



Developer

The PlayStation Developer's Newsletter

<http://www.scee.sony.co.uk>

Issue 4: September 1996

New Tools Exclusive DTL-H2500 Development Kit

Like the old DTL-H2000 Development Kit, the new DTL-H2500 runs on PCs.

Essentially a lower cost version of the DTL-H2000, it consists of one main PCI board and a 'mini' board - the latter hosting two sockets for Development Kit Controllers.

Being PCI based, it is designed to be more compatible with existing PCs and the standard

consumer PlayStation (with no need to run snpatch.cpe). Whilst the main board requires a full PCI slot, the 'mini' board simply needs a space in the back of your PC. The system includes a new function key driven console shell.

Its accompanying software comes on one disk which contains a DOS driver and utilities. The DTL-H2500 runs under



The DTL-H2500: Bet you can't wait to get that silicon in your machine

DOS with a Windows '95 debugger in development.

Developer Support have had three early versions up and running for a few months. A guide

to installation and running (and in particular any problems associated with this) is in a file on the BBS, called 'newkit.zip'. Of course, you won't need to use it. See also: *Postcard from Japan* (page 11) for information on the tools coming out of R&D in Tokyo.

STOP PRESS
(28th August 1996)

Known Bugs of DTLH2500

Incompatibility with:

Ami BIOS Intel Endeavour version 1005CB0

Suggested remedy:

Install an earlier version (version 1002CB0 is known to work correctly).

Home Development System: The Black PlayStation



The black PlayStation 'Net Yarozei' project, unveiled at E3 last May and at the Developer Conference in April, will be coming to Europe soon.

The black PlayStation is a 'home' development system, costing a few hundred pounds which will enable anyone to make demo

games for the PlayStation.

HOW?

People registered with Sony for the project receive some software to load onto their PC and an exclusive black PlayStation. Using the software, they can write games programs to download and run on their black PlayStation.

INTERNET SUPPORT

Support will be based around the Internet, with mailing lists and a web site providing information from Sony, inter-developer contact and an opportunity for everyone involved in the project to show their own demos.

The project is up and running in Japan where each project member has their own home page on the Net Yarozei web site. This site is password protected but the

Net Yarozei project is covered in SCEI's web site in Japan - <http://www.scei.co.jp>.

WHO IS IT FOR?

The project is aimed at anyone who is interested in dabbling in PlayStation games making. There are lots of people who would like to play around with the PlayStation to see what they can

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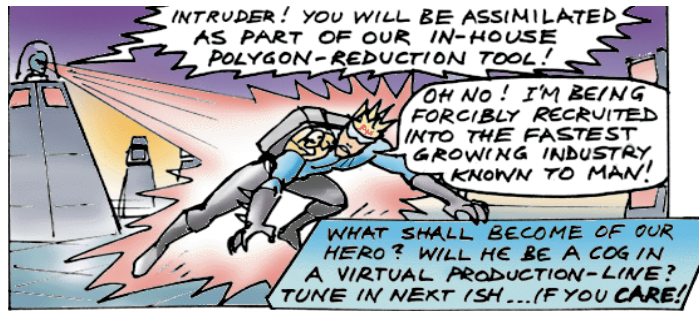
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PRM No More

Left hanging in mid-adventure, Polygon Reduction Man is no more. As Rolf Mohr, the creator of PRM left SCEE, so his character ceased to go on...forever suspended in the grip ray of the evil Sentinel.



Polygon Reduction Man: All his polygons reduced - permanently

◀ Continued from page 1

do but find that, as they do not work for games companies, the financial commitment of a full PlayStation Development Kit has so far prohibited them from getting involved. This project should provide a vehicle for these people (students, programmers, gamers) to experiment with the PlayStation and gain first hand experience of the hardware.

NO MORE DEV KIT?

The black PlayStation does not have the capacity of a PlayStation development kit, proper; it has limited tools, there is no access to the CD or PC file system - code must run in 2Mb, and you have to download code from a serial port on a PC, making the whole process fairly slow. Thus the black PlayStation can't really be used for serious development.

BE FIRST ON THE MAILING LIST

Be first for info on the project by mailing SCEE at: ps_yarozei@interactive.sony.com

Similarly, mail SCEE at this address with any ideas on what you would like to see as part of the project and especially the web site.

The Net Yarozers could be the games developers of tomorrow. Watch your backs.

Developer Support Runners

(ORDER IN LENGTH OF SERVICE):

- 1 - Sarah 'Benne' Bennett
Production Co-ordinator for Tools Ordering
Thorough-bred filly but can be highly strung.
- 2 - David 'Hasselhof hair-a-like' Coombes
Technical Support
Expected to be exported to SCEA at any moment.
- 3 - Laura 'Slapper' Smith
Technical Author
Should be out to grass. Destined for the glue factory, for sure.
- 4 - Paul 'Pullman' Holman
Developer Support Manager
Looks like a stayer.
- 5 - Vince 'The Don' Diesi
Technical Support
Italian Stallion, bred on cucumbers.
- 6/7 - Colin Hughes + Michael Braithwaite
Tools & Libraries Engineers
'Hughesie' now a father and currently racing in Japan.
'Braithers', understated majesty.
- 8 - Tim 'The Timp' Flett
Production Co-ordination Assistant for Tools Ordering
Unkempt mane, in need of trim.
- 9 - Dave 'Virus' Viropen
Technical Support
Prone to injury, Irish stable.
- 10 - (NEARLY NEW) - Jason 'Maestro' Page (See picture, right.)
Musician & Sound Engineer
Fairly new to SCEE but been round the course a few times, well known breed of Essex stock.
- 11 - (NEW) - Mal 'Ginge' Duffin (See picture, above right.)
Technical Support
Red coat, another from Irish stable, good in the wet.
- 12 - (BRAND NEW) - Lewis 'Bodie' Evans
Technical Support
Of Welsh stock, good on all terrain, clever money is on him.
- 13 - (JUST ARRIVED) - Richard 'Hack' Milner
Producer, Special Projects
Always crosses the finish line, one to watch out for.



Mal Duffin, Technical Support ginger style



Jason Page, Musician & Sound Engineer

Goodbye

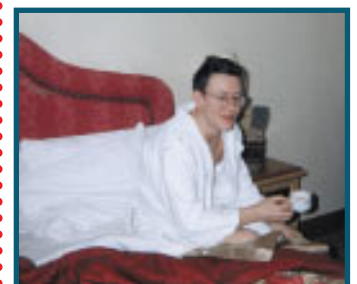


Jason Perkins, (former) SCEE Account Manager, hard at work

Mr Perkins, sometime Account Manager to European PlayStation developers, has now left SCEE for pastures new. We are assured that his departure coinciding with pictures of him with a young colleague (shown below) turning up at SCEE offices is pure chance. He did in fact leave so he could 'spend more time with his wife and family/explore his creativity/concentrate on his solo career/due to artistic differences'.

