



UNIVERSITÀ DEGLI STUDI
DI MILANO

Mobile Games

Lesson 108

The Future of Gaming is Mobile!

“As computer games become increasingly persistent, there will be an increasing demand to access the game information at all times.”

Guido Henkel (Game Over Magazine, 2004)

So this is a well-known trend since the last 18 years ...
We are not going to cover much unexplored ground here

“Mobile” Does NOT Mean “Phone”

- First, because there are many portable gaming consoles which are not phones
 - They are greatly outnumbered, not very widespread, but nevertheless they are here, and they might be profitable as platforms



- Secondly, playing “on the move” implies player’s mobility, not just software mobility

The game must be designed to have the player move his/her



Classify These ... if You Dare



Augmented Reality Gaming



ARQuake

<http://wearables.unisa.edu.au/arquake/index.html>

The “King of Mobile Games” is ...

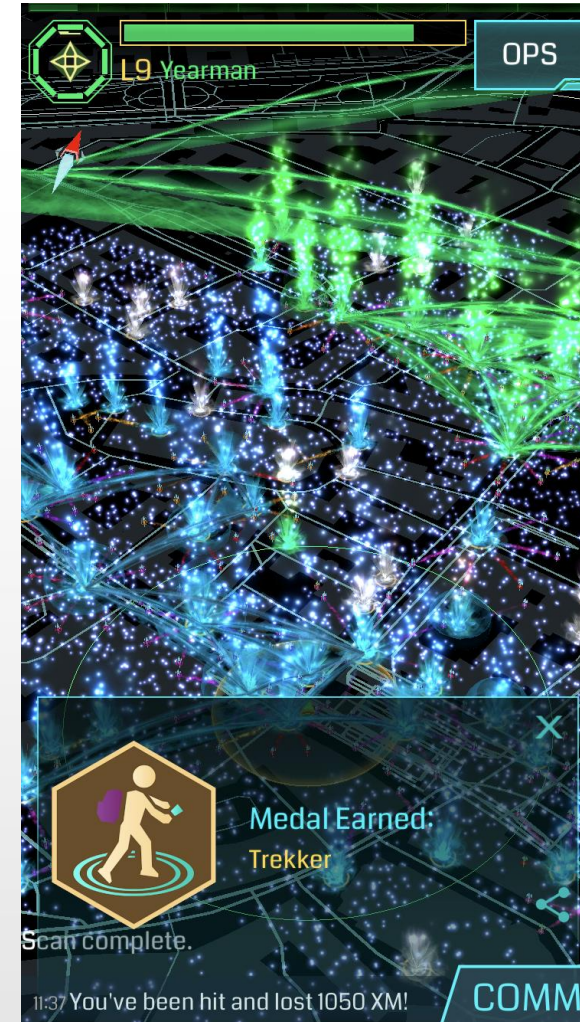


A game introducing location as a game element and movement as part of core game mechanics

The “King of Mobile Games” is ...

A game introducing location as a game element and movement as part of core game mechanics

Ingress (2012)



The “King of Mobile Games” is ...

A game introducing location as a game element and movement as part of core game mechanics

Dario

Laura

Ok, ok. I was kidding!
They are coming from the same developer (Niantic).
Ingress was first, but pokemon GO has been much more successful thanks to the underlying IP

Pokemon Go (2016)



Why is This “Mobile” Wor[l]d so Important?

- Think about ubiquitous computing
 - Computer power everywhere, at every time, no matter what
- Think about ubiquitous network access
 - Data access everywhere, at every time, no matter what
- What is so wrong in “playing everywhere, at every time, no matter what” ?
 - With a decent (ubiquitous) computing
 - With a decent (ubiquitous) network access
- But ... we need something to help us, and moving with us

Something always in our pocket!

- What is this object in the modern age ?

A phone !

This, is why you usually get confused



Why is the Mobile (Phone) World so Different?

- The devices are different
 - And the underlying infrastructures too
 - A PC is “plugged into your ADSL”, a phone is born with an embedded (wireless) network
- The application design is different
 - You have a small screen for everything
- The interaction design is different
 - You touch stuff, you have no mouse
 - Keyboard is a hindrance in many cases
- The business model is (very) different
 - Everyone wants to take moneys out of YOUR phone
- The distribution follows other rules
 - The only package you receive is your phone. All the rest is airborne

(Vintage) Challenges From the Market

- Multiple operating systems
 - Palm
 - Windows
 - Symbian
 - SONY
 - ETI
 - RIM
 - iOS
 - Linux (moko)
 - Android



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These are dead,
because no one
was using them
any more



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- Android

This has been killed by
nokia's short sight.

