magazine.

► Sinclair's ZX80 was one of the first computers available in the UK for under £100

When the editor and then the assistant editor fell seriously ill, Sinclair ended up helming the magazine, even though he was only 17. Yet he still found time to design circuits too, and this led to him setting up Sinclair Radionics Ltd in 1961, which operated until 1979. Curry joined the company in 1966.

BIDDING FOR SUCCESS

Curry enjoyed working for Sinclair Radionics, helping to develop hi-fi products, calculators and scientific instruments. He shared Sinclair's passion for making large products smaller, and became a key figure in creating the first pocket calculator in 1972.

As a trusted employee, he was asked to make operational an inactive company called Sinclair Instruments, and this enabled him to work on the release of the Wrist Calculator – "a ghastly thing," he would later say.

In 1977, Sinclair Instruments became Science of Cambridge and it released the MK14, an early computer that cost £40 in kit form. But it was during this period that Curry became frustrated. He wanted to develop the MK14 further, but Sinclair wasn't keen. Having spoken to his friend, physics researcher Hermann Hauser, he decided to leave and set up his own company, and this led to the birth of Acorn Computers.

Sinclair had no ill feelings towards Curry, and there was no hint of rivalry when Sinclair Research demonstrated another computer, the ZX80, for less than £100 in January 1980 at an exhibition in Wembley.

The following year, however, the BBC Computer Literacy Project invited bids from Britain's leading computer manufacturers to build a machine that could be badged with the broadcaster's logo. Newbury Laboratories, Tangerine Computer Systems and Dragon Data were among those who responded – along with Sinclair Research and Acorn Computers, putting those two companies head-to-head.

Each had a week to produce a prototype. Acorn had been working on a design for a computer codenamed the Proton, and a



team was rapidly assigned to create a working model of the machine in time for a visit from the BBC.

They just about achieved it, getting BASIC up and running in the morning and graphics by the afternoon. This swift turnaround, combined with a can-do attitude, helped Acorn win the contract. But Sinclair, who had hoped his company's success with the ZX80 and the imminent release of the newly developed ZX81 would have been enough to turn the BBC judges' heads, was furious.

From that point on, Sinclair Research and Acorn Computers were at loggerheads. It became a story of pride as well as money, and Britain's version of the battle between Apple and Microsoft rumbled on during much of the early 1980s, and was a tale so fascinating that it was re-created in a BBC Four drama called *Micro Men*, televised in 2009.

SPECCING UP

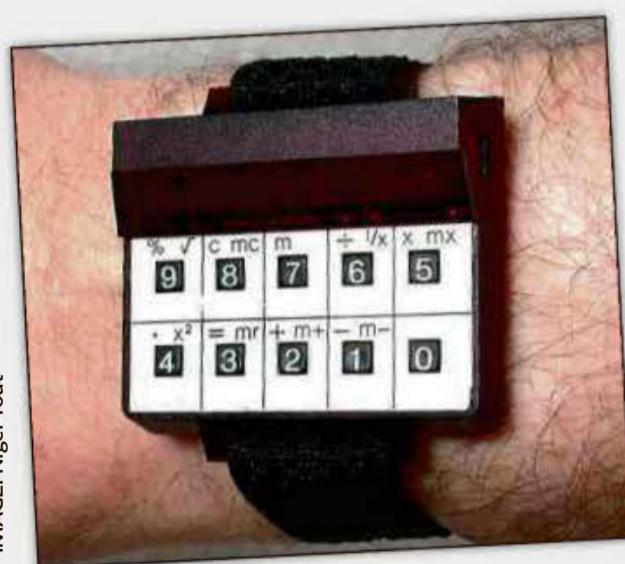
The programme has not been aired for nine years, making it a retro relic in itself, but the blurb summed up the situation well. "When Acorn wins the contract, Sinclair is furious, and determines to outsell the BBC Micro with



▲ Alexander Armstrong (top) and Martin Freeman played Sir Clive Sinclair and Chris Curry in the 2009 BBC Four comedy-drama *Micro Men*

his ZX Spectrum computer," it explains. The BBC Computer Literacy Project had driven a wedge between the men by seemingly derailing Sinclair's burning ambition to get a computer into every home.

In many ways, this only served to fuel Sinclair's desire. Although he had viewed the opportunity presented by the BBC as



◀ Sinclair Instruments' Wrist Calculator, which Chris Curry described as "a ghastly thing"



↑ The BBC Micro made a huge impact in schools, but it cost far more than Sinclair's computers so struggled to find a place in many people's homes

a golden path to achieving his aim, he remained determined to continue down the path he'd set himself.

So while Acorn was soon able to get a computer into almost every school, frustrating rival attempts to make inroads, Sinclair looked at how he could still get his machines into houses up and down the land. The first salvo was the ZX81, sold for £50 in kit form and £70 assembled.

It helped enormously that it was far cheaper than the BBC Micro, which was priced at £235 for Model A and £335 for

helped him achieve his aim of making computing accessible to all.

MICRO MANAGEMENT

So what of the BBC Micro? Well, it was making much less of an impact outside of schools, but it nonetheless proved a crucial turning point for British computers.

The BBC legitimised computing at a time when it was feared the UK was going to get left behind in the technological race, and the competition between Sinclair and Acorn actually proved a healthy one.

attract buyers in education and the office. But Sinclair didn't appear to see it that way.

In November 1982, *Your Computer* carried a piece written by Meirion Jones in which she wrote of the "Cambridge air [turning] suitably blue with allegations and counter-allegations between the rival firms".

In reference to the Acorn Electron, a budget version of the BBC Micro that had yet to see the light of day but was eventually released in August 1983, she said: "Sinclair is particularly scathing about Hauser's claims for the Electron, Acorn's Spectrum challenger." And when you read Sinclair's quotes in that article, you can certainly feel the venom.

"[The Electron] will have – as Hauser says – more RAM, more ROM, more ULA, for the simple reason that in my view they don't know how to produce a machine half as well as we do," Sinclair blasted.

"Ours isn't complex if you mean it has fewer chips – but that of course is the clever bit about it. It takes them 32K of ROM to do the interpreter and so on, which we do in 16K: they need 32K RAM minimum because their display takes 20K to do exactly the same as our display does in 8K. It's going to be much more expensive to make than the Spectrum and it only does the same job – in some ways not as well."

Sinclair loved the fact that he had beaten his rival to the market, and he was not shy in

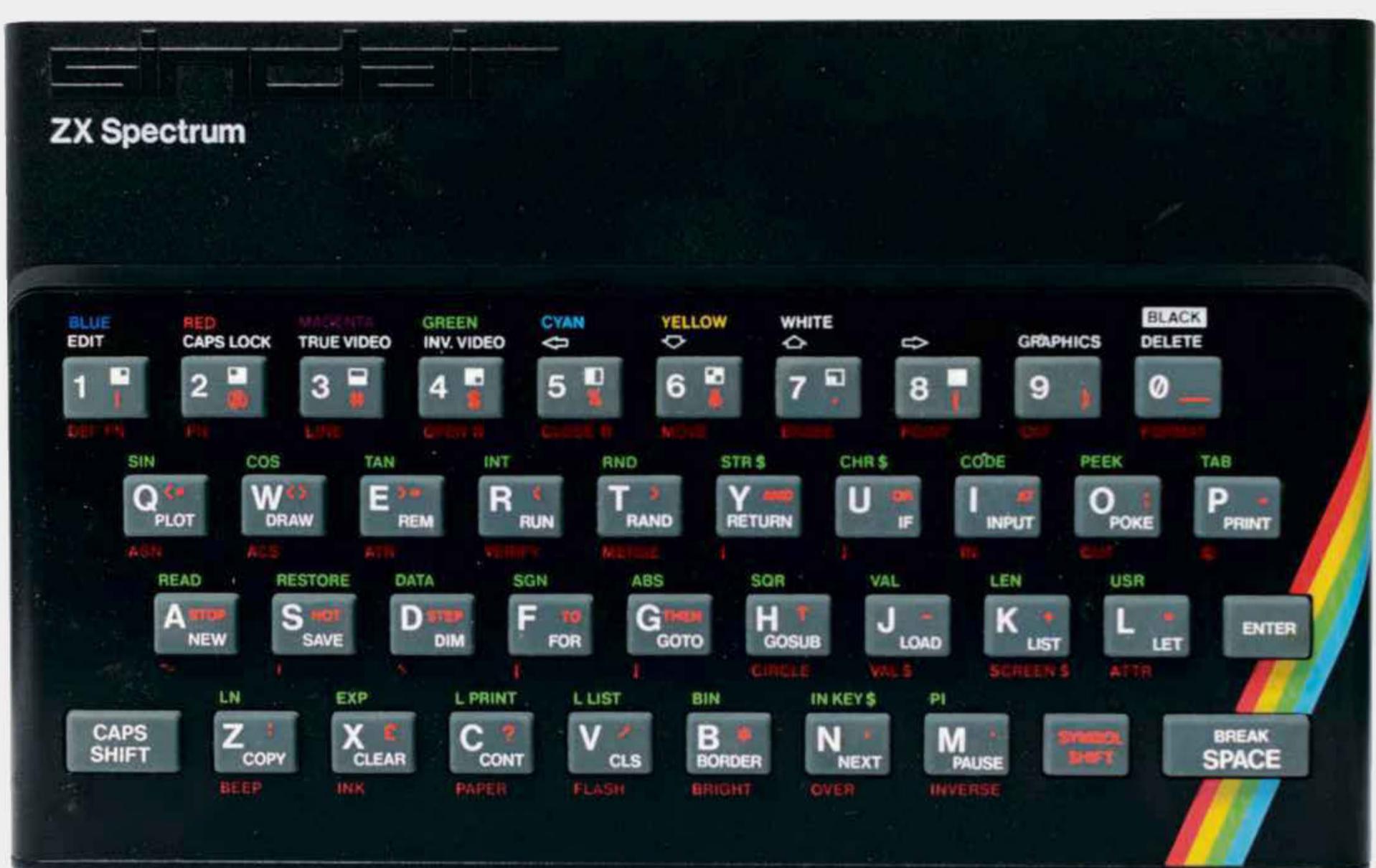
THE BBC COMPUTER LITERACY PROJECT HAD DRIVEN A WEDGE BETWEEN THE MEN BY SEEMINGLY DERAILING SINCLAIR'S BURNING AMBITION TO GET A COMPUTER INTO EVERY HOME

Model B. Parents looking to buy a computer 'to help with their child's homework' had a viable, more pocket-friendly alternative.

This was followed by the ZX Spectrum in April 1982, and its popularity was helped by a growing games market. Sinclair didn't like the fact his machine was becoming popular for such frivolous means – the BBC Micro was seen as the serious machine and his computer as more of a toy – but it

But you only need read an interview or two to get the gist of how this war was fought. In 1982, Curry spoke to *Practical Computing* magazine and said Apple, not Sinclair, was his major competitor, pushing aside suggestions that his firm's computers were going head to head with the Spectrum.

He believed the Speccy, as it was affectionately known, was aimed at a consumer market, with Acorn trying to



↑ Sinclair's ZX Spectrum, released in 1982, was instrumental in the rapid growth of the multi-million-pound UK gaming industry

mentioning this. "[Acorn] were announcing it [the Electron] at the same time as we were announcing the Spectrum," said Sinclair.

"By the time it does appear, I'm afraid the competition will be so fierce in that sector of the market that I think it will be too late. Hauser says that if he does have a problem, he just picks up the phone. Well, we don't – we do it all in-house."

As Jones reported in her article, Sinclair continued to be damning about the BBC Micro many months on. "If it wasn't for the fact that the BBC for their strange reasons

allow Acorn to stick a BBC logo on their machines I don't think they would sell many computers. Hauser says it's an Apple and PET competitor. Those machines were designed a long time ago and the Spectrum far exceeds their specification – and so it should, it's up to date."

Sinclair then goes on to fire more salvos towards Acorn, saying Sinclair BASIC rather than BBC BASIC was the standard. He also hit out at Commodore ("technically way behind") and, when pressed on the Dragon and the Oric, he offered: "Wait and see."

He was certainly taking no prisoners.