Mr Perkins explains the photos thus: "We simply shared a bed so that we could save on Sony expenses". Already replaced by **Alistair Bodin**, and almost forgotten by most, he will be sadly missed by Sony's accountants.

**Please circle your preferred catch-all excusehe has used them all.*



Right half of the picture:

Mr Perkins enjoys an innocent morning cup of coffee



Left half of the picture:

His young colleague, 'Jim', 22, sleeps on cost-effectively

CD Loading Times & How To Improve Them

'Please Wait While Loading' - a much reviled request, leading to frustration and irritation in the gameplayer.

Given this, it is important to consider CD loading times when making a game. Here I describe the four basic ways in which the CD loading times can be improved. These are to: minimise seeks, organise data, read asynchronously and avoid speed changes.

MINIMISE SEEKS

When reading a file from CD it's first necessary to seek to that file (i.e. to move the head of the CD drive under the required sector of data on the CD). As this is a mechanical process, it can take a relatively long time. Although a necessary action, there are seeks which occur "behind the scenes" which can be eliminated and hence speed up the loading process. Elimination can be done with the library routine `CdSearchFile()` which is used to obtain file details

three seeks before the file can be read. (See fig1.)

One way in which to get around these two "extra" seeks (and hence save time) is to hard-code all the file locations. This can be done by first processing the .CCS file, output by the CD-GEN software, to create a header file listing all these positions and then re-compiling your code with this header file. (See figure 2 - a very basic version of this utility is now available on the BBS in the PSX TOOLS area - called CCS2POS.ZIP.) A similar technique can be applied to .MAP files which are output from BuildCD.

DATA ORGANISATION

Carefully organised files is actually another method of minimising seeks and hence speeding up data streaming. Seeks of approximately +/- 100 sectors require only the rotation

of the CD head. In order for this to be utilised, data should be organised into contiguous blocks. It may be nice, neat and tidy to have all your textures in a TIMS directory and all your

By

such as absolute sector address and file size.

Due to memory restrictions and time limitations, `CdSearchFile()` caches the file details of only one directory. Hence the process of finding the location of a file is as follows:

1. Seek to the directory table of contents (one of the first sectors on the CD) and read this sector. This gives the absolute sector address of the table of contents for each directory on the CD.

2. Seek to the required directory's table of contents and cache the file details of that directory. This will give the absolute address and file details of all files in the directory.

3. Although not part of `CdSearchFile()` a seek is still required to move the head to the start of the required file.

So, there is a possible overhead of

models in a TMD directory and all your data files in a DAT directory, but this can cause delays in the loading of related data. (This can be seen in figure 3.)

ASYNCHRONOUS READ

Of the many ways to implement asynchronous reads, I have included two: the first using the low-level library routines, the second the higher level `CdRead()`. In the latter example, I have also included how to handle a read error. A similar technique can be applied to the first example, although more thorough error handling can be achieved in the callback routine.

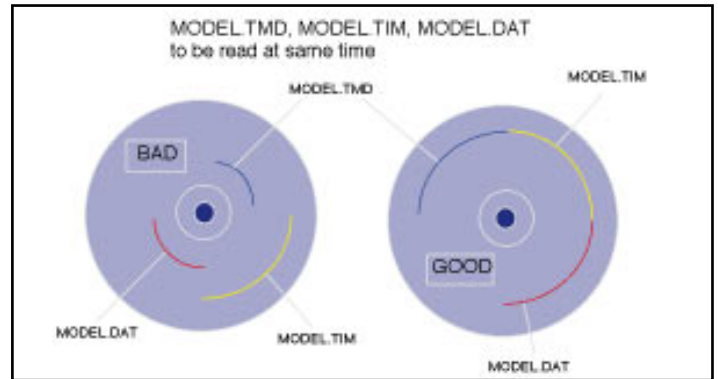


FIG 3: Careful and logical organisation of data can save many seeks in a game

```
...
CdReadyCallback(cbdataready);
CdControl(CdlReadN, (unsigned char *)&fp.pos, 0);
...
while (((padd = PadRead(1)) & PADk) == 0) {
    balls();
    FntPrint("Intr count = %d\n", hit_intr);
    for (i = 0; i < RINGSIZE; i++) {
        for (j = 0; j < 3; j++) FntPrint("%08x", sector[i][j]);
        FntPrint("\n");
    }
    FntFlush(-1);
    opadd = padd;
}
static void cbdataready(int intr, u_char *result) {
    if (intr == CdlDataReady) {
        CdGetSector(sector[rid], 2048/4);
        rid = ((rid+1)&RNGMASK);
        hit_intr++;
    }
}
OR
ERROR:
while( CdControl(CdlSetloc, (u_char *)&fp.pos, 0) == 0 );
if( CdRead(nsector, sectbuf[I], CdlModeSpeed) == 0 )
    goto ERROR;

/* Since CdRead() runs in the background, the program can do
 * another task in the foreground. The current reading status can
 * be modified in CdReadSync().
 */
while ((cnt = CdReadSync(1, 0)) > 0)
{
    :
    /* Foreground routines */
    :
}
```

FIG 4: Two methods to get an asynchronous read

(See figure 4.)

AVOID SPEED CHANGES

The final method of improving the performance of data streaming is to avoid speed changes of any kind. Spin-up and spin-down takes a lot of time, making it inadvisable to have a lot of CD-DA playing with intermittent CD access/data loading. This is because CD-DA plays at sin-

gle speed and data streaming should be implemented in double speed. One solution would be to play XA-ADPCM at double speed in replacement for the CD-DA. Although the quality is inferior, 37.8Khz Stereo XA-ADPCM is very close. Furthermore, it is sacrilege to stop the CD spinning completely and then spin up to double speed. So never use `CdlStop` - use `CdlPause` instead which will keep the CD spinning.

USE OF COMPRESSION TECHNIQUES

Finally, have another look at the data that you are reading from the disk and when you can read it in. One powerful technique is to

Continued on page 10 ►

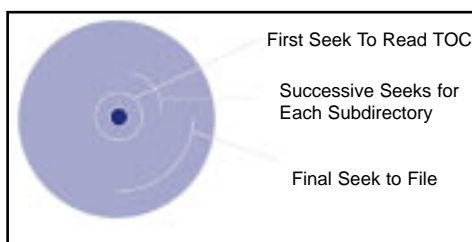


FIG1: Three seeks to find a file

```
Use CDGEN to do a layout (works without CDW-900E)
Put MAIN.EXE last in track 1 (so size can vary)
Save as .CCS file
Write/use a utility to create POS.H with position info from CCS file
Absolute file location appears on the line following each sourcefile
path
Compile with POS.H
Burn CD / Build emulation image
```

FIG 2: Utility to hardcode file locations

Speed Up Your C in 15 Mins

By ALLAN J MURPHY

Not content with hammering the D-Cache in the first episode, it gets another sorting here. Is this some kind of obsession? Tartan Revenge? Too much *Braveheart*?