But, believe me, it is MUCH
better that way, given its
crazy development model
and tools



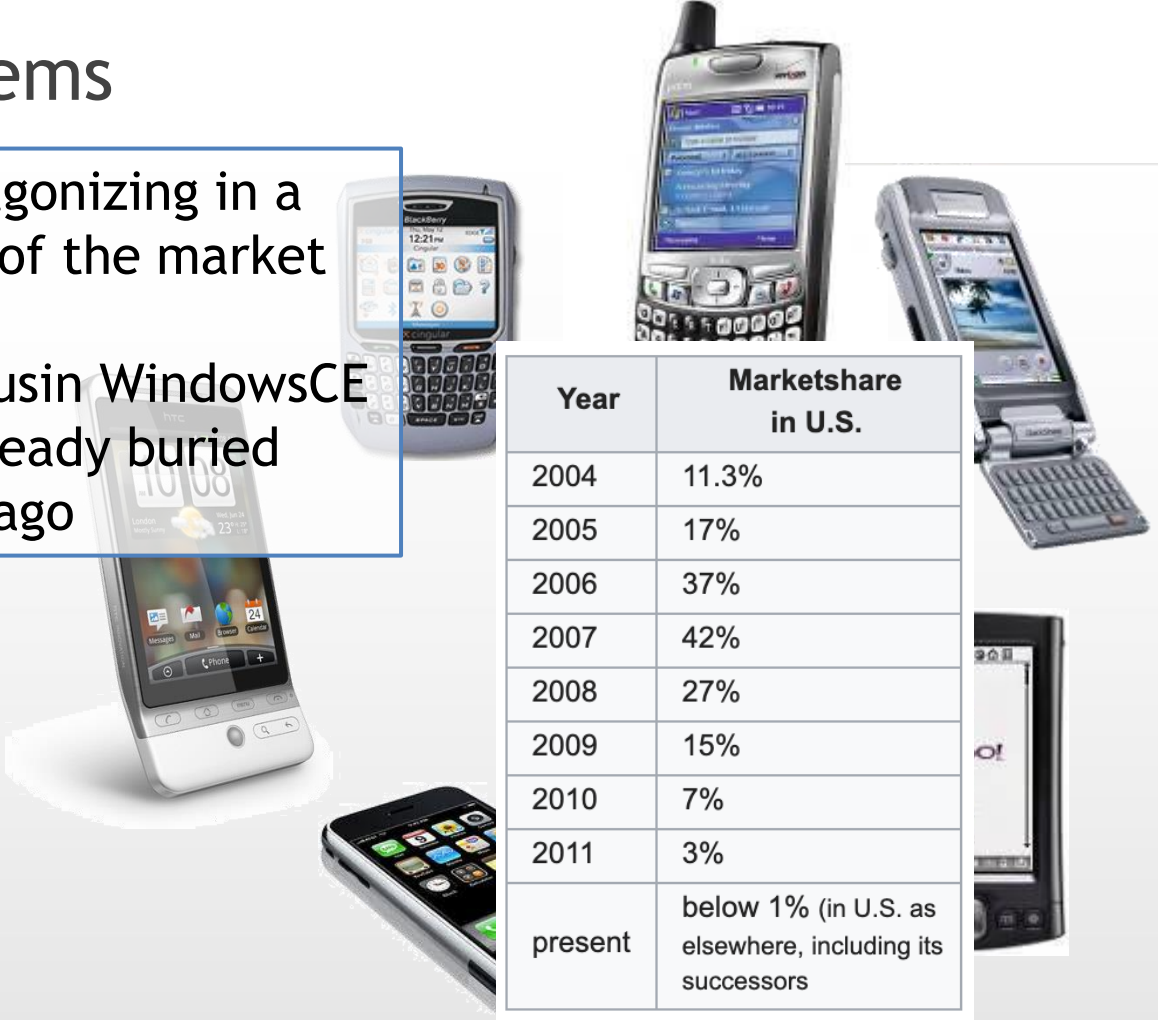
(Vintage) Challenges From the Market

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- Android

This one is agonizing in a dark corner of the market

His older cousin WindowsCE has been already buried many years ago



Year	Marketshare in U.S.
2004	11.3%
2005	17%
2006	37%
2007	42%
2008	27%
2009	15%
2010	7%
2011	3%
present	below 1% (in U.S. as elsewhere, including its successors)

(Vintage) Challenges from Manufacturers

- Multiple devices from the same manufacturer (with very different capabilities)
 - Treo's
 - Blackberries
 - Nokia



Spoiler alert: we are getting the same kind of problems today when developing skills for Amazon alexa