AN IRON GRIP

It also seemed that people were listening. Around the time that Sinclair would have given that interview, the ZX Spectrum was starting to gain international attention. Indeed, the ZX Spectrum was used as a weapon of sorts in September 1982 by British Prime Minister Margaret Thatcher on a visit to see her Japanese counterpart Zenkō Suzuki.

Relations between the two countries had become rather strained. Japan had not given clear support for Britain during the Falklands War, and Thatcher was far from happy. Even so, she'd ventured east to persuade the country's business leaders to invest in Britain, taking the opportunity to show off the UK's technological might by showing Suzuki a ZX Spectrum.

"This is a small, home computer," she said very slowly – in English – to the gathering delegates as Sinclair Research's John Mathieson looked on. "You press that button," she ventured, her finger prodding the keyboard, and a program appeared on screen. "A game of chess," she announced.

And even though it may have felt like handing fistfuls of snow to an Inuit, one of the UK's most loved inventions was being promoted over the BBC Micro (ironically, perhaps, since Curry was an admirer of Thatcher, and was at the Grand Hotel in Brighton on 12th October 1984 when it was bombed by the IRA during the Conservative Party conference). For Sinclair, the PM's endorsement was undoubtedly a proud moment not just for his company, but for him personally.

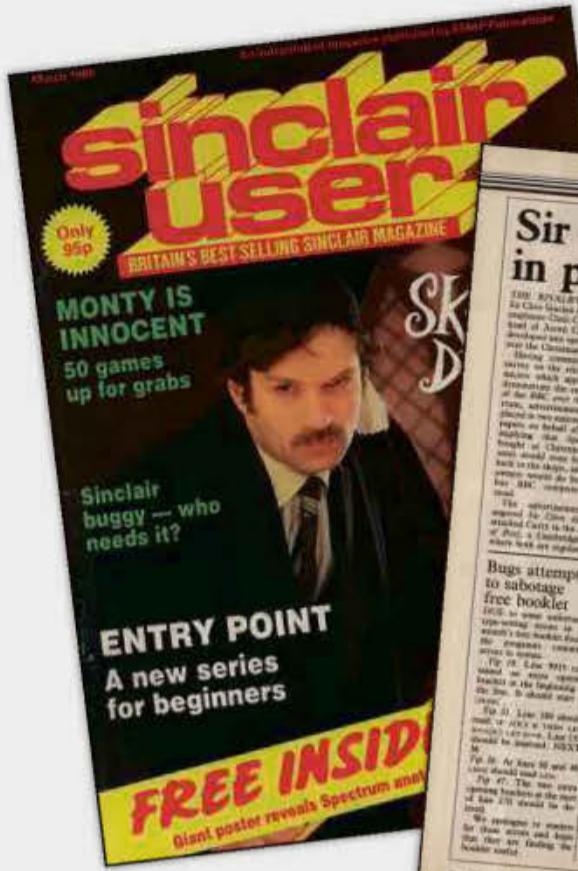
After all, this was a man who had sought to personalise his computers. They bore his name, and he'd appear in the company's adverts. He was a successful, if quirky, inventor in the eyes of Brits. The man



↑ Chris Curry says he is proud of the MK14 computer that he designed for Sinclair Research



→ Sir Clive Sinclair is as well known for his transport inventions as his computers. Here he's pictured on a prototype X-Bike



→ Issue 36 of *Sinclair User* reported on the fight between Chris Curry and Sir Clive Sinclair at the Baron of Beef pub in Cambridge

who made computers and the brains behind the wacky one-person, battery powered velomobile, the C5, which launched in 1985.

THE BIG BEEF

It was in the previous year, just before Christmas, that one of the more remarkable incidents took place. *Sinclair User* magazine carried a report about an advertisement that angered Sinclair so much, it culminated in him and Curry coming to blows.



The advert appeared to imply that anyone who bought a Spectrum computer would end up taking it back to the shop in exchange for a BBC Micro. Thus enraged Sinclair. When both men bumped into each other at a Cambridge pub, the Baron of Beef, "Sir Clive walked up to Curry and slapped him about the head," the report claimed.

The fight is said to have continued in an upmarket wine bar called Shades (although Curry later said the entire incident happened

in there, after the pair had left the Baron of Beef). Thankfully, the two men made up sufficiently for Curry to be a guest at Sinclair's New Year's Eve party, with Curry claiming it to be a "storm in a teacup". And, with hindsight, both ended up as winners.

Although neither Acorn nor Sinclair went on to dominate the computing landscape, the ZX Spectrum was much loved and is still fondly remembered today. The range sold more than five million units, and it's generally

neus

VIEW A MINIATURE MODEL OF A MAINFRAME COMPUTER

The IBM 1401 mainframe computer was introduced in 1959, selling more than 12,000 units over the course of 12 years. It didn't have a screen, but it had



16KB of six-bit core memory, six tape drives and punch-card input. It was also so big that it filled an entire room.

Nicolas Temese fancied having one of his own, so he's built a replica – albeit in miniature. Rather than 3D print his model, he's spent more than 300 hours on the design and construction, cutting most of the pieces out of polystyrene and assembling it all by hand.

The level of detail has to be seen to be believed. There's a punch-card reader, as well as extremely small punch cards, along with a tiny desk, chair and terminal complete with coloured buttons. Drawers filled with pins, fake wires and orange SMS cards fold out of the main processing unit, and there's a line printer with a box for the sheets. Let Temese take you on a journey at tinyurl.com/393retro1.



DELVE INTO CODEMASTERS' ARCHIVE

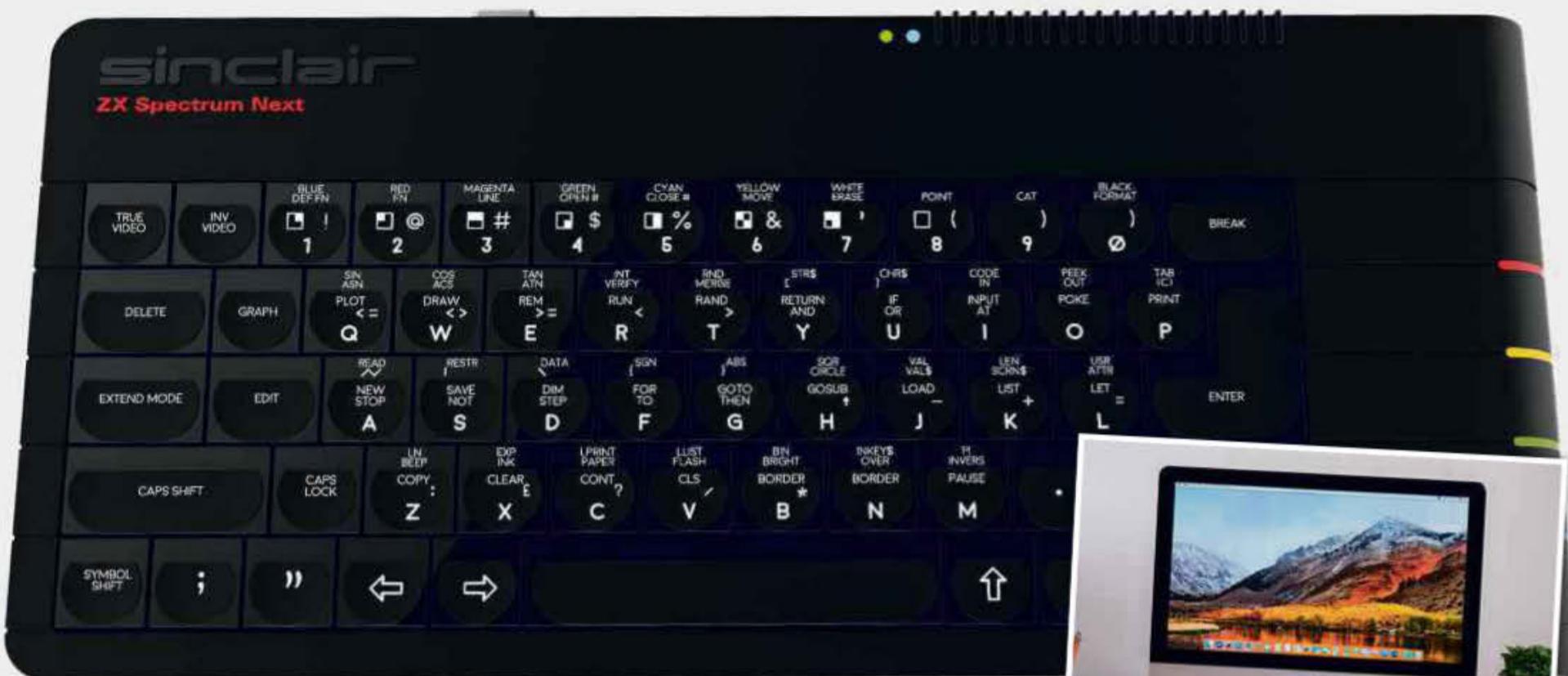
Founded by brothers Richard and David Darling in 1986, Codemasters became one of the most prolific videogame publishers of the 1980s and 1990s. It's still producing best-selling games today, but a group of fans have set up an online archive dedicated to

those past titles, and it's already looking very promising.

More than 100 games have been included and the entries are packed with screenshots, box art images and videos of the games in action. You can also play many of the titles

in your browser, even going as far as choosing your favourite system, be it a Commodore 64, Nintendo console, Spectrum or other retro gem.

There's a very brief history of the company alongside a couple of archive videos from a time when the Darlings were barely out of school. A number of past employees have also begun to leave their memories. If you're into design documents,



▲ Specy fans have created a modern version of the Sinclair classic, the ZX Spectrum Next

perceived more favourably in the minds of computer enthusiasts than the BBC Micro. As much as Sinclair wanted his machines to be taken seriously as business computers, they helped spawn a booming multi-million-pound videogame development industry in the UK. Fans have even produced a new version, the ZX Spectrum Next. Yet Curry's company created a long-lasting legacy, too.

Acorn's research and development team worked on developing a microprocessor called the Acorn RISC Machine, or ARM, in 1983. It had fewer resistors and simpler

architectures and, proving more efficient and using less power, it ended up in a low-cost PC for the first time in 1987.

By this time, Acorn had been sold to Olivetti and Sinclair Research to Amstrad. But what became ARM grew into one of Britain's most successful technology companies. ARM chips would eventually find a home in phones and mobile devices the world over, including in the iPhone. And the company hit the headlines again recently when Apple announced it was switching to ARM-based processors in its Macs.

▲ Apple has revealed that its future Macs will be powered by ARM-based processors

Given such legacies, we're calling a draw. British videogaming would not be where it is today without the ZX Spectrum, and Acorn ensured Britain has continued to influence technology on a global scale. As for the two men, Curry stated in a 2012 interview that the pair are good friends. "Always were," he said.

All's fair in love and war, it seems, and in this case we're all better off for the rivalry. **CS**

there's a whole host of them posted within the Scrapbook section. Another page includes pages of Codemasters coverage in retro magazines. It's absolutely brilliant!

VIC-20 MAKES A COMEBACK AFTER 40 YEARS

Commodore computers are making a habit of dusting themselves down for a new era. Some of you may have already checked out THEC64 – a full-size recreation of the Commodore 64

with a working keyboard – and a number of readers may have rushed to pre-order a development version of the MEGA65 which, as we reported in last month's Retro, is based on the cancelled Commodore 65.

Now it's the turn of the Commodore VIC-20, which is being reborn as THEVIC20 by Retro Games Ltd. This particular retro machine has its place in history as the first personal computer to sell more than a million units, and the new version will include a micro-switched classic joystick, four USB ports and a HDMI connection so you don't need to mess about with an old CRT monitor.