Ah yes, the humble D cache, I haven't finished with you yet....

So maybe you use a lot of stack space. Maybe you don't like the idea of crashing your program because the stack falls off the bottom of the scratch pad. Or maybe you have some stuff you'd rather keep on there that you access all the time - like the slug statistics in your game, *3D SlugFest '96 (The Interactive Movie)*. But hey, I just make a pointer to the D cache like so:

```
int *slugSpeed = (int *)0x1f800000;
/* Hey, pretty neat eh ? */
*slugSpeed += maxSlugAcceleration;
/* etc etc */
```

Nah nah nah, gawd bless you. Although this is quite quick, it isn't the quickest, because the pointer dereference is slow, *and* the pointer is in normal D-RAM, *and* you have to load the pointer into a register as a 32 bit address, *and* there's a pile of cycles wasted there when you really just want to get right on with it. To be honest, it would be good if you could just declare things straight on the D cache straight

away... but nah, that would be... hold on! Those top scientists and light engineers at SN Systems have come up trumps again with the following world class piece of compiler magic:

```
int slugSpeed __attribute__((section("cachedata"))) = 0;
```

But what does it all mean? All this means is that the integer slugSpeed goes in a special section (what again? another one?) called cachedata. You must initialise the variable or the compiler ignores the section specification. There is one further step to make the variable go in the right place - open up your link file (What do you mean you don't use link files? Come along now.) and go to the bit where it says this.... (see Figure 1), and edit it so it says this...(see Figure 2).

This means the linker makes a new group for the section cachedata, and its address is fixed at 0x1f800000 - surprisingly, this is the D cache. What does this get you? Quite a lot, because now you no longer have the dereference of a pointer to get at the D cache, the variable slugSpeed takes only 1 cycle to read or write. This is miles quicker than dereferencing a spooky old DRAM pointer.

```
text group
bss group bss
< various section definitions, eg section .rdata, text etc etc >
< your libraries and object files at the end>
```

FIG 1: The link file before

```
text group
dcache group obj(0x1f800000) ; add this line
bss group bss
< various section definitions, eg section .rdata, text etc etc >
section cachedata, dcache ; add this line too
< your libraries and object files at the end>
```

FIG 2: The link file after

Episode 3

The D-cache - REVISTED

There's only one problem - the values to which you initialise the D cache variables do not get transferred to the D cache itself automatically. You have to manually copy the data from the executable in main RAM to the D-cache. This doesn't take long (after all, you can only have 1Kbytes of data, max)

and should probably be done right at the start of the program. To save a lot of problems, and because I have a heart of gold, here is a piece of dodgy old assembler to copy the data to the cache, and also the command line to turn it into an object file. I don't know, I'm cutting my own throat. (See Figure 3.)

```
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
; (C) Sony Computer Entertainment. All Rights Reserved.
;
; Name:      CACHE.S
; Author:    Allan J Murphy
; Date:      21/11/95
;
; Description:
; Simple function to copy data from inside cache section in an executable
; to the data cache where it belongs; this is for when you declare a
; cache variable with the __attribute__ compiler directive from C; if you
; initialise it then the value never gets put in the right place.
; Call this before anything else to shift your data to the right place.
; Its got nops in it, it isn't the quickest; who cares for <= 1K ?
;-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
dcache group                ; Assume this is your d-cache data group
    opt      c+              ; Case sensitivity on
    xdef     InitCacheVariables ; Xdef the function
    section  .text           ; Put it in the text section
;-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
InitCacheVariables:
    la      t0,grouporg(dcache) ; Load the start of the group in RAM
    la      t1,groupend(dcache) ; Load the end of the group
    la      t2,group(dcache)     ; Load the destination address
    beq     t0, t1, End          ; If the group is empty, quit.
    nop                     ; Ohmygoodgawd a nop.
Loop:
    lw      t3, 0(t0)           ; Load a word from the group
    nop                     ; Another one, who wrote this crap ?
    sw      t3, 0(t2)           ; Store it at its rightful place
    addiu   t0, t0, 4           ; Skip to next word
    addiu   t2, t2, 4           ; Skip to next cache location
    bne     t0, t1, Loop        ; If we have not copied everything...
    nop                     ; Branch to top of loop (another nop ! No !)
End:
                                ; Finished
    jr      ra
    nop
;-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
; end
;-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
NOTE: To compile this code with asmpsx and make an object file, add to your makefile:
      cache.obj: cache.s
      asmpsx /l cache,cache
And add the object file cache.obj to your link file as per normal.
```

FIG 3: Assembler to copy data to the cache

P s s t ! (1)

Accused of being Jeremy Beadle, James North-Herne (Gremlin Interactive) immediately counters the accusation by showing that he has long, rather than short fingers on his hand. Thus he proves in one swift action that he is not the 'You've Been Framed' front man. Well, at least that's what we thought he was doing



James North-Herne proves that he's 'Game for A Laugh'

An informant at Millennium writes: "Whoever sorted out the bundles of games for the 10 'lucky' winners on the last day of the Developer Conference this year deserves a pay rise. The look on Alan McCarthy's face when he opened his parcel to find a PlayStation version of 'Defcon 5' was worth the conference fee alone. He'd just spent 3 months doing a particularly tricky Saturn version. Oh how we laughed!"



SCEE staff test out the proposed Real Virtuality PlayStation peripheral. Made entirely from sponge and retailing at only 99 pence per unit, it uses real life to simulate virtuality. Thus, for a fraction of the cost VR technology, an RV user can still look like a complete plonker

Most Wanted

NAME: Isidro Gilabert (Software Manager) & The Development Team

COMPANY: Bit Managers, Barcelona - SPAIN

On the PlayStation we would like to see games like: **SUPER MARIO 64, ZELDA, FRONT MISSION**. Not for any visual or audio effect in these games but really because they are huge games that are not over quickly.

Our favourite game is, undoubtedly, **RIDGE RACER REVOLUTION!!!** It is the best racing game in the world!!!



'Help Me'

I was here at Developer Support mission central at 7 o'clock last Friday (pathetic aren't I?) and the phone began to ring, so I picked it up and tried to help the developer concerned. Now back in the old days, say about a year ago, we used to tell developers that we didn't have phones or email! You had to use either the BBS or fax.

That doesn't mean to say that I don't like e-mail or the phone. It's cool, I enjoy talking to you lot on the phone, but I guess that, like any normal person, I get a bit shirty if the phone rings every half an hour. It stops me working on existing support problems and getting any work done. So the aim of this article is to help you get the best out of Support whilst ensuring that we in Support don't all go insane.