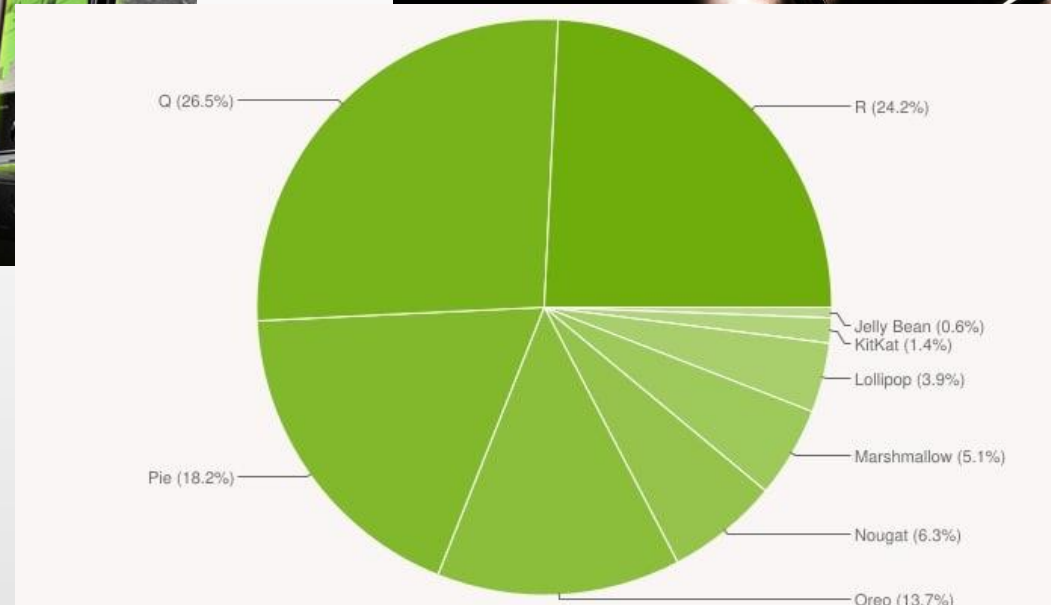
And Challenges From the Users (Still Valid)

- Users have a phone, but many want to use something different
 - Cheaper
 - Faster
 - More supported
 - “Trendy”



Did iPhone and Android Saved us All ?

... I am not so sure



Then, Why Focusing on Phones ?

- Let's put this in term of device usage
 - Tablets are adults-only devices
 - They are expensive, difficult to carry around, serves more purposes, and contain also work-related information
 - Game handhelds are children-only devices
 - They are used solely for games, and not devices the average adult wish to own
 - Phones are EVERYBODY devices
 - Because they can have all the benefits above without being difficult to carry around, and they are always in your pocket
- Therefore, phones have the broadest range of game types

A Real Change for Us (The Developers)

- We can assume that the player is **ALWAYS** connected
 - But we must be ready to pay a price for that
 - No, I am not talking about money
- The device will suffer from many constraints
 - Limited resources
 - Power
 - Memory
 - CPU
 - Limited network traffic (volume, not bandwidth)
 - Limited 3D capabilities

Other Limitations from Using a Phone

- Limited screen and interaction
 - Touch gave a huge help, but it is not as precise as a mouse pointer
 - Specific UIs must be designed to accommodate all the required information
- Limited options for development
 - SDK is provided only from the O.S. manufacturer
 - Language may not be very user friendly (objective C anyone?)
- Sharing the device with many other (seemingly useful) applications
 - Like an agenda and a dialer applications
 - Applications competing for resources will degrade the overall user experience

If your game is draining too much power, apple will remove it from the store. Not because it is bad, but because the average apple user will say “Battery already empty? This phone s***s!”