In many respects, it's going to be similar to THEC64, at least on the

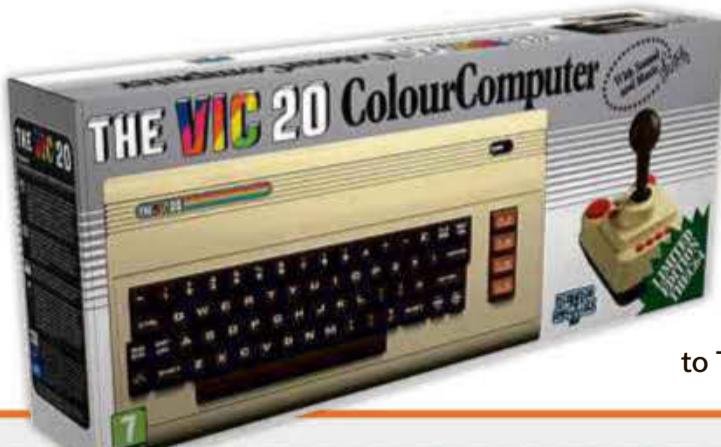
inside: you'll be able to access C64 BASIC as well as VIC-20 BASIC, and the range of built-in games spans both machines (there are 28 VIC-20 games and 36 C64 games). But it's the outer case that matters here for anyone wanting that pang of nostalgia. It will cost £110 when it hits the shops on 23rd October.

USE A MODERN MOUSE ON A RETRO COMPUTER

You can't just buy a mouse from a supermarket, stick it into a computer from the distant past and expect it to work. But that's not to say you should wake up and smell the cheese. All you need is an adaptor such as Project mouSTER, which lets you plug any USB mouse and gamepad into an DB9 socket. It even supports plugged-in PlayStation 4 controllers.

Although it's still in the development phase, the adaptor has already been shown to work well, with the work of translating falling to a small microcontroller. Originally made with the Atari ST in mind, the adaptor now aims to be multiplatform and, since it's configurable via a USB flash drive, options are being added for other retro machines such as the Amiga, Commodore 64/128, 8-bit Atari and ZX Spectrum.

For more details, check out Retrohax's blog post at tinyurl.com/393retro2. Retrohax also sells other retro goodies, including capacitor replacement kits, keyboard springs and S-video adaptors.



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Lenovo oh no

We bought a Lenovo V110 laptop from Ebuyer.com in November 2018. In September 2019 it developed a fault, and Lenovo repaired it under warranty. Unfortunately, in the process its disk was wiped, and I lost many documents and family pictures.

The laptop worked fine again until June this year, when it developed a similar fault. I contacted Lenovo, which concluded that the laptop again needed to be sent in for repair. Unfortunately, however, I was informed that because the laptop was now out of warranty, this would be chargeable.

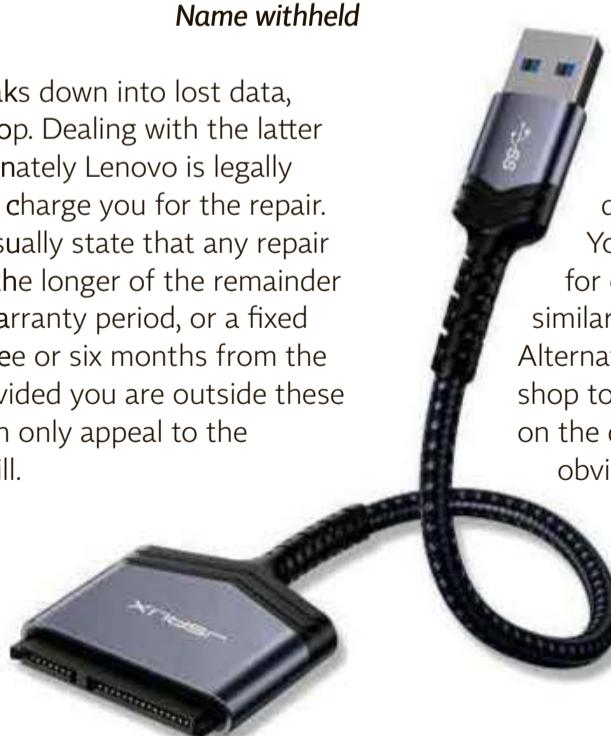
While I understand that the original manufacturer warranty expired in November 2019, I'm disappointed that the original repair didn't entitle us to any extended warranty. I wrote a complaint to Lenovo, who simply replied that they could only offer us chargeable options.

We're now in the situation where we've lost our computer, I've lost more important work files, and my daughter has lost all her GCSE work from during the lockdown. Is there nothing we can do to recover our data, or compel Lenovo to repair the laptop? We can't afford to pay for a repair or replacement under the current circumstances.

Name withheld

Your problem breaks down into lost data, and the failed laptop. Dealing with the latter issue first, unfortunately Lenovo is legally within its rights to charge you for the repair. Warranty terms usually state that any repair is guaranteed for the longer of the remainder of the purchase warranty period, or a fixed period such as three or six months from the date of repair. Provided you are outside these provisions, you can only appeal to the company's goodwill.

► A cheap USB-to-SATA adaptor can help you recover disk contents from a broken laptop



The screenshot shows the Ebayer.com website with a navigation bar at the top. The main content area is titled 'Returns Policy'. It contains text explaining consumer rights regarding returns, mentioning a 14-day cooling-off period and statutory rights. It also links to 'Terms and Conditions of Sale'.

↑ The Ebayer.com returns policy stresses consumers' additional statutory rights

You do, however, have statutory protection under the Consumer Rights Act. This states that products must be 'of satisfactory quality', 'fit for purpose' and 'as described'. While computers can and do go wrong, having two major failures within two years of purchase could be construed as falling short of one or both of the first two requirements.

It's important to note that any claim under the Consumer Rights Act is against the retailer, not the manufacturer. And because the laptop is more than six months old, the burden is on you to prove that it was of unsatisfactory quality, or not fit for purpose. You might try to search online for other users experiencing similar problems, for example. Alternatively, you could ask a repair shop to prepare an independent report on the device, although this would obviously be chargeable.

In the first instance, you should contact Ebayer.com using the options on its Contact Us page. Set out the circumstances and dates of the purchase and

the problems you've had. Explain that you're seeking either a refund, repair or replacement under the Consumer Rights Act, and on what grounds (such as not of satisfactory quality).

We would expect Ebayer.com to respond outlining possible resolutions, and any further information that it needs, such as an independent or manufacturer inspection of the laptop. Should it accept your claim, Ebayer.com has the right to choose whether to repair, replace or partially refund the laptop.

In the unlikely event that Ebayer.com doesn't reply or you aren't satisfied with its response, you could threaten to report the site to your local trading standards office or to www.retailadr.org.uk. If all else fails, and you originally bought the laptop on a credit card, you could pursue the claim with your credit card company under the Consumer Credit Act.

Finally, it's unlikely that the data on the hard disk is lost. For around £10-15 you can buy a USB-to-SATA adaptor, allowing you to connect the drive to another PC and recover your files. Physically removing the Lenovo's disk shouldn't invalidate your statutory protection, but as a precaution you might want to clear this step with Ebayer.com, or ask your repair shop to do it for you when preparing its report.

Dual band death knell?

I've had a TP-Link TL-WDR4300 router for some time. I configured its 2.4GHz and 5GHz wireless networks with separate SSIDs, and set up my devices to prefer the 5GHz one. The idea is we get 5GHz speeds when within range, but things fall back to the more stable 2.4GHz network further away.

That all worked fine apart from some occasional issues where the wireless networks would temporarily disappear. Rebooting the router always brought them back up, but recently the 2.4GHz network has disappeared altogether. I've checked in the admin menu that both frequency ranges are enabled, and tried turning the router off and leaving it for several minutes, but we can only see the 5GHz network. Is the 2.4GHz one dead?

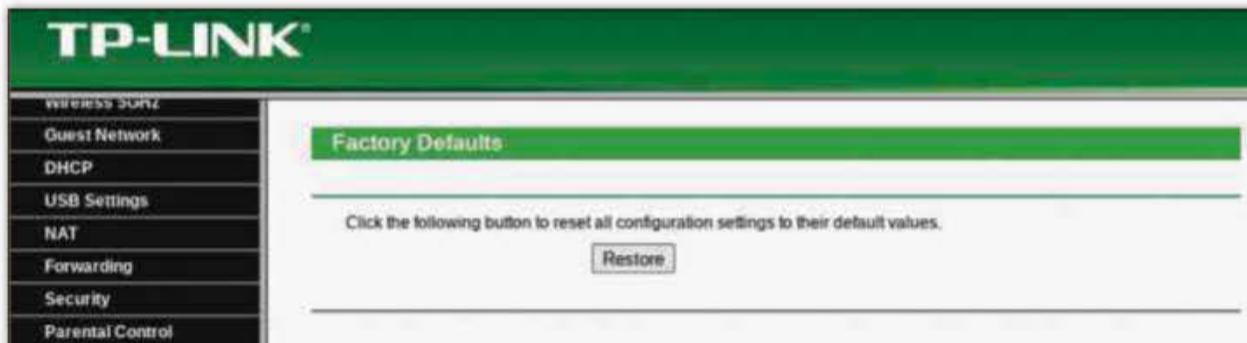
Colin Gibbs

The TL-WDR4300 uses separate chipsets to provide its 2.4GHz and 5GHz networks, so it is

conceivable that one has failed. In our experience, it's more likely that there's an odd firmware or configuration issue, however.

Log into the router, open the System Tools menu, select Backup & Restore and create a backup of your settings. With this done, visit www.tp-link.com/uk/support/download/tl-wdr4300 and check if there's a more recent version of the router's firmware. If there is, download the firmware file, then click Firmware Upgrade, select the downloaded file and click Upgrade.

After rebooting the router, log back in and choose Factory Defaults from the System Tools menu. Make a note of the default login settings displayed on the right, then click Restore to restore all settings to their defaults. Finally, log back in and either manually re-create your settings, or restore them from your backup via the Backup & Restore menu. If this doesn't encourage the 2.4GHz network back to life, it's probably gone for good.



It's worth restoring all the defaults before concluding that the hardware has failed

Switch it up

Our Virgin router is on the other side of the house to the lounge. I use Powerline adaptors to get a fast broadband connection to our home entertainment equipment. The adaptor in the lounge has three Ethernet ports, but I need four.

I've got a simple question: can I connect a five-port switch such as the TP-Link TL-SF1005D to the Powerline adaptor, and plug in Ethernet cables from my NUC, Virgin box, smart TV and Xbox? Switch instruction manuals usually say that the switch needs to be plugged into the router, but in my case this would only be indirectly true. Would this work as a 'plug and play' option?

Chris Murphy

What you're suggesting ought to work perfectly, but you should consider a better switch. The TL-SF1005D is a 100Mbit/s device, so it's probably slower than some of your other equipment. Importantly, it may also be slower than your broadband connection and Powerline adaptors, in which case it would definitely become a bottleneck. As a secondary consideration, you may find you need more ports in the future. As such, it might be wiser to pay more for an eight-port Gigabit switch such as the TP-Link TL-SG108.



We'd generally advise buying Gigabit, rather than 100Mbit/s, Ethernet equipment

Notification overload

I recently bought a Nokia 5.3 phone, which generally appears to be fine. However, sometimes when I pick it up the Android notification menu starts dropping down without my bidding. It doesn't always happen, but when it does it sometimes does it so repeatedly and insistently that it's impossible to use the phone at all.

I wondered if it might be something to do with my case encroaching on the corners of the screen leading to 'ghost' inputs, but it still does it with the case removed. I had an 'Aha!' moment when I noticed a fine crack in my screen protector, but this became a 'Doh!' moment when I replaced it and the problem persisted. Is there anything else I can try?

Craig McCaffrey

Swipe fingerprint



Swipe fingerprint for notifications

To check your notifications, swipe down on the fingerprint sensor on the back of your phone.

If your phone has a mind of its own, try checking which gesture inputs are enabled

While you've ruled out the most logical causes of the problem, there is a less obvious one. Modern phones let you swipe the fingerprint sensor to pull down the notifications bar, but on some phones this can lead to false or accidental inputs, particularly those with rear-facing sensors. Try turning off the feature by dragging down the menu bar and clicking the settings icon. Search for 'fingerprint' (without the quotes), select Swipe fingerprint for notifications and disable it.

If this doesn't work, it may be worth removing the screen protector and case, cleaning the screen thoroughly and seeing if the phone works when completely 'naked'. If the issue persists, there could be a hardware problem; contact Nokia's customer support for further advice.

Facebook is snooping on me

I don't trust social media, and don't have any accounts. I use a Windows 10 PC with Firefox, while my wife has a laptop and uses Chrome. We are both connected to the same router and have the same common external IP address; to the outside world, that is all we share.