IT'S JUST A TYPICAL DAY IN DEVELOPER LAND.....

Your game's nearly done and you've hit a seemingly un-breachable impasse because the Sony supplied library/tool doesn't seem to work/ has a bug/doesn't exist (delete as applicable, what-da-ya-

mean "they're all applicable")? and you've got 24 hours left to meet that deadline and get that bonus. So you reach for the phone. **STOP!**

1. HAVE YOU READ THE RELEVANT MANUALS OR ACROBAT DOCUMENTS?

It is far quicker for you to read the docs than for you to phone me, I read the manual and then I call you back and tell you which page to read. What about the developers conferences notes? Both the American and European notes are available electronically. There are masses of technical documents available on the BBS.

2. HAVE YOU LOOKED IN THE SAMPLE CODE?

Well have you? Some of it's pretty good these days.

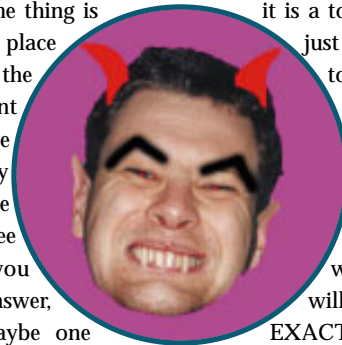
3. HAVE YOU CHECKED THE BBS ?

It is quite likely someone else has had this problem before. Check the BBS or at least the archive of it we provide on the Developer CD. Currently there is a large number of developers onto their second and third PlayStation titles. They didn't get where they are today without making mistakes, finding bugs and asking questions.

The BBS. Evil. If you think your

end is ugly, you should see ours! But the point of the thing is that any query you place can be read by the entire development community, so the entire community can give you advice and help. If you see a query that you think you can answer, help the guy. Maybe one

effect is broken in my program'. If it is a tools problem, it is just a little bit helpful to know the version numbers of the tools concerned, the same goes for libraries. If it's a problem with a function I will need to know the EXACT function name



David Coombes: answering a support query
(Cut out and stick on your telephone to remind you who you are talking to next time you call)

day he'll help you back! Everyone benefits.

CONTACTING SUPPORT

So you've not found a solution to your problem and you need to contact Dev Support. You could: phone, fax or email (BBS or Internet). Which one you choose depends on the nature of the query.

Try to present the problem in a clear manner, using the most appropriate medium. Remember that too much information is better than not enough information. (there is no such thing as a stupid question - only a stupid questioner).

You are going to need to tell me more than 'the elephant trunk

and what you're trying to do with it. Please don't be vague because if I can't pinpoint the cause of the problem, I can't help you... I'll just make soothing noises and say platitudes.

Similarly, please don't phone up and quote lines of C code down the phone either. What looks like nice sensible code on the screen in front of you, sounds like this to me; "Padinit bracket zero close bracket semicolon, setdefdrawenv bracket ampersand draw comma zero comma three hundred and twenty comma two hundred and forty close bracket semi colon

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Developer Support CV



PLACE OF BIRTH:
Aylesbury: 'Home of the Duck'

ADDRESS:
South West London

EDUCATION:
UK, France

EMPLOYMENT HISTORY:
Music industry

FAVOURITE FILM:
Any martial arts films - with a story line

NAME:
Sarah E Bennett

JOB TITLE:
Production Co-ordinator

WHAT DO YOU ACTUALLY DO?
Supply development tools,
Agony Aunt to developers.

AGE:
Twenty something

WHAT'S YOUR POISON?
Hooch, Hooch and more Hooch

WHERE DID YOU LAST GO ON HOLIDAY?
Venice, Italy

ANY HOBBIES?
Eating, Films, Travel

Or: How To Get The Best From Developer Support

Once described as 'the Stock, Aitkin and Waterman of games', Probe is now sees itself as a serious games developer, producing games which are more *Pulp*, *Oasis* and *Blur*, rather than *Jason*, *Kylie* and *The Reynolds Girls*.

Traditionally Probe have not been that visible in the eyes of the games buying public. A developer for hire to any publisher, they were known within the industry for three things: doing licenses, getting a product out on time (to the actual days specified) and Fergus McGovern, the company's owner.

In games history, Probe's greatest moment so far has been the multi-platform *Mortal Kombat* (the critically acclaimed MK2 in particular). However, when they first started the company got a

reputation for doing bad licenses based on bad TV programs (one based on Basil Don't Do the Russ Abbott TV character being a case in point). Further, they were seen to use a formulaic approach to making games - *Judge Dredd* with the same looking game

"WORK HARD,

engine as *Stargate*, for example. Times change, however, and so do approaches.

Joe Bonar, now Development Director at Probe, takes the Stock Aitkin and Waterman accusation on the chin, "Yes, it is a fair criticism of Probe in the past but now we have more time and resources, more interesting products and ideas."

Indeed, Probe are restructuring the way in which they produce titles, development becoming more team based. Joe: "Previously we were task based - with an Art Department and Programming Department and some outside contractors to get the work done but now development is grouped according to the product that each person is working on". This, then is a move away from factory style to craftsman style production. Probe found that out-of house contractors cost too much in terms of time and effort in data transferral - *Mortal Kombat 2* is

17 MB of data zipped, for example. So, while historically 90% of development was out of house, out of the 120 now working for Probe only 10 are outside contractors, many of whom work in-house.

Probe have been around since 1984 when they were 6 people. They are now part of Acclaim for whom they will be exclusively working in the future although

PLAY HARD,

they are currently finishing off *Die Hard* for Fox (see article in issue 3). The company are also currently working on *Bubble* and more *Hexen*, among other titles. In total there are 12 teams for the 12 products currently in development.

In the main PlayStation is the lead development platform but with source code ported to other platforms via conversion libraries, there is a lot of code re-use. In the future however, Probe want to perform parallel development on all platforms. They find PlayStation to be technically better than current PC technology and the Saturn. In *Die Hard* on the PlayStation, the nine digit score is made of Polygons as there is not enough V-RAM. This does not port to Saturn as on this platform it takes a comparatively long

time to draw each digit.

Although claiming to like PlayStation as a development platform, they do have two big whines: the class A bug that is 'MEMORY CARD' (capital letters are wrong - it should be 'Memory Card') and the number of dex boards in a dev kit - which means that they have to buy huge PCs (see Probe's bid for the largest PC in PS development, pictured below left).