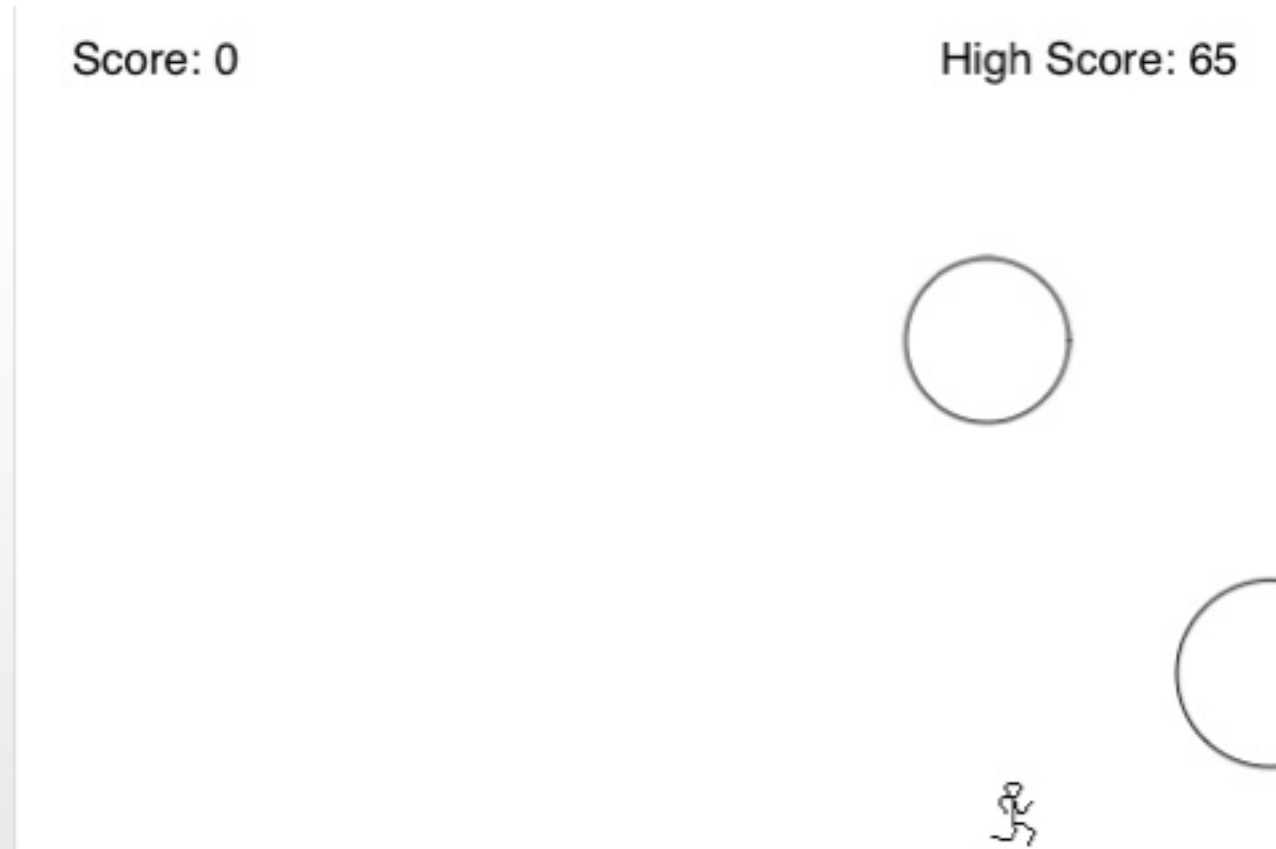
Designing a Game for Mobile

- A mobile game must:
 1. Be easy to learn
 2. Be interruptible
 3. Take advantage of mobile innovations and features

Easy to Learn

- This is true for all games, if you target general audience
- You want to reach general consumers not only computer-geeks
- Controls should be intuitive and leverage on the device general use and/or shape
 - Take advantage of the gestures and swipe your player is already accustomed to
 - Tilting or moving the phone to drive a car or throwing a rock is a valuable option