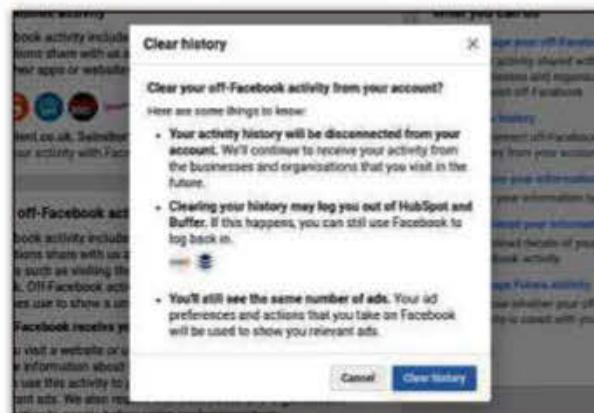
Yesterday afternoon, I was searching the internet for decking boards and a specific mirrorless camera. Later that day my wife, who does use social media, logged on to Facebook. She saw targeted adverts for decking boards and the model of camera I was looking at. By what mechanism can my browsing jump ship to another machine and be hijacked by Facebook?

Tony Nicholls

Facebook and Google's public-facing services – Facebook.com and Google search, for example – are just the tip of their activities. Both companies are leading providers of tracking and digital advertising services to the majority of commercial sites on the web. Generally speaking, if you visit a website, one or both companies are likely to know about it.

Exactly what they know depends on what you choose to share with them. For example, depending on your wife's Facebook settings and profile data, Facebook may have a clear picture of her background, interests and web activity. However, both companies and their advertising partners can also track anonymous users' activities, through techniques including cookies, tracking pixels and IP address logging.

The most likely scenario is that the sites you visited use advertising services connected

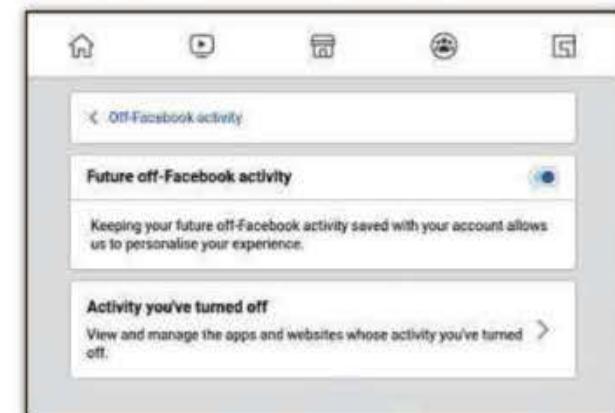


▲ Clear your off-Facebook history to prevent ads targeting your previous activity

to Facebook. Although you're browsing anonymously, these services have recorded that a user with your IP address may be interested in buying decking and a camera.

By default, Facebook serves customised adverts to its users, basing its customisations on recent behaviour – in this instance, picking up on the browsing activity from your IP address. It's important to note that, while Facebook may know a lot about your wife, it's not sharing this information with the advertisers in question. Instead, advertisers pay to have their adverts shown to the most relevant audience, as determined by Facebook based on its data.

Unfortunately, it's incredibly hard to prevent third-parties tracking your behaviour altogether. You can enable Do Not Track in Firefox by selecting Preferences from the menu and selecting the Privacy & Security panel. Under Send websites a "Do Not Track" signal, choose Always. Unfortunately, there's no obligation on websites to honour this, and



▲ Disable Future off-Facebook activity to prevent adverts targeting ongoing activity

the majority don't. You could further limit data gathering by using Firefox's private browsing mode, which will prevent advertisers saving cookies to your PC. You could also use a VPN service, which will prevent advertisers seeing your public IP address. Alternatively, you could use a privacy-focused browser such as Tor.

Finally, your wife could adjust her off-Facebook activity settings to prevent Facebook targeting data based on her (or your) activity on third-party sites. To do this, she'll need to drop down the menu arrow at the top right of the new Facebook interface, choose Settings & privacy, then Settings, then select Your Facebook information, followed by Off-Facebook activity.

Choosing Clear history will delete the existing history Facebook has added to your wife's account. Dropping down More options will also reveal Manage Future Activity, which will let your wife prevent Facebook from associating third-party information with her Facebook account in the future.

Overextended

Lately an icon that looks like a mallet has appeared to the right of the omnibox in Chrome. If I click on it, it lets me manage my extensions. I don't really want it there. Can I get rid of it?

Philip Moore

The extensions icon is a recent addition to Chrome. You can't get rid of it through the regular settings menu, but you can by setting one of Chrome's flags.

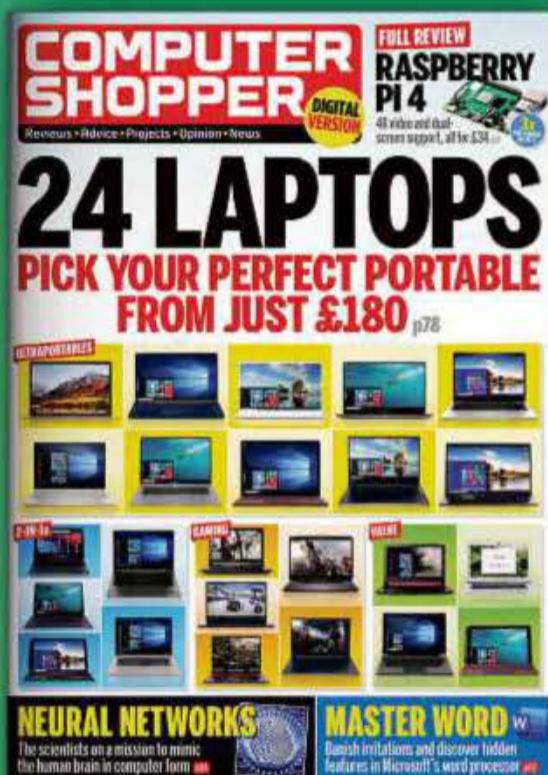
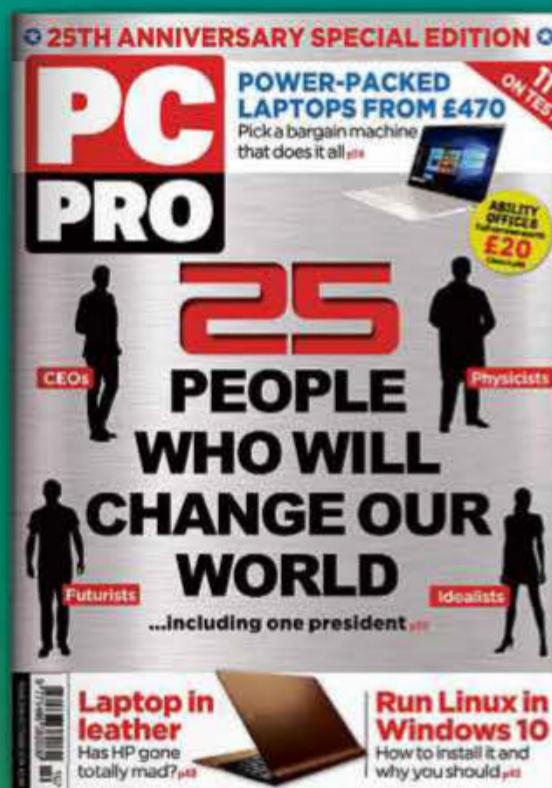
Type `chrome:flags#extensions-toolbar-menu` in the omnibox and hit Enter. Switch the flag Extensions Toolbar Menu to Disabled, then restart Chrome and the icon will be gone.

You can retrace your steps to re-enable the feature in the future. However, Google may make the flag unavailable again. At some point you may find that the icon reappears, and that this fix no longer works. ☺

→ Chrome's flags support advanced configuration, but individual ones may disappear in the future

Extensions Toolbar Menu	Enable a separate toolbar button and menu for extensions – Mac, Windows, Linux, Chrome OS #extensions-toolbar-menu	Default
Extensions on chrome:// URLs	Enables running extensions on chrome:// URLs, where extensions explicitly request this permission. – Mac, Windows, Linux, Chrome OS, Android #extensions-on-chrome-urls	Enabled
Show Autofill predictions	Annotates web forms with Autofill field type predictions as placeholder text. – Mac, Windows, Linux, Chrome OS, Android #show-autofill-type-predictions	Default
Smooth Scrolling	Animate smoothly when scrolling page content. – Windows, Linux, Chrome OS, Android #smooth-scrolling	Default
SMS Receiver Cross Device	Enable the SMS Receiver API to work across devices – Mac, Windows, Linux, Chrome OS, Android #sms-receiver-cross-device	Default

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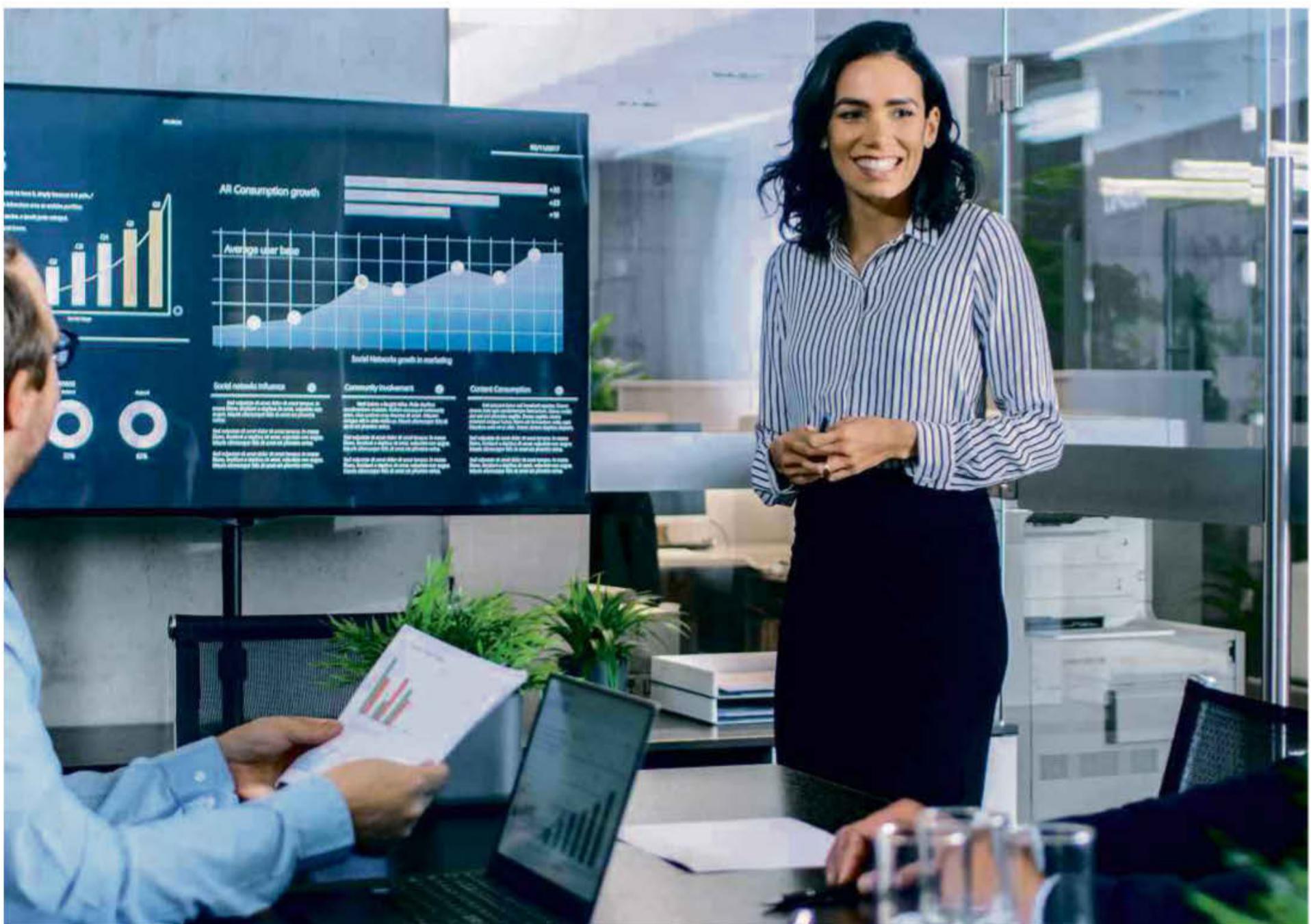
Whether you're an IT professional or a first time buyer, Dennis technology has a magazine for you, all of which are written and produced by expert editorial teams.