Probe are now into motion capture and quality sound in games: big time. While *Alien Trilog* use some expert motion capture from

AIM HIGH"

the States, *Die Hard* was a more home-made affair, captured in a church hall in Croydon - although none the worse for it. This experience in motion capture lead Probe to set up their own motion capture studio. They are also in the process of setting up a sound studio with two full time staff Andy Brook and Stephen Roo (see photo). The latter has worked with Barbra Streisand, Neil Palmer and Halo James and was involved in the theme tune for the Olympics. Stephen demonstrates the music on *Die Hard* with enthusiasm....the *Starsky and Hutch* style for the chase scenes in the snow and the slow ambien



The biggest PC in the world? Probe claim that this is the only PC man-enough to hold the two dex boards of the dev kit, the one board of the CD emulator and its extra hard disk - the mug is one metre tall apparently

Saying "Oh yes, *Sentinel* was good in its time but have you played it now?"

Going down the arcade and playing an old arcade game

Time Crisis

Standard Console Configuration

3D hardware as standard

Open Development Community

Soul Edge





Development Director:
s pepperoni and extra
ut hold the anchovies"

music for the tense
enes.
hings don't change,
hile no longer the sole
robe and now a Vice-
of Acclaim, Mr
still has a high profile
industry recently mak-
Edge as one of the
Power Players' (March
ork Hard, Play Hard,
, he says " this would
mpany motto". The
Probe, however, claim
other one: "Fergus did
?"



Stephen Root, Musician: "Let me just
connect this amp up and configure my
Mac and move this cable here...it was-
n't like this when I worked with Barbra
Streisand, you know"



Carl, perennial paragon of
sartorial elegance sporting
'The Croydon Look': teaming
a pink tee-shirt with red
shorts and finishing the
ensemble off with yellow
socks (shoes optional, as you
can see)



asters, it's just games, games, games....oh for some real work - a bit
or some hod carrying



Fergus McGovern, VP of Acclaim: demon-
strating his new 'hands off' management
approach

We Ask The Questions

NAME: Steve Metcalfe
COMPANY: Bullfrog Productions
JOB TITLE: Conversions
Programmer, soon to be console
R&D
FAVOURITE GAME:
Recent: *Master of Orion*
(MicroProse), Nostalgia: *Chariot
Race* (on VIC20)
MOST ADMIRED PERSON
IN THE INDUSTRY:
Fin McGeachie
HOW CAN YOU BE BOUGHT:
Money (cheers, Fin)
HOW WOULD YOU COMPARE
DEVELOPING ON THE
PLAYSTATION TO OTHER
DEVELOPMENT PLAT-
FORMS?
Quite easy, although the debug-
ger's not very good, as usual.
Much simpler than the SNES where
I had to recode everything from C
to Assembler, preferable to the
Amiga, but top of the list is the
flexible Commodore 64.
FAVOURITE CHAT UP LINE:
Just the chance to meet women
would be a fine thing.
WHAT BOOK ARE YOU
READING? *A Brief History of Time*
HOW MUCH HOUSE WORK
DO YOU DO A WEEK?
I hate housework. I operate a once
a month slash and burn policy.
WHAT FOOTWEAR DO
YOU HAVE ON?
Boots! Hoorah. The all weather, all
occasion footwear.
IF YOU WORKED IN ANOTH-
ER INDUSTRY WHAT WOULD
YOU CHOOSE TO DO?
I'd like to work with animals, not
old people, just animals.
WHAT CAR DO YOU DRIVE?
I've just bought a Suzuki Vitara.
It's great. 16 valves of automatic
fuel injected loveliness....gush
gush... sad.



Retro-gaming

its compilations CDs on Ronco with authentic dipswitch settings

Virtua Cop 2 (in Arcades)

with standard or 1/2 MB of RAM and/or a bulk storage device

ion of 3D accelerator cards which cost more than a PlayStation

'Dream team'

Sonic The Fighters/VF Kizu



Survival Tips for PlayStation Programmers

So you're given a game to port to the PlayStation and, as well as Europe and North America, it turns out you must do a Japanese version too. Now, because those helpful lot at Sony provided us with Kanji on the standard ROM, this should be easy, right?

Well, only possibly. If you're lucky, you will have a shed load of mind-numbingly tedious work ahead of you. If you're really lucky, you will get the opportunity to modify the original version's design to accommodate the specification of the Kanji ROM.

Before we get into it, let me dispel a myth. Yes, Japanese gamers CAN read text from left to right and no, you won't have to redraw all your screens so the text goes from top to bottom. See.....it's really quite easy!

SPINDLE-TASTIC FONTS

The Sony ROM provides all of the Kanji characters (up to Shift-JIS level 1), western characters (including European with a special patch) and even has the standard controller symbols. Each of the characters in the ROM are 16x16 pixels. This looks fine if all the text in a block

is Kanji, but sometimes English words need to be displayed in a block of Kanji (names and untranslatable words, for example). These western characters are really quite spindly and so look odd against the Kanji characters.

From my experience, the Japanese publishers like all of

PART 3 -

their text to be solid blocks of characters (every character is 16x16 so there's no jagged edges on the right), so the issue of western character spacing doesn't come up. However, if your game has strings of text consisting of western characters you really should space them more appropriately. (Refer figure 1 to see what I mean.) To help speed things along for you, I have provided a sample program available on the BBS (Bob_3.zip) that uses a spacing table for western characters.

If your game is 320x240 (remember Japan is NTSC) those 16x16 pixel characters look positively huge.

WHAT ARE YOUR OPTIONS?

- You could redraw them your-

By Bob Koon
Vortex Media (USA)

self in a lower point size (probably 12x12 is the smallest you can get them and still have them readable) but that would take up way too much main memory so I wouldn't advise that.

DESTINATION

- You could be really cheeky and get away with using the characters specifically for children: Hiragana or Katakana characters (which can go as small as 8x8 and are also in the ROM). However, you must resist the temptation to take this easy route as these characters are for children and so should only be used for children's games - your Japanese publisher is not likely to let you get away with their inappropriate use.

- You could make your game high-res, but you must run in a frame if you do that. Quite a high penalty for aesthetics don't you think?

However, short of doing this there's not much you can do I'm afraid. Not much help I know... Sorry about that.

PROGRAMMERS AND THEIR SANITY

Getting back to that potential mind-numbing work I talked about earlier.

Since the Kanji ROM provides

16x16 pixel characters, that means that you need to make sure there is enough screen real estate for it. Common sense right?

However, if your game is heavily text intensive (as ours at MicroProse was) and, depending on how it was written, you might have to adjust every string of text

JAPAN

by hand (as our game required, through no fault of our own, you understand.) The moral of the story (for any suited/manager-types reading this) is: for the sake of your programmer's sanity, make sure you design your game's screen layouts to be at least 16x16 for areas containing text.

PRACTICALITIES

Other than the normal problems of doing a foreign translation of a title, such as making sure things fit on screen, the process of actually getting Kanji text in to your title is fairly straightforward. It's probably safest to use the -kanji option for the compiler (just in case you need it.)