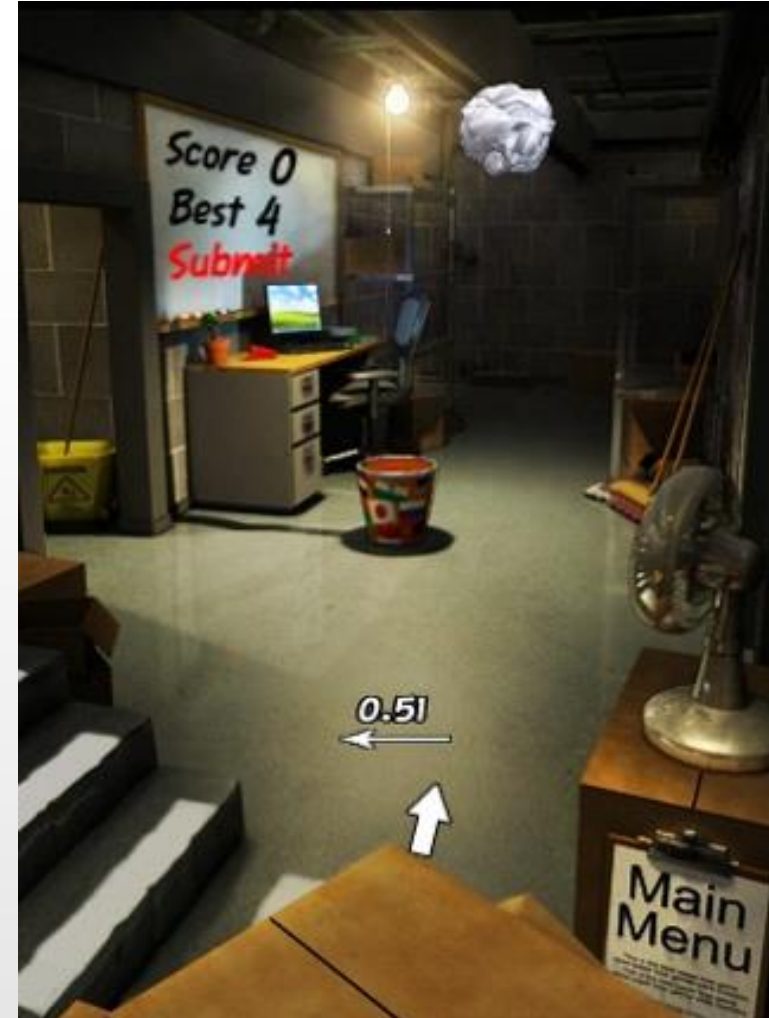
Falling Balls



Interruptible

- A mobile game should provide entertainment value for short time periods
 - You must put your player into perspective
If the player is an adult, he/she will probably seek for entertainment:
 - During coffee breaks
 - While commuting, between bus stops
 - While waiting in line at the grocery store
- Multitasking is a basic characteristic of the mobile lifestyle
 - We must be able to suspend the game at any time for an incoming call, an important alarm, or even to jump onto the bus
 - Game mechanics, in particular, must be designed around this requirement
- From a design standpoint, player actions should be as self contained as possible, and require limited mid-term strategy
 - In this way, the player will be able to concentrate on something different for a while and then come back to the game

Paper Toss



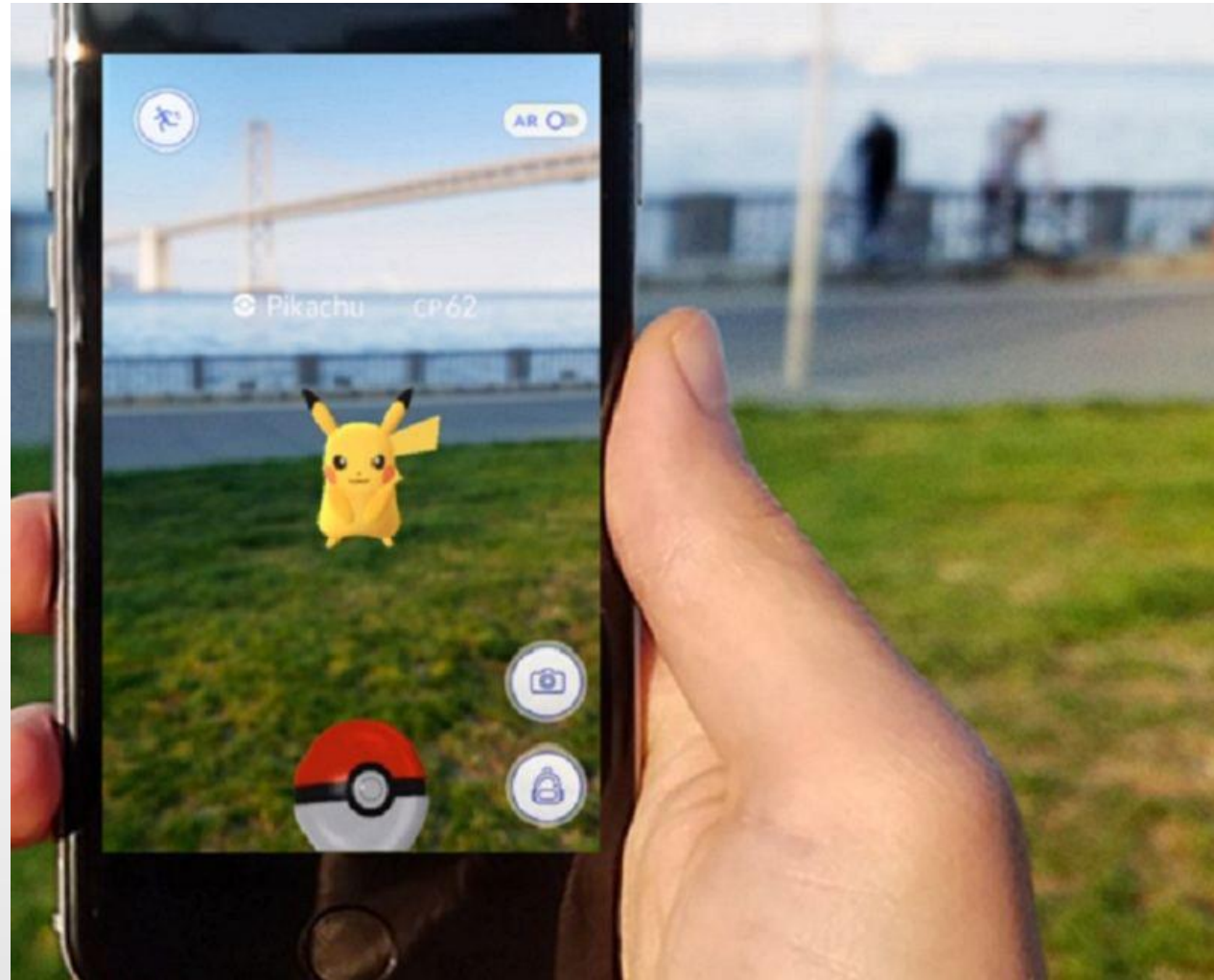
Take Advantage of Mobile Features

- A mobile phone is equipped with many sensors and actuators which are not available on a standard PC
 - GPS
 - The position as part of your game
 - Camera
 - QR Codes recognition
 - Augmented reality
 - NFC
 - Exploit proximity with objects and people
 - BTLE
 - Extend the capabilities tapping on data from additional external sensors
 - Vibration
 - Provide haptic feedback as part of the game experience
 - Flashlight
 - Give visual feedback with a stroboscopic lamp
- Exploit these, and your game is not going to be the next “computer game on a small screen”