We cover the whole spectrum of technology news, reviews and features.

Advanced Projects

Clive Webster has been tinkering with computers ever since Windows 98 forced him to manually install his drivers

clive@computershopper.co.uk



Master PowerPoint

PowerPoint still dominates meetings, lectures, group activities and even comedy shows. But you don't need to inflict Death by PowerPoint with **Clive Webster's** masterclass

HOW MANY TALKS start with the phrase, "I've got some slides, but don't worry, not that many"? How many times have you said that yourself?

Death by PowerPoint is now so common that most of us feel a need to apologise before launching our slideshow. But don't let those bad presenters put you off: PowerPoint is still a great tool

to convey information, keep attention and help people understand why you're worth listening to.

This article focuses on how to create professional, impactful and high-quality PowerPoint presentations quickly and easily. With our basic tips and a few design principles, you'll soon be wowing the crowds or impressing your colleagues.

WE STARTED OUR Microsoft Word

masterclass (Advanced Projects, Shopper 379) with the following warning: is Word the right tool to use? It's so easy to launch Word, start writing, adding some boxes or graphics, and then think, 'Oh drat, I should've used something different for this job!'

The same is true of PowerPoint: if you're about to talk to a group of people, we automatically choose PowerPoint. But you need to consider some fundamental questions about your event. Is a presentation the best way to help your audience understand your ideas? Would a group workshop be better, or is your subject so detailed that a roundtable discussion supported by more lengthy briefing notes would be better? Even if a presentation is required, is PowerPoint's linear, slide-by-slide process suitable? We discuss that idea more in 'Alternative choices' on page 118.

PRESENT AND CORRECT

Before you even launch PowerPoint, stop to ask yourself two key questions: to whom do you intend to talk, and why? From those answers should flow concerns such as what your audience wants to know, what they expect to learn, and what they need to be told that they don't already know. You'll then know how to grab their attention, hold that focus, and when to wrap up before you inevitably lose their interest.

How you answer those questions is up to you. You might scribble notes on a scrap of paper, or create a series of cards, or maybe you could use OneNote. But don't use PowerPoint just yet, as you're more likely to get into a muddle than save time.

Once you've got your essential points sorted, you can put them into an engaging



▲ Putting together a professional-looking presentation needn't be painful

'narrative' order. Narratives give a logical or engaging flow to the stream of information you intend to present. The flow of your presentation might literally be how a strange situation led to the breakthrough you're able to explain, or the narrative might just give some context.

The best narratives begin before the presentation even starts, whether that's pre-event hype or the mood music and pre-talk animations or first slide. Take a look at Apple's online-only WWDC 2020 keynote (see tinyurl.com/393projects) – the music is uplifting and the imagery inspiring, making us excited about what we're about to hear. Tim Cook's introduction then outlines why WWDC is too important to let Covid-19 disrupt it, providing context for why this

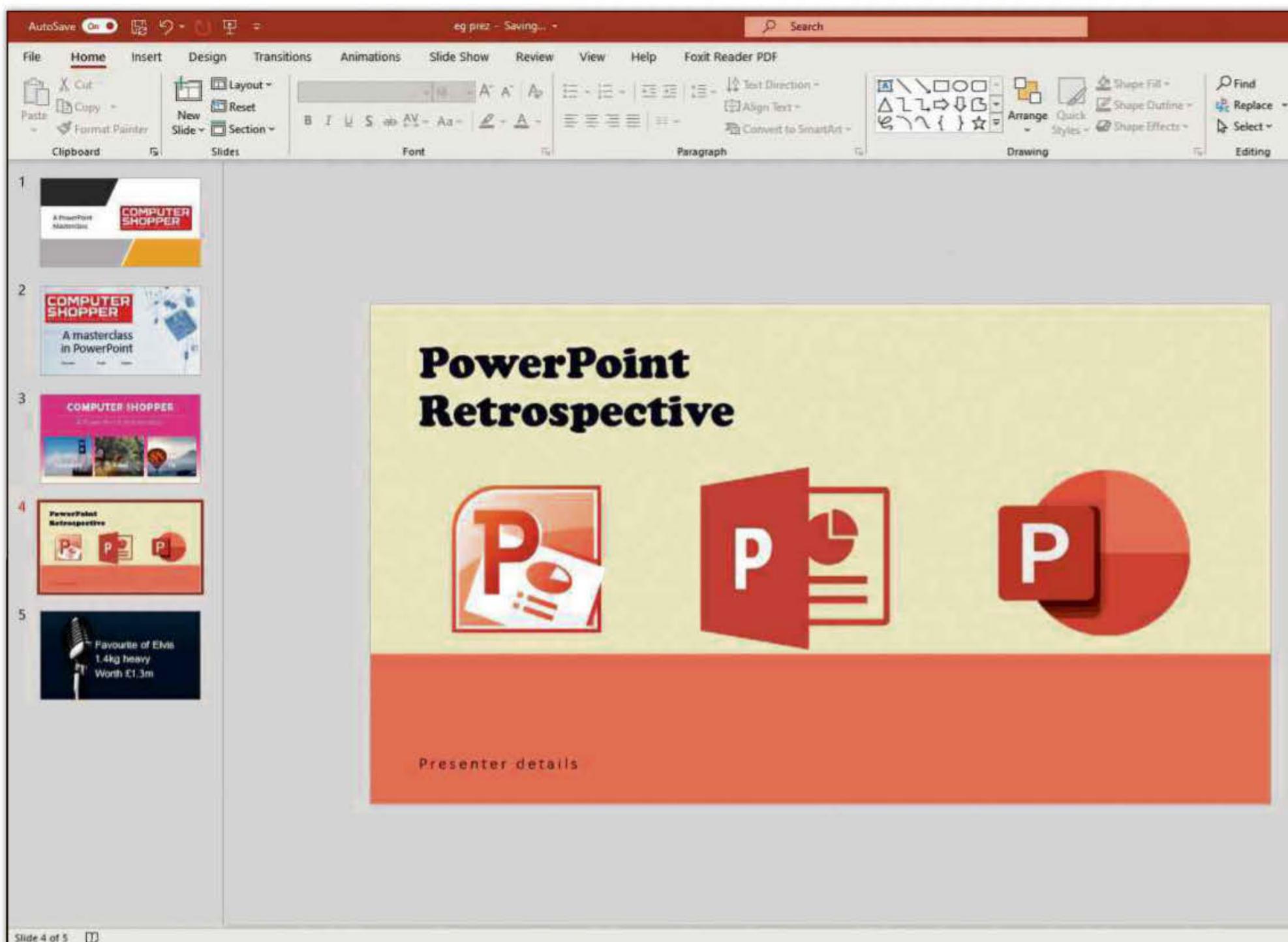
strange online version is even happening, and then talks about various other challenges Apple has tackled. Suddenly we've moved from pre-hype to context to being eager to hear about all the clever and interesting ways Apple might have solved some major problems. The perfect intro.

TEMPLATES AND DESIGN

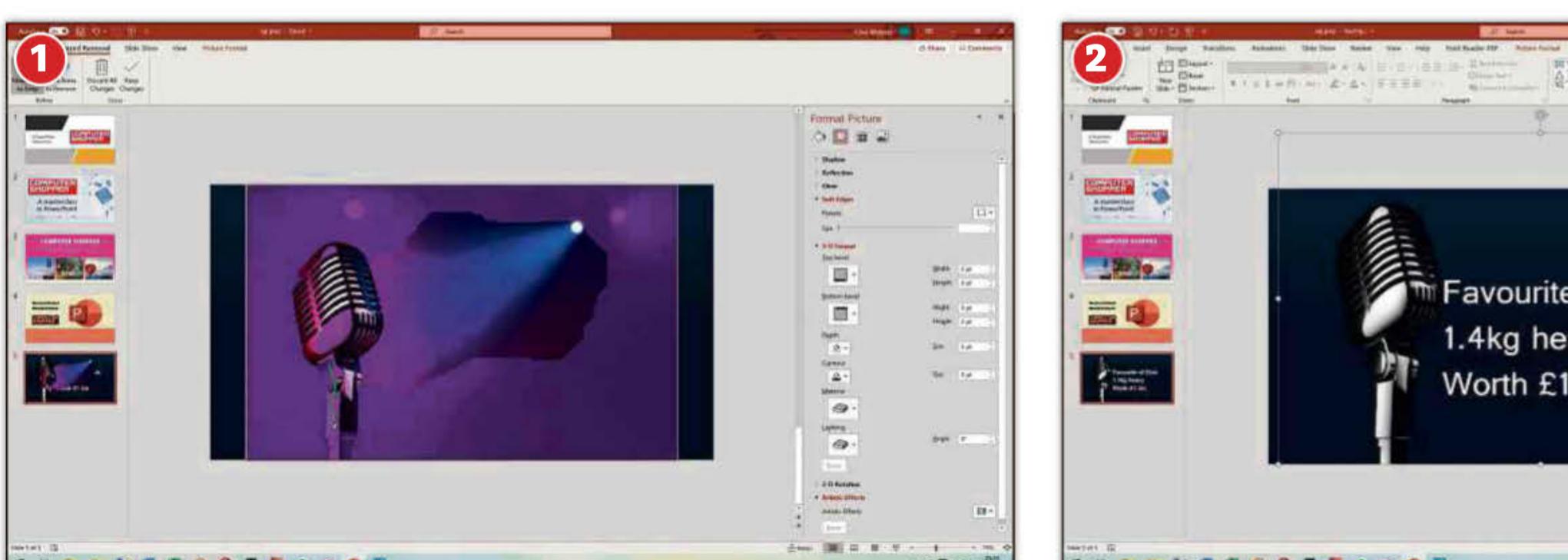
You might have been given a template by your marketing department, but if not (perhaps because you don't have a marketing department), setting up a template is worth doing. You'll need three: an introduction slide, a section slide and a details slide.

Start with your introduction slide, as the content of this is easy: title of the presentation, relevant logo or image, and your

▲ Use bright colours such as this Plastic Pink (hex code #FF1493) or a vibrant purple (try #8A2BE2) for a fresh and youthful look



▲ Pastel, muted and earthy colours are still in fashion, and are more appropriate for certain subjects



▲ We went from blank slide to the final design in roughly five minutes, using the built-in stock image library and the Remove Background and Recolor tools 1.



be presented as phrases not sentences, and certainly not paragraphs. Bullet points are unnecessary, and text itself can look interesting without any images on a slide.

As an example, we created the slide below ③ in PowerPoint 365 in a few minutes. First, we created a new blank slide, opened the Design tab and selected Format Background to set a blackboard-style gradient of a

Version check

PowerPoint was launched in 1987, but it wasn't Microsoft that made it. Instead, Microsoft acquired its publisher, Forethought Inc, for \$14m three months after PowerPoint hit the shelves. The first Microsoft version of PowerPoint was part of the Office suite for Macintosh in 1989 and was launched in the same way for Windows a year later.

The first incarnation of PowerPoint helped us design overhead projector transparencies; version 2.0 could create colour 35mm slides, delivered by mail order once the files had been sent via modem to an imaging centre. It was only the third version of PowerPoint (launched in 1992) that could output directly to a digital projector or large screen. In 1993, PowerPoint was integrated into the Microsoft Office development stream and started to share common interface features with other Office apps. PowerPoint 2007 joined its Office stablemates in adopting the Ribbon interface.



POWERPOINT 2010

Introduced Sections, to organise longer presentations, and much improved image and video tools. You could now insert or embed online video, and edit images or videos within PowerPoint. The Save As Video option was also useful to prevent compatibility issues.



POWERPOINT 2013

Slides were now widescreen by default, and online collaboration was added. The interface supported multitouch commands, and the Presenter tool was enhanced to help you track and rehearse your presentation. Clip art was relegated to an online-only choice.



POWERPOINT 2016

The Tell Me toolbar helped us quickly find features, while the Morph transition (for 365 subscribers) made slide-to-slide animations slick and easy. Zoom allowed non-linear presentations in PowerPoint for the first time, while integration with OneDrive made real-time collaboration possible, and the Presenter View became even more useful.