When the text is given to you to implement, it's very possible that there will be a backlash (!) character imbedded somewhere.

Continued on page 10►

This looks a bit strange.
This looks a bit better.

FIG 1: Which style do you prefer?

So How Did You Get Into Games?

NAME: Ian Elsley
NATIONALITY: Scottish
COMPANY: Millennium Interactive
JOB TITLE: Senior Programmer

"I joined Millennium this year. My first job in the games industry.

I had wanted to be a musician (I play violin, viola and various mediaeval instruments) but when I went to University I initially studied Mechanical Engineering swapping along the way to Computer Science. After my third year I took a year out in the USA where I taught, among other things, IT. From graduation on, and despite swearing at 18 that I would never sit in front of a computer for a living, I have worked on academic and commercial research in; computer vision, object orientated computing and 3D modelling of the human face for surgical reconstruction (the latter at UCL and Maastricht).

I was attracted to games not because I am a gamer but by the technical challenges made possible by faster hardware. As for gameplay, my chosen genre is strategy: Sim City and Civilisation."



'You have Run Out of Virtual Memory'- Anyone who has had this message mid-render will know the frustration it brings. Here I give a few tips on how to get the most out of memory when working with certain 3D software packages and SGI computers.

Within Alias's PowerAnimator there are certain functions that are memory intensive: a classic example being rendering.

There are extremely complex calculations involved in rendering a given model or scene that can quickly use all of the available memory (RAM) on your workstation. In this situation the Alias package starts dealing with IRIX to use and share swap space.

3D software companies recommend at least 64 Mb of RAM with swap space to 150 Mb or higher.

However experience shows that the hardware memory in an Artist's machine (usually 64 or 128 Mb) is not enough to cope with the demand put on it. Each job the machine is requested to do absorbs chunks of this memory. Just turning on your SGI will use about 5Mb and the Alias package will use another 15 Mb (approximately). As you start working, models and textures take up further space in memory. As you can see, this can quickly add up to the amount of RAM that your machine has physically installed.

SO WHAT IS SWAP SPACE?

Swapping is the UNIX memory management technique used on systems that require a complex process (such as rendering) which require more memory than there actually is in the installed main memory.

Traditionally, to keep things from coming to a halt, a system is used called virtual memory which can provide an address space to a UNIX application. It uses a user definable reserved position on the hard disk (called the swap space) where the memory management system can offload processes that are divided into pages (1 page = 4096 bytes).

These pages are then moved between RAM and the swap space. The system manager is continually looking to see which pages have been idle for some time and shifts them out into swap space where they sit until reactivated, keeping

the RAM for active processes.

Swapping is usually worth the inconvenience since it allows your machine to run more processes that could otherwise fit into its RAM. This means that, although

and RAM you continually have, type the following command in a shell window of your Alias account:

```
#/usr/aw/alias/bin/getid
<return>
```

ALTERNATIVELY

One thing to keep in mind is that increasing your swap space is not the best long term solution. Of course, it will allow you to run an application that exceeds your RAM but it does so at the expense of CPU performance. If you find that your machine is constantly swapping when using Alias (you can hear that hard disk going mad), it may be time to ask your boss to fork out some cash and add more RAM.

You can quote to him/her the following lesson (based on one of the 10 computing Golden Rules).

The more computing that your machine can do in main memory, the faster your application runs: the faster your application runs, the faster you can work: the faster you can work, the faster you get the project done: the faster you get the project done, the more money the company makes.

Now who can argue with that?

MAXIMISING MEMORY BY ALESSANDRO TENTO

using swap slows your rendering time, it does allow you to render more complex models or files.

RUN OUT OF VIRTUAL
MEMORY?

The Alias PA rendering module sees virtual memory which is basically RAM and swap combined. Thus, if your render aborts with the message 'out of virtual memory', it means that the render has used all physical RAM and swap space. To get around this problem you can increase the swap space.

First: check how much virtual memory you have.

To determine how much swap

Second: check hard disk space.

You also need to make sure that you have enough space on your hard disk, since all swap space is taken from the disk. Type the following command to check disk space.

```
#df -k <return>
```

Third: increase swap.

Next, if you have sufficient disk space, bring up the System Manager tool, select the Administration Tools and access the Swap Management Tool. Simply type in the amount of swap you want then exit and the system will create additional swap file to your hard disk.

10 GREAT EXCUSES FOR: WHY LIBSPU HAS HELD UP YOUR PROJECT

- 1) "Well the sample loop points weren't on a 28 sample boundary, and it wasn't a month with 'y' in it, so nothing worked for ages"
- 2) "You just can't tell when a sample is finished playing, so I have this table of times in CPU clocks, and you just..."
- 3) "There only is one interrupt from sound RAM - it's on a read and a write, how was I to know?"
- 4) "I had to write a VAB parser specially - yes I know there's one in libsnd but...."
- 5) "I had to reverse engineer the SPU ADPCM format using the original SNES manuals, it'll come in handy later, honest"
- 6) "Apparently there's a digital input somewhere, I've been working on an external speech recognition box to bundle with the game, should be quite cheap, but I just can't work out how to plug it in, something to do with the parallel port I think, give me a couple of weeks"
- 7) "I think the Memory Card stuff interferes with the sound and so if you have a multi tap in the left port, and no pad in the right, and 1 card in either slot during the first attempt at reading a save game and while you're starting a sample not on a 331 byte boundary then the playback rate is out by 0.00013 samples per hour"
- 8) "So after 4 weeks I realised that the left headphone wasn't working, then...."
- 9) "Once I got the loop points right the cross fade was wrong and so it made a clicking noise, so I turn the volume up and down really quickly, it sort of works OK but the music sounds a bit weird"
- 10) "So I'm streaming SPU ADPCM from CD.....what? of course I can't use DA, there's nothing clever about that for God's sake"



So you want to talk about music and sound effects then? And you really can't wait to hear what I believe we music types should be aiming for, can you?! Good, then here we go:

I get the feeling that over the last 12 months, people have been blinded by science.

No longer is it fashionable to simply have good tunes and a selection of powerful and fitting sound effects. Now we are told that our stereo samples just aren't

good enough because they really could all be in 3D. OK, I agree that 3D sounds can add to a game's atmosphere if implemented correctly, but the question must be asked: who will actually benefit from the effect they produce?

How many people have a perfect audio set up, with stereo speakers on each side of their monitor and a chair positioned at the correct distance and height from them? To be honest, I have

never been that convinced of the end result anyway, and the conversation..... "Yeah, well it sort of sounds like the noise is over my right shoulder, but I'm not too sure" rings far too many bells for my liking. Could it be that 3D

**All New Formula,
Harry Free**

sound is just a gimmick that requires twice the amount of sample space? You decide.