Father.IO



Pokemon GO



Chromeracer



Game Networking Approaches

- We have two possible ways to implement online games on mobile phones

1. Server-centric

- Server-driven games
- Client-server service model
 - Cross carrier
 - Cross platform
 - IP based

2. User-centric

- Peer-to-peer games
- Ad-hoc network service approach
 - No Carrier (and no billing)
 - Bluetooth based (WiFi used rarely)

Server-Centric Approach

- All data traffic is routed through the operator
 - The bill is a player's issue
- Each phone communicates only with the remote server
 - Connection drop must be managed
 - You must keep the game state in a reliable place
- Server is responsible to tracks all player's actions and to send updates to each player
 - It is also a single point of failure
- Cellular network games are usually server-driven
 - And used to be also provided by the operator itself

Advantages of Server-Centric Approach

- Only the server needs to know the whole game state
 - More control, but with a single point of failure
 - The server is down → no one plays
- Each phone sends and receives only the data it needs
 - The fog of war is guaranteed for each player
 - No sniffing
 - Cheating is difficult
- With a fast server (or a farm of them), it is possible to scale up and run *Massively Multiplayer Mobile Games*
 - The problem, then, is to create a MMO game playable on mobile
 - Read: energy and interface problems

Disadvantages of Server-Centric Approach

- Developing a multiplayer game is a double project
 - Server side
 - Usually a web-based service on a powerful machine
 - Computationally intensive
 - Client side
 - A highly customized client on a small device
 - I/O intensive
- All is different
 - Technologies
 - Platforms
 - SDKs and languages
 - Testing

It may double (or more) your project costs

User-Centric Approach

- No participant is authoritative
 - All nodes are “peers”
 - We need an election mechanism to select a coordinator
- Each device sends and receives data to/from all surrounding devices
 - Area of coverage may become a problem
 - Network partitioning will disrupt the game
 - Signal fading and interferences will (greatly) reduce channel quality
- Each device keeps track of the overall game state
 - Keeping everything in sync is a very complex problem
 - Cheating is easy because fog of war is not guaranteed
- Bluetooth is a favorite technology here
 - Easy to setup as peer-to-peer
 - Encryption on the socket; sniffing is more difficult
 - Uses less energy than WiFi, especially with BTLE