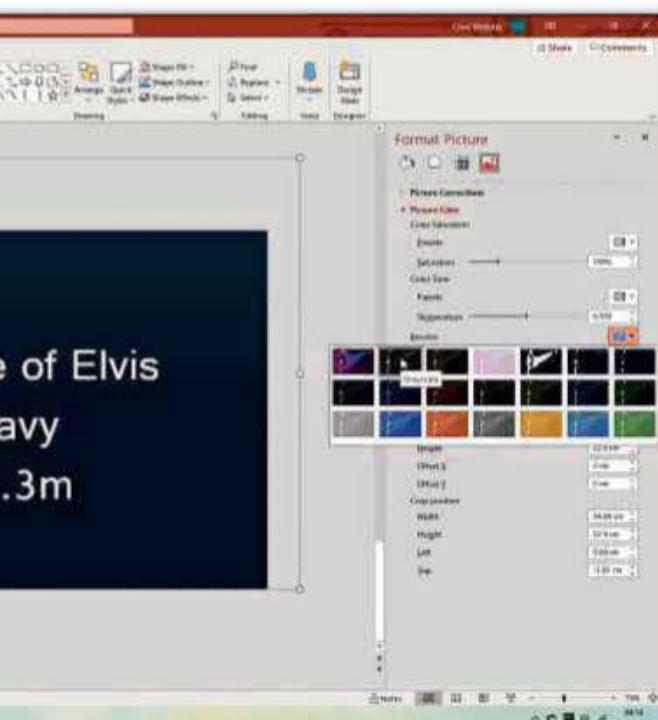
POWERPOINT 365

Upgrading the Tell Me toolbar to an AI-assisted search tool made finding options even easier, while the Design Ideas tool suggested more interesting layouts and graphics. A 365 subscription also unlocks a stock library of images, icons and other graphics.

charcoal-blue that lightened toward the top of the slide. We then opened the Insert tab, selected Pictures and then Stock Images. We found an image of a 50s-style microphone in a purple-lit club. We selected this and PowerPoint dumped the image on to our slide.

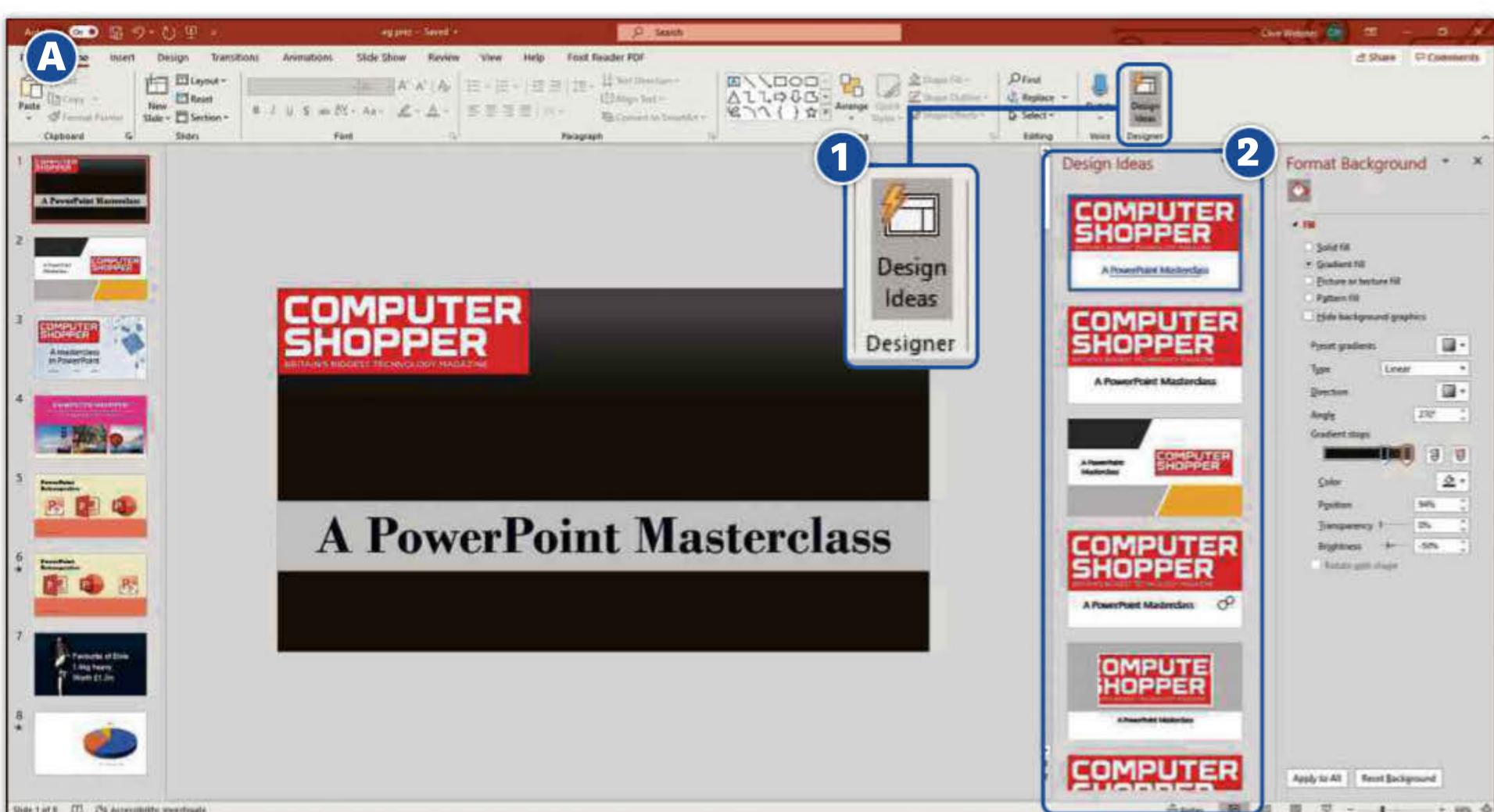
We didn't want the purple club background, just the microphone, so we used the Remove Background tool of the Picture Format tab ②

(which only appears when you select a picture). The tool lets you scribble on parts of the image you want to keep or remove; you don't need to be precise, as PowerPoint does a great job of working out which parts of an image you're trying to highlight. However, the microphone still had a purple hue, so after 10-20 seconds 'cutting out' the mic we also applied a Recolor from the Format Picture



Finally, the 3D Rotation tool gave our text a visual lift ③





▲ The Design Ideas button ① suggests a list of alternative layouts ②, either rearranging the elements currently on your slide or introducing whole new elements

pane. The greyscale filter maintained the shine and gave a more neutral tone ②.

Then we added the text. PowerPoint wanted us to use bullet points, but we deleted them and just had the three (factually dubious) phrases hanging in the air. However, plain, flat text looked dull, so we applied 3D Rotation to 'twist' the text and make it more visually interesting ③. A bit

of fiddling later and we had a decent enough slide for our five minutes of effort.

COOL TOOLS

We've already highlighted some of the cool tools of PowerPoint 365. If you're a big PowerPoint user, a 365 subscription unlocks a lot of features to make high-quality presentations a doddle.

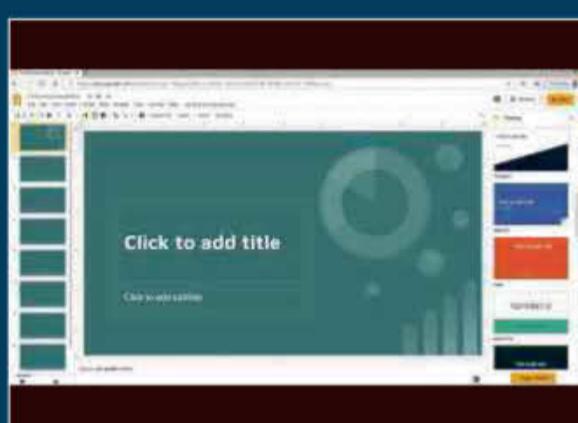
Designer (or Design Ideas) can help less experienced designers. The tool suggests many options to rearrange the elements of a slide, either just using what you've already got or introducing other elements. We tried a horrendous design ④ and Designer immediately produced the revised design shown ⑤, which gave us something much better to work with.

Alternative choices



APPLE KEYNOTE

Free • MacOS, iOS, web
Apple's Keynote is a direct rival to Microsoft's PowerPoint, and offers similar features. While many Mac owners will argue they use it for the slick integration with other Mac software, we suspect the fact that it's pre-installed with macOS for free also contributes. Keynote Live lets you broadcast to other people's devices (either over the internet or in the room), while you can control your presentation via the Keynote iOS app.



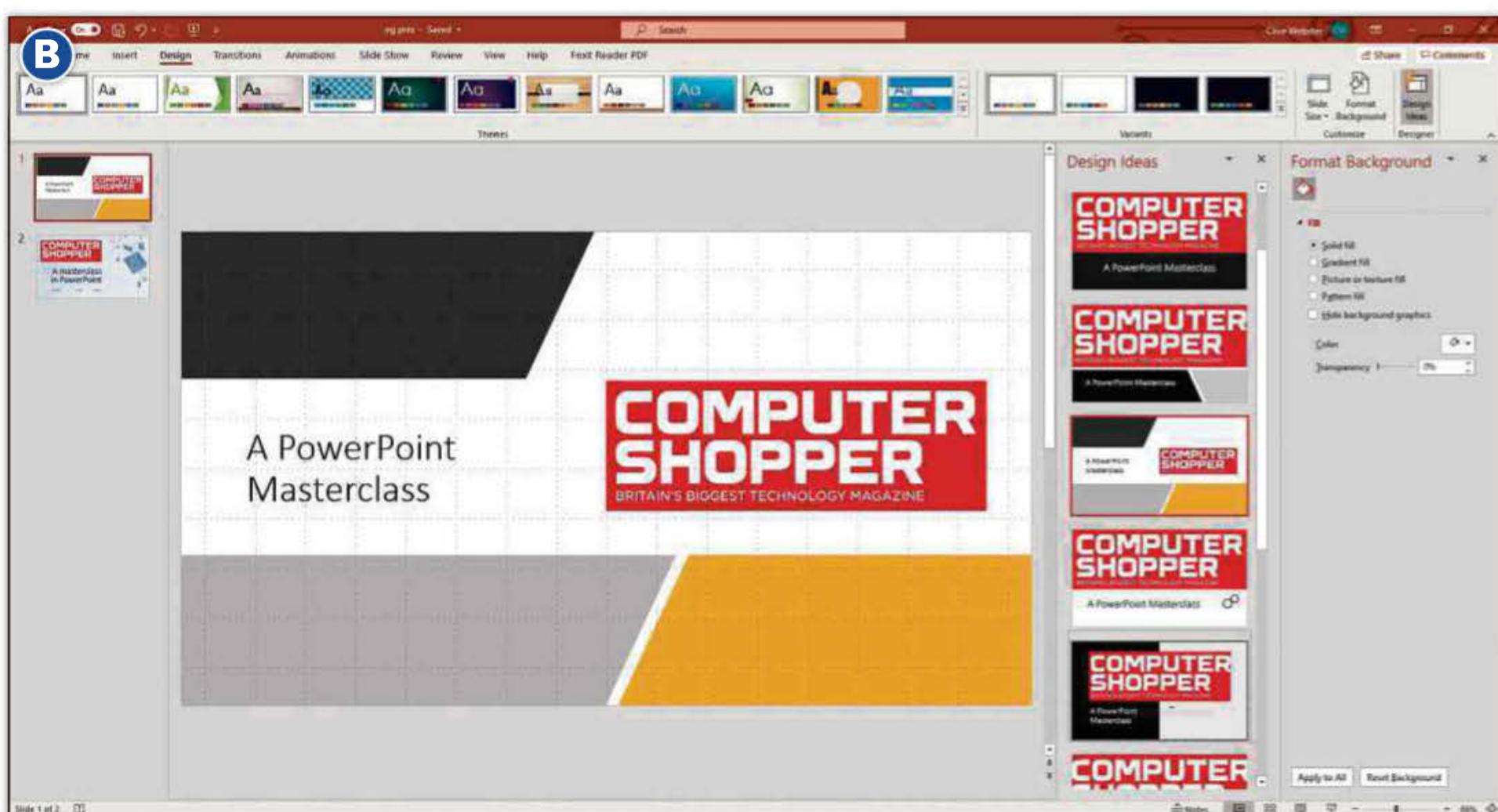
GOOGLE SLIDES

Free • Web
It's easy to see why Microsoft had to reform itself over the last five years, but Google is still a threat to the Redmond tech giant. Slides is a clear example of this: a powerful, open, connected and free slideshow creator, and all you need is a Google account to start making impactful presentations. Slides includes useful presenter tools, and you can provide a link to your audience to allow them to message you directly as you talk.