My second point is interactive music - good or bad? Once again, there are certainly games which would benefit from it, but unless it's used correctly, it can easily detract from the gameplay, rather than add to it. The question musicians and game designers should

consider is: will Joe Public turn the game volume down and play a music CD instead and, if so, why? If a thumping techno track works really well in a game, why bother trying to make it an interactive orchestral masterpiece?

The bottom line is to do what seems right, rather than to do what happens to be in fashion at the time. Use what equipment you have for its best qualities, and enjoy what you do!

Too many games seem to have attempted to try something different (like interactive music) with results that can at best be described as 'above average'.

My advice is to try anything, but if it doesn't seem to work too well, change it! The "That'll do" attitude should really be "That won't do. Let's try something else". JASON PAGE

SURVIVAL TIPS FOR PLAYSTATION PROGRAMMERS

◀Continued from page 8

Before you compile the new text, you must scan the text for backslashes and add another one. (Incidentally, it goes without saying if you don't make the backslashes doubled it will totally muck up the rest of the line.) If you do have to make changes to the text, remember to give it back to the translator, otherwise you'll be modifying the same string over and over again. (Doubling backslashes doubled doesn't mess up the importing process in a Kanji text editor, Mifex (which is share-

ware) for example, so you probably won't have to worry about that.)

If you can, get a Japanese native in your office to translate the text.

Don't rely on an off-site translator to provide you with new text. They will more than likely botch it up because they don't know the context of the phrase they're translating when it's used in your game. It might cost a bit more, but the time saved more than pays for itself.

HELP ME

◀Continued from page 5

equals SPU malloc bracket.....bla bla bla..... bracket, padinit,bla bla bla....."

If you need to show me some code, upload it into your file area on the BBS. If you can make something I can compile (including a makefile and a link file), even better.

Make sure you understand the problem, write it down and draw some pictures if necessary. (You can always fax this to me). Then, if I can't help you, I can always colour them in and send them back.

Please don't get your producer to call, he probably doesn't really understand the problem, and as a result you won't get the information you need.

WELL, THERE YOU HAVE IT

So the key to doing a Japanese version of your title is common sense. I can't stress enough how important it is to design your game with the Japanese territory in mind. If there's a remote chance there'll need to be a Japanese version, design for it. You'll make your programmer irate, otherwise. And, as we all know, an angry programmer is an ugly sight and something you don't want to witness.

Next time, we'll discuss the memory cards and why they're such a pain in the slot.

CD LOADING TIMES

◀Continued from page 3

speed up loading times is simply to compress the data itself, decompressing on the fly when it is being loaded (see *Using Compression on the Playstation* by Colin Hughes in issue 3). Another technique is to try and load data 'under camouflage'. That is when the player is absorbed with something else on screen. Examples of this method include loading game data whilst the obligatory ELSPA warning screen is displayed or, as in Ridge Racer, whilst a distracting game of Galaxians is available.

AFTER YOUR PROBLEM IS SOLVED

If you solve the problem before dev support get back to you, please tell us. If we've not replied it's either because we don't know the answer yet and/or we're working on it. There is nothing worse, I find, than phoning up with a solution only to find the developer fixed it himself, ages ago and has since gone on holi-

day, got married and had three children while I have been locked in a Sony basement trying to solve the problem.

FINALLY

Don't get me wrong, I'm not trying to discourage you from asking any questions. I'd be out of a job if nobody called! Just stop, think and, most importantly, prepare before you pick up the phone.

Our "All Time Favourite Support Questions of All Time"

QUESTION #4: IF I PUT THE FRAME RATE HIGH ON MY STREAMING, THE QUALITY IS REALLY BAD. BUT IF I PUT MORE DATA IN EACH FRAME, I CAN'T GET A GOOD FRAME RATE. WHAT AM I DOING WRONG ?

The answer to this is that you are using the MDEC.

An explanation for Producers is included below. (Hint: You will need to turn the page upside down.)

He is doing nothing wrong, this problem is inherent in MDEC compression (which is in the PlayStation).

<:-)Producer Friendly: helping to integrate producers into the community.

What, Why, Who, When, Where, How?

Q: My game consists of several executables which will be chained together using LoadExec() or run consecutively by a simple loader program. How can I prevent the display from momentarily going out of sync when I call ResetGraph(0) at the start of each executable?

A: When your loader runs for the first time, or in your first executable, call ResetGraph(0) for a complete GPU reset. From then on all programs can use ResetGraph(3) during initialisation. Using setGraph(3) in this way only works using Libs 3.5. ResetGraph(3) initialises the GPU without causing the display to go out of sync. It also has the benefit of preserving the contents of V-RAM and the display environment. This is extremely useful as each program can display some graphics while the next program is loaded. Once the new program gains control it can then fade out the previous program's graphics. *Vince Dies*

Q: How do I find out how much space is free on a Memory Card?

A: Use the firstfile and nextfile functions to fill an array of the DIRENTRY type. An example of this is given in memcard.zip on the SCEE BBS. Then DIRENTRY type not only holds the filename but the size of the file in bytes. Note that you should round this value up to take into account of the slot size used by the memory card filing system (8K). It is then simple to subtract the sizes of all the files on the card from the capacity of a card (15*8K). *David Coombes*

Q: I am using Win95 and call dexbios in my exec.bat. I find that that when I access the PC filing system I get a lot of errors and I cannot lose files. This means I get a lot of sharing violation problems. What is going on?

A: Under Win95 when running dexbios, run dexbios in the current DOS window, not in the autoexec.bat. This will ensure that the interrupts used by dexbios are allocated correctly. *David Coombes*

Q: I want to display a moving icon whilst accessing the CD. How do I do this?

A: Attach a function to the PlayStation's vertical refresh interrupt using the VSyncCallback() function. In this function, do something like this:

```
void load_spinner()
{
    static int i=0;
    i++;

    update_spinning_icon(&cdb->wait_sprite,i); /*update texture coords e.g. anim frame*/

    DrawPrim(&cdb->wait_sprite);
    cdb = (cdb==db)? db+1: db;
    PutDrawEnv(&cdb->draw);
    PutDispEnv(&cdb->disp);
    draw_backdrop( (unsigned long*)&backtimbuff[0]); /* draw the background */
}

VSyncCallback(load_spinner); /* to install the spinning icon */
VSyncCallback(0); /* to remove the spinning icon */
```

Note:

Don't just use a spinning CD or an egg timer, be original! How about a goldfish swimming around?

This technique can also be used when accessing Memory Cards and at other times where a static screen is often displayed. Of course the aim of all programmers should be to ensure that there are no loading delays anyway :) *David Coombes*

Postcard From...