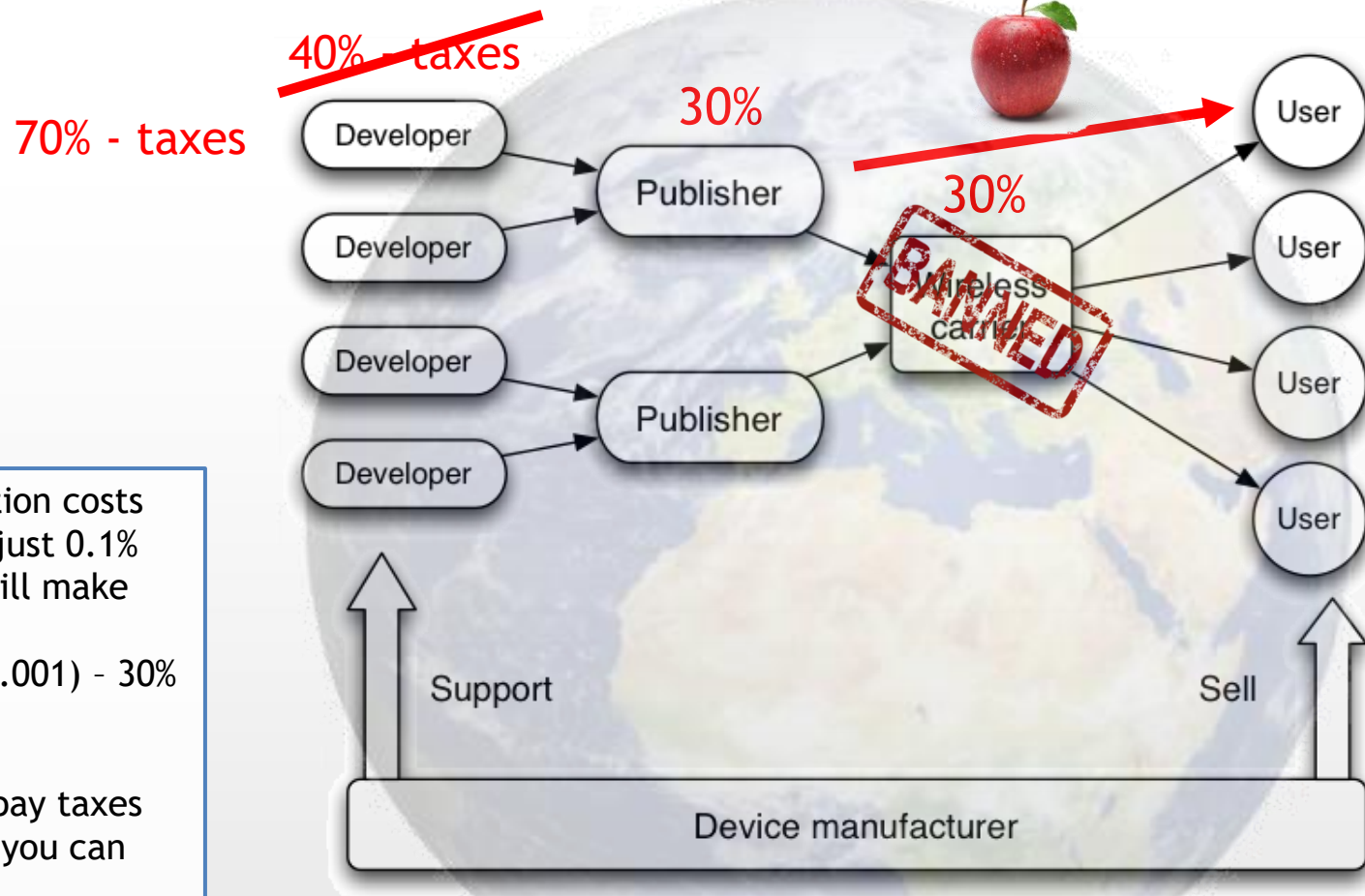
Advantages of User-Centric Approach

- Players supply both hardware and bandwidth
 - Bandwidth can be broad, depending on technology
- Much cheaper to play
 - There is no bill to pay for the connection
- Game traffic will not be filtered by the operator

Disadvantages of User-Centric Approach

- Data flooding on an area
 - Packet collisions on shared medium (ether) grow exponentially
 - Poor scalability with the number of players
- Cheating is easy
 - Sniffing is possible
 - Eavesdropping is possible
 - Impersonation is easy
 - Especially over ad-hoc WiFi
(WiFi between peers without using an access point)
- BT technology limits the connection to eight players at a time due to the design of its layer-2 protocol
 - Not much of a MMMG, isn't it ?

Value Chain for Mobile Games



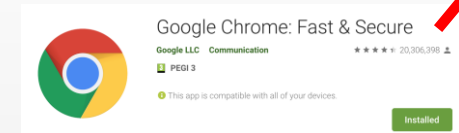
Even if your application costs 1 US\$ and you have just 0.1% market share, you will make

$$(1\$ * 4780000000 * 0.001) - 30\% = 3.346 \text{ MILLIONS}$$

Of course you must pay taxes on that income, but you can live happily anyway

The trick is ... 0.1% worldwide is a HUGE market share

Indicates the direction of the application flow.
The money flows at the opposite direction.



This software is installed basically on every existing android phone

0.4% ???

- Yes, that is correct (by the numbers).
How is it possible?
 - There are old phones that are still using the stock version
 - So, that is a reason to develop your game in an older version of android
 - There are countries where google and apple are not “welcome”, and there is a local, closed, internal market
 - E.g., China

China is a 1.6 BILLIONS phone users market
NOT using Google applications!

On Mobile, Always go BIG!

- Financial success depends on large volume
- Never, ever, target a single country
 - Never do your game only in Italian, French, or German
 - Even a continent may be a bit small
- Never, ever, think in term of:
 - Killer application
 - Blockbuster title
- Distribute costs by offering many titles fishing from the same code base along similar storylines, and hope that one will bring you enough money to pay back everything
 - **Thus, NEVER, EVER write code to be used only once!**



Ask Zynga About Reusing Code



Vampires



Racing



Mafia wars

And Ask Storm8



Warfare



Pokemon-like



Mafia wars

They also had: vampires, racing, ninjas, medieval fantasy, and rockband-like ... all the same!