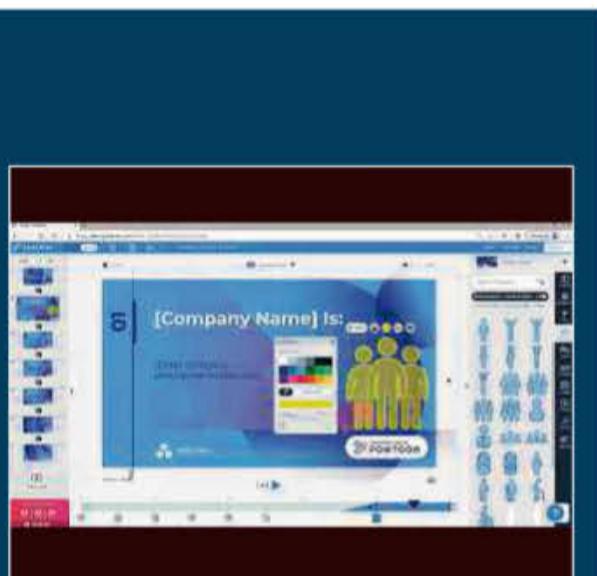


PREZI PRESENT

From £7 per month • Web
Prezi Present breaks the traditional slide-by-slide method of presenting in favour of a guided tour through a mind map. A 'canvas' lets you map your thoughts in a single cloud of interconnected ideas. Present embeds those thoughts and ideas in slick animations and graphics, so it's easy to follow as you delve into the details of one branch of thought before zooming back to show (literally) the big picture again. Head to prezi.com to see it action.



There are also a range of very impressive animations that you can apply with a few extra clicks. For example, you can introduce elements of a chart separately. Once you've inserted your chart, open the Animations tab and apply an animation to the whole chart. The Effect Options button should then activate. Click that and select the By Category sequence option, letting each element act as a separate object.



POWTOON

From \$228 per year • Web
While not a presentation tool as such, PowToon is worth considering as it allows you to use a presentation-like approach to create animated presentations and explainer videos. Now think back to the opening paragraphs of this article: would a quick explainer video help your audience understand a complex issue before you actually talk to them? Possibly. Especially if you often talk to large groups, in which case the price might be acceptable.

Another interesting feature (in PowerPoint 2016 onwards) is Zoom. We mentioned that PowerPoint has been criticised for forcing a linearity to presentations that might hinder your efforts. Zoom solves this by letting you create a connected branch structure of slides. To use Zoom, open the Insert tab and click the Zoom button. The Zoom Summary option is essentially a 'landing page' or homescreen, while the Section option links slides, and the Slide option allows you to insert a standard slide so you can drill down into that topic.

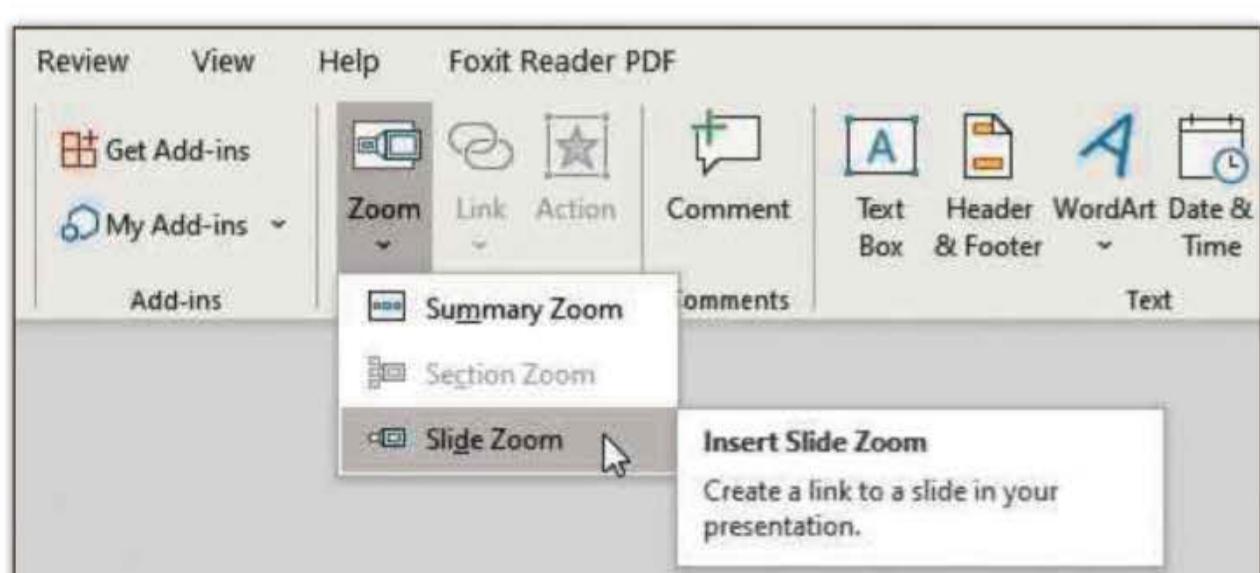
Zoom isn't as slick as Prezi Present, however. Morph is also worth using if you like some pizzazz in your presentations. Technically, this is a transition effect, but it looks more like an animation effect. To use Morph, duplicate a slide and move some elements about on the second slide. Then open the Transitions tab and select Morph; the tool will automatically animate the changes from the first slide to the second. This can be applied to images, shapes, objects and even text.

Once you've made your presentation, don't forget to practise delivering it. PowerPoint has a wealth of tools to help here, too, with further features promised soon. For example, if you've got a lot of technical information to convey, you should use Notes and Presenter View. Notes allow you to put annotations and reminders on slides that only you will see, so the presentation on the main screen will be clutter-free. PowerPoint also has tools to help you practise, including timing your talk. You can use the Present Online tool to invite others to join you virtually, or just share your screen through whichever videoconferencing application you've settled on.

NEXT MONTH

RECYCLE A PC

We show you everything you need for a tech spring clean, from wiping hard disks to hardware donations



It's easy to miss in the Insert tab, but the Zoom tool (introduced in PowerPoint 2016) lets you create branching presentations rather than rigidly linear ones

HOW TO TAKE ONLINE PAYMENTS

In the second in our series of articles aimed at helping high street shops and small businesses sell and offer their services online, Madeline Bennett explores the various options for accepting internet payments

Following on from our article last month on moving your business online (*Shopper* 392) – something many smaller companies and individuals are looking to do in the wake of the coronavirus pandemic – here's our guide to setting up and taking internet payments.

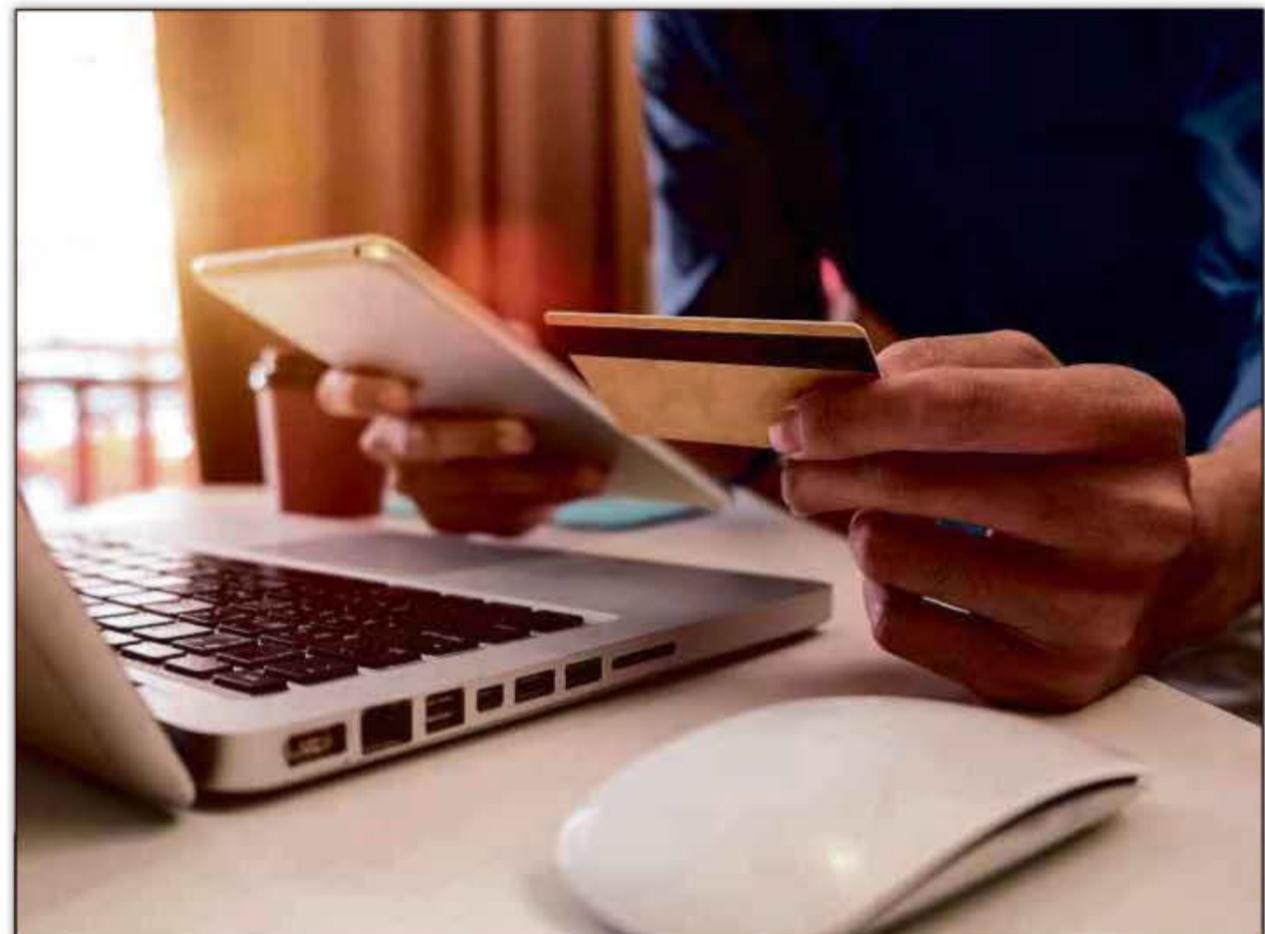
Despite a decrease in Covid-19 cases across much of the world, many people are still choosing to stay at home due to concerns about going back to normal life, with a knock-on impact for shopping on the high street and working in offices. Hence there has been a significant increase in online sales over the last few months. Take high street stalwart John Lewis: the department store expects between 60% and 70% of its sales to be online this year, compared to 40% in 2019. In fact, the pressure from the internet is so great, John Lewis is even planning to drop its renowned and much-loved 'Never knowingly undersold' price pledge, a slogan that has been in place for almost 100 years, since 1925.

For those firms already trading online, or those of you new to web sales that are trialling it based on our previous 'How to move your business online' guide, having a web proposition is just the first step. The next major decisions will be how to actually take your customers' cash; what the best online payment options are for your outfit; and how many different payment systems to support.

HOW TO GET YOUR SITE READY FOR PAYMENTS

Nick Corrigan, UK&I managing director and president at payments specialist Global Payments, notes, "If businesses are already accepting payments online, now is a great time to ramp up. For those that aren't, this is the optimal time to start."

"To establish and set up an online presence, two things typically need to be



done: build an e-commerce website from scratch, or utilise a third-party software, commonly referred to as a shopping cart. Building an e-commerce site from the ground up is, of course, a much larger undertaking in terms of time, money and technical capability. Conversely, the use of a shopping cart lends itself to faster and easier implementation."