They say that Tokyo was once modelled on the streets of London - if so SCEI must surely be on the Japanese equivalent of Park Lane.

The question is - do the men and women of R&D ever have time to appreciate the view of the Imperial Palace and park.

In common with many of their countrymen, R&D work well into the night on all matters PlayStation related - and my brief visit is an opportunity to report back on the fruits of their recent labours.

The high point has been the first glimpse of the enhanced DMPX (see DMPX.ZIP on the BBS) which now supports assembler access to the GTE - and even allows you to fill in the essential timing delays (NOPs) with your own non-GTE instructions (described in GTEDOCS.ZIP).

On the hardware front, as well as development kits moving to PCI [see article on page 1], so is the MAC based Sound Artist



R&D in Tokyo

Board (DTL-H800) which will be available towards the end of this year. (Incidentally, you may see minor changes in the product codes for items such as the debug stations - in general these are related to CE adherence.) One thing to note - newer debug stations will now be multi-voltage to avoid one frequent reason for 'blow-ups'.

I've also had a glimpse of a new tool - the DTL-H1500, designed to make the standard debug station accessible as a single threaded TCP/IP server.

The DTL-H1500 will be available with the standard PC based development tools (compiler, debugger &c.), but will also include simple tools to download data and programs from an SGI. More news on the availability and features of the DTL-H1500 as they become available.

We'll be bringing you more news from R&D soon - our very own Colin Hughes is based out in Tokyo until the end of September, and will be sifting out useful information on your behalf. *PAUL HOLMAN*

P s s t ! (2)

SCEA (Sony in the US) were chuffed to show off the text search option in the new (SCEA and SCEE jointly produced) Developer CD (ver 1.7 - August '96). One day they had one too many root beers and, being a crazy bunch of Californians, decided to do a search for words of dubious character. They were both shocked and appalled to note the amount of foul language in it, deciding that the next one should be censored. And where did the bad language come from? Yes, the European Developers on the SCEE BBS!

Here is a list of the top five favourite swear words of Europe's PlayStation Developers (listed by occurrence on the Developer CD):

F*** - 21 occurrences
B***r - 13 occurrences
B***y - 12 occurrences
B***x - 8 occurrences
B***cks - 3 occurrences

You will notice that the SCEA BBS does not make an appearance on the CD. Coincidence or just not hard enough?

My Dream...

Imagine that instead of calling 'Pizza My Mind' every time you wanted a three cheese dose of cholesterol death....

You had to battle Zordan the Wizard for some mystical self-raising dough, then explore a sprawling dungeon searching for the three Cheese Chests. The search complete, it's time to head back to the restaurant within a strict time limit in order to stop the Oven of Plenty conking out. And just when you thought it was time to indulge in a celebratory fat feast you realise that you forgot the Tomatoes of Legend and have to go through the whole escapade again... Aargh! To me this stinks

Notice Board

ON THE MOVE

Some developers may have got a card through the post telling them that, as of 15th July 1996 SCEE has moved to 25 Golden Square, London W1R 6LU. While this is not a lie, it is not entirely true.

The departments that were formerly at 13 Great Marlborough Street: Human Resources, Finance, Communications, Business Development, Product Management and Operations have moved to that address, leaving Developer Support, Approvals and Account Managers at the Waverley House address (below) - with Internal Development on a separate floor.

USE SCEE'S PROGRAM ANALYZER

We're pleased to announce the availability of a prototype Program Analyser. Any PlayStation developer can come to Developer Support and make use of it.

UNREALITY OR NOTHING

like a sunbathing kipper, so why is it that so many video games still follow this premise in the name of gameplay?

For me, videogames are about escaping from reality and taking part in scenarios I could never dream of in the real world, not about solving mundane problems or going on dull journeys - I've got the Jubilee line for that. Give me a rocket launcher to frag some foul critters, let me tear down the motorway in a turbo-charged super car without a care for the speed limit or make me president so I can tax you pathetic citizens to your knees.

Best of all let me do this against

other human players or at least computer controlled characters that take risks and make mistakes just as my friends do in the name of glory or getting that elusive power-up of destruction before I do.

I'm tired of playing one-player video games and it's got to the stage where I play them through to the end just to see if there's any good ideas lurking deep inside rather than gaining any satisfaction or pleasure from actually completing them. If we want to make video games bathe in the kind of mass market adulation that would make *Take That* gasp and not the continued preserve of no-mate bedroom dwellers, then



for me multi-player games are where we should be focusing our main attention. After all, having fun with another human beats playing with yourself every time.
RIK SKEWS

The Analyser is designed for final performance tweaks for games that are already making use of features such as inline GTE, D-cache et al. Let us know if you're interested, and we can provide a copy of the manual, and pencil in a booking for a day's use at our offices. We'll be able to offer access to the unit from mid-September.

(You'll need to have your title on gold disc, with your source and build environment on an external SCSI device for best analysis).

BBS MOVES TO WEB SITE

The BBS is expected to move to a Web site sometime later this year.

It will give inter-developer discussion and file download and upload functions as does the existing BBS but hopefully with a more intuitive interface than the cosmetically challenged Wildcat that we have come to know and love (not).

In addition, this should cut down the telephone bills for all

developers in continental Europe.

We will be recommending at least a 28,800 bps modem for speed (OK that's if you don't have an ISDN line already, all you net-head smarty pantsers) and a Frames enabled browser (Netscape 2.0 or MS Explorer 3.0 or later) so get downloading the latest free beta versions now.

Anyone who may have problems with this move should contact Developer Support as soon as possible.

NEW ORDER FORMS & PRICES

You should have received new hardware and software Order Forms, labelled 'July 96', detail new prices. These are the only Order Forms currently accepted.

NEW DEVELOPER CD

The latest Developer CD (version 1.7) should have arrived on your desks by now, bringing with it with software, documentation, the BBS and joy to your heart. Contact Developer Support if you

haven't received one yet.

KEEP UP-TO-DATE

SCEE uses a database of licensed developers maintained by Business Affairs. The designee and address held there is the one used to contact you. Should your address or designee change, please let Alison Cooper or Tania know. Tel: 0171 533 1285, Fax: 0171 533 1390

NEW ON THE BBS

Of the many, many new documents on the BBS since the last issue, here are the highlights:

gtedocs.zip: GTE low level documentation version 1.0

libs35.zip: version 3.5 of the PlayStation libraries

libref35.zip: 3.5 library documentation

psxdiv.zip: polygon sub-division code by Del at Core design

qadoc.zip: technical requirements for all SCE (Europe, Japan, USA) - near final version

codetl32.zip: 32 bit version of the compiler



CONTRIBUTIONS:

If the title hasn't given it away already, this is the developers' newsletter. Please field any articles/gripes/questions to the contact address/numbers below. Many thanks to all the contributors for this issue.

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