There are benefits to each option, which can be explored with payments partners, but in either scenario, any online payments solution needs to come equipped with robust fraud prevention capabilities and strong data security features to lower potential risk and better protect the business – more on this later.

While payment processing is often considered by businesses to be simply a box to be ticked as they set themselves up online, it plays a much more vital role than that. Looking beyond the payment-processing capabilities, it's often the value-added services that payment providers offer that can make you money.

These can boost, protect and create revenue, as well as reduce internal costs.

Different payment service providers' (PSPs) unique offerings can bring a host of benefits, including fraud protection, chargeback management, tax remittance and comprehensive reporting, to name just a few.

Ed Hayden, senior business development manager at all-in-one payment platform BlueSnap, advises, "When looking at the broader picture of your balance sheet, the right PSP should strive to boost revenue, reduce friction in the checkout process and streamline many of the manual back-office processes involved in reconciling payment data."

"The potential for online businesses to operate across borders and in new markets is a good example of where PSPs can really help to maximise profit from a new revenue stream. Trading internationally can be an overwhelming prospect if you are new to e-commerce, but picking the right payment provider can dramatically help to simplify that process and maximise your margins."

CHOOSING A PAYMENT PROVIDER

Unfortunately, one size doesn't fit all when it comes to payments. It's important to select a PSP that suits both your business model and your customers. For instance, businesses that operate within the retail industry will need to ensure that their PSP has an integration with the shopping cart or e-commerce platform

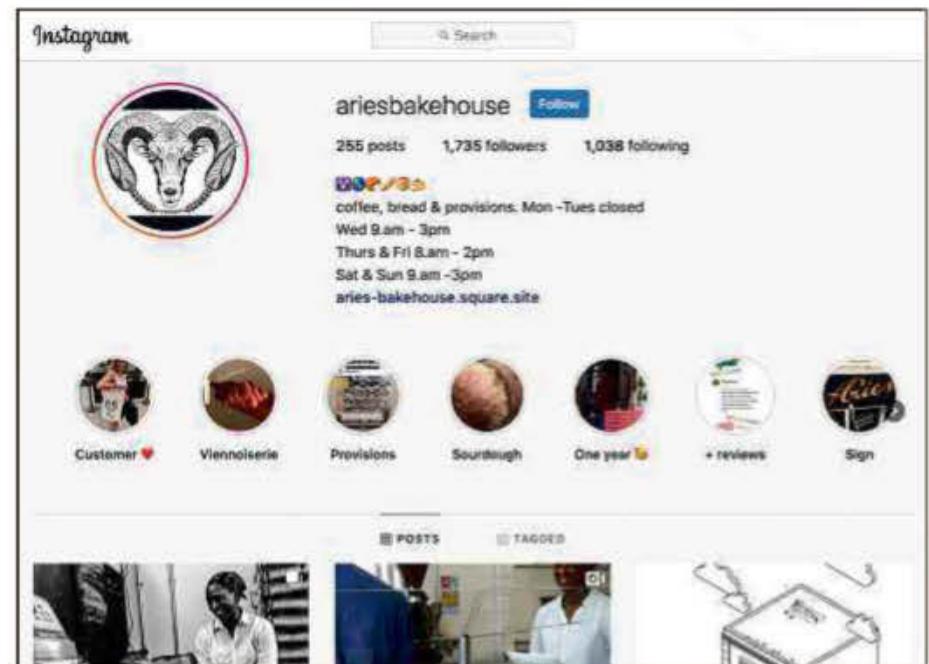
The screenshot shows the BlueSnap homepage with a blue header. The main headline reads 'The All-in-One Payment Platform for Marketplaces'. Below this, there are two orange buttons: 'Accept Payments' and 'Payments for Platforms'. A smartphone icon displays a sample marketplace interface. At the bottom, there's a section titled 'Powering the Payments for' followed by logos for 'WHEELS UP', 'Finalsite', 'VERACROSS', 'ripples', and 'Cakemail'. A small note at the bottom left says 'All-in-one payment systems such as BlueSnap are ideal for small businesses'.

Case study: Aries Bakehouse

Aries Bakehouse, a Brixton staple, has been run by Jackie and her partner Les for the past three years. Jackie comes from a family of small business owners who've always lived in Brixton. Aries Bakehouse is known for its selection of artisan breads, pastries, cookies and decadent cakes.

When lockdown began, Jackie needed to adapt to keep the Bakehouse's doors open while operating and serving customers in line with the government rules. Every part of the business needed to be reviewed. As produce and pantry items were scarce at the start of lockdown, Jackie opted to source local produce, such as beers and other goods for her customers.

Additionally, as shoppers were opting to buy more goods online, Jackie and her team set up a Square online store in May to accept online orders with Square. Prior to this, Jackie had never traded online before – however, the online availability was a hit. Customers have been enjoying the convenience of being able to order online,



and either collect or have their goods delivered. It's something that Jackie and her team are planning to continue to offer customers in future as it has proved to be a roaring success.

that they are going to use. Alternatively, businesses that operate a subscription model must select a provider that can process recurring payments.

"In terms of customers, when moving online your business potential expands tremendously as you are able to reach new segments of a domestic market, or new markets altogether, and your provider's offering should reflect the requirements of customers in those markets," Hayden adds.

"While it sounds like a daunting task to identify and evaluate your requirements against the many PSPs out there, it's actually really easy to find a provider that suits you. They should all have information online on their key functions, partners and integrations, which you can use to identify what will work best for your individual business."

ALL SQUARE

For small firms and individuals wanting an option to offer payments on the go, Square offers a portable card reader. Square's Online Store also allows all types of businesses to sell online and send orders to customers.

Square allows businesses to accept payments any way they want, with the online payments system assuring safe and secure transactions, enabling small businesses to manage cashflow through real-time sales and inventory updates. There's also the option of requesting digital invoices, which can be easily tracked through the Invoices app.

Square also provides marketing features that allow small businesses to reach their customers by raising search engine rankings with SEO tools, insight on how to sell successfully on social media, and how to build an email list.

Helen Prowse, European communications and policy lead at Square, says, "If your small

business is just starting out, Square Online Checkout could be the right option for you. You can create an instant link for your product without the need for a website. This will allow you to accept payments, as well as integrating your online and in-store sales so you always know what you have in stock, what your most popular items are, and when you need to start resupplying your inventory.

"If your business offers a variety of services and products, then setting up a Square online store may be worthwhile, as it allows you to expand your business immediately. You'll be able to alert customers to new products and service offerings, while also informing them of sales or promotions."

PAYMENT PITFALLS

There are some pitfalls to avoid when choosing your payment partner. Choosing a payment provider based on processing rates alone could mean you miss out on the value-added services that can minimise internal costs and boost revenue, such as built-in fraud providers or digital reports.

"Payment acceptance is complex and it can create real headaches if things go wrong, and so I would always advise businesses to

opt for PSPs that provide around-the-clock support," explains Hayden.

"Issues can occur at random, so continuous support is invaluable in order to meet customer expectations. This becomes even more important when you are working across different time zones."

You should also always be continually testing your payment processes; it's not the end of the story when you receive your payments. Customer requirements are forever changing, and so testing your own checkout process is key to success, be that increased sales or customer retention.

"A simple way to do this is to use the sandbox – or test – accounts that all PSPs provide, to see the checkout experience that your customers have for yourself. Having cumbersome and complex checkout procedures leads to a higher rate of 'checkout abandonment', where customers fail to complete a sale," Hayden notes.

"This is a real problem, but by testing your checkout flow you can tackle this head on."

SECURE ONLINE PAYMENTS

Using technologies that authenticate the person paying, such as through a fingerprint or password, increases payment security. Digital payment wallets, such as Apple and Google Pay, are great options for this.

"Customers can choose to allow merchants to save their payment details on file, and this can strike the right balance between data security, customer authentication and a seamless end-to-end payment experience, particularly for businesses a customer is likely to buy from again," Corrigan explains.

"Fraud prevention needs to be built into any payments system, but with new technologies it doesn't need to come at the expense of fast and easy transactions." ☎



↑ The Square Reader lets any business accept cards, Apple Pay and Google Pay

Zygote

Thousands of free Wi-Fi access points have been installed across the Philippines to help kids with home schooling. Yet **Zygote** can't even get a decent signal in central London

ROAD RAGE

Ben Rose sold his Mazda CX-5 just before Christmas. He is a careful man who values his privacy, so he made sure to trigger the factory reset on the built-in computer and satnav, and erase his personal data before the next owner took over.

The data included all his contact details, and records of his destinations, journey routes and calendars. It also included a debit card transaction for a live traffic alert service from TomTom. He followed the instructions in his owner handbook, and was satisfied that his records had been shredded before handing the car over to a dealer.

Nothing then happened throughout the long months of lockdown, until Mr Rose discovered that his debit card was being billed by TomTom for continuous use of their 'World' services. Naturally, he complained to both Mazda and TomTom, and asked why the on-board computer had told him that his data had been erased when clearly it had not, and how come he was being billed for services associated with a vehicle that he didn't even own.

TomTom admitted that the records had not been erased and remained on the database, whereas Mazda continued to insist that his data could not have been passed on to the new owner. Zygote notes that the denial came from Mazda's Public Relations Director, with the amusing name of Mr Fudge. A career in politics surely beckons.

ROAD RAGE II

Four Uber drivers were murdered in the Brazilian city of Salvador when a brutal hit squad was called in by a local gang leader. It was a revenge killing triggered by the gangster's mother. Not because the old lady had been slain, but because an Uber taxi she had called never turned up.

On the other hand, taxi drivers themselves can get very upset when somebody tries to muscle in on their territory. Gokada is a popular transport-sharing app founded by 33-year-old tech entrepreneur Fahim Saleh. Until very recently, he lived in a luxury New York apartment. Saleh started his career while he was still a student by launching a hoax phone-call app called prankdial.com, which he turned into a \$10m business.

He then moved on to design a precursor of Uber, and made \$100m from an app to exploit three-wheeler taxis across Nigeria. It is certain that he made some very nasty enemies by cutting out taxi cartels all over the world via online bookings, because his body was found by his sister in the living room of his apartment, which occupied the entire seventh floor of the swanky Lower East Side block. His head and legs were found elsewhere.

PESO THE ACTION

The Philippines boasts a population of 109 million souls spread across its seven thousand inhabited islands, and their government's reaction to the pandemic has been one of the strictest and most proactive on the planet. For example,

schools will not reopen until a vaccine for coronavirus is found, meaning that home education needs to be sorted out pronto.

Billions of pesos have been allocated towards a Free WiFi For All programme, with 5,000 sites already installed and another 20,000 to go. Sites include all public offices, health centres, libraries, transport terminals, plazas and parks. Meanwhile, Zygote is still unable to get a half-decent Wi-Fi connection in Trafalgar Square.

DA DA DA

Patriarch Kirill is the leader of the Russian Orthodox Church. In an interview on state-owned channel Rossiya-1, the holy man has let rip against "this worldwide web of gadgets" because they can "gain control over mankind". Unlike your official sponsors at the Kremlin, eh, Kirill? "Every time you use your gadget, somebody can find out exactly where you are, exactly what your interests are and exactly what you are scared of," he preached. Unlike the all-seeing, all-knowing almighty God, eh, Kirill? "Such control from one place forebodes the coming of the Antichrist."

Readers will be interested to know that Patriarch Kirill is a good mate of Vladimir Putin. It takes one to know one.

WHAT'S APP DOC

A very important decision has been made by the US Food and Drug Administration. They have authorised doctors to legally prescribe EndeavorRX to treat attention deficit hyperactivity disorder in children between the ages of eight and 12.

The reason this decision merits inclusion on Computer Shopper's back page is because EndeavorRX is not a pill or a potion for treating the mental health condition. It is a video game, and as such is the first computerised entertainment ever to be put on prescription.

After no fewer than seven years of clinical trials involving 600 children who suffer from the condition, a team of doctors has declared that, "after playing the target-collecting game for 25 minutes a day, five days a week for four weeks, one third of children treated no longer had a measurable attention deficit on at least one measure of objective attention".

Zygote would like to point out to the Food and Drug Administration that the doctors who undertook this study work for a company called Akili Interactive. Akili Interactive is a manufacturer of video games. One of their titles is a video game called EndeavorRX. Just saying. 



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