Localize the Fun

- People want their native forms of entertainment
 - Whatever entertainment means to them
 - We must learn how to build games based on culture
- Can't sell Western products at Western prices
 - Mobile phone gaming is set to go big in India because the hardware is already there, and in huge quantity
 - This may be a problem if you have a single price worldwide (iTune store or android market)
 - That is why, in each store, you have huge listings where you can set a different price for every supported country

Human-Related Issues (Not for us to Solve)

- How important is the retail shopping experience?
 - Retailers may actually add some value
- Maybe people like browsing in game shops
 - Like in book shops
 - Some sales are impulse purchases
- Children whining in shops makes games sell
- Is it important to get a box at Christmas ?
 - Maybe your [girl/boy]friend will not like a keycode in an envelope



Mobile Interfaces: Design for Usability

The sole purpose of an interface on a small mobile device is to be usable!

Usability really just means making sure that something works well: that a person of average (or even below average) ability and experience can use the thing - whether it's a web site, remote control, or revolving door - for its intended purpose without getting hopelessly frustrated

Steve Krug (web usability consultant)

User Interface Constraints

- Screen is small
 - Text is more difficult to input
 - Should be requested only where strictly needed
 - Long typing should really be avoided!
- Single window interface
 - Cut'n'paste between applications may be difficult

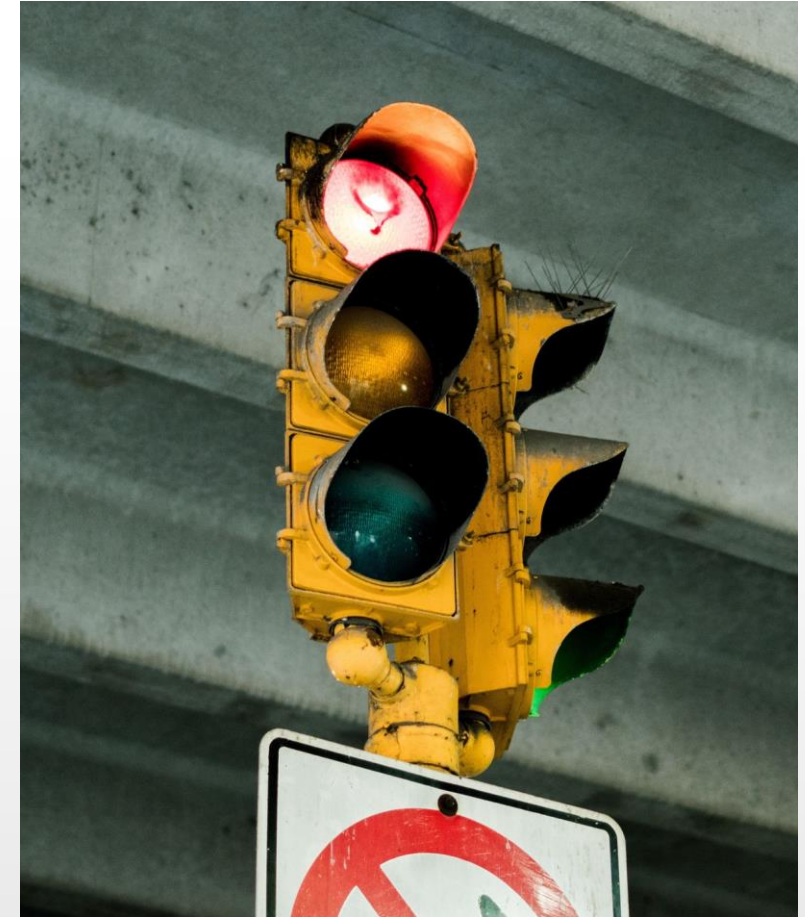
Keywords for a Good Mobile UI

1. Intuitive
2. Easy to learn
3. Well-organized
4. Efficient
5. Consistent

None of the above is optional

Always Remember

- “The user do NOT read, the user SCAN”
 - Color may be more relevant than text
 - Position may be more relevant than color
- Quick question (reply quickly)
 - In a traffic light, the RED is:
 1. on top
 2. at the bottom



Keep It Simple and Consistent

- Create a structure that promotes simplicity and consistency
 - Few buttons, well placed, always put a certain function in the same position
 - These rules are ENFORCED on iTunes store by apple guidelines.
Not following them will result in your application being rejected
- Make interactions simple and consistent
 - Everything should be “one tap away”
- Make terminology, icons, buttons and layout, consistent
 - Do not confuse the user; he/she should not “look and understand” the icons, guessing from their shape must be enough
- Have uniformly designed interface elements, but incorporate irregularity to create meaning and importance
 - Noise will attract attention (unless “noise” is all around) and suggest a careful reading

Neither Simple, nor Consistent

Big Money Annuity

Start	20 November 2009	Now
End	15 November 2029	Now
Time	Years: 20.00	CA
	Months: 240.00	?
	Days: 7300.00	
Year Semi Quarter Month Week Day Cont		
I %	4.0000	Comp Simp
PMT	150,000,000,000.00	Adv Arr
PV	2,038,548,951,745.15	
FV	0.00	

Is This Consistent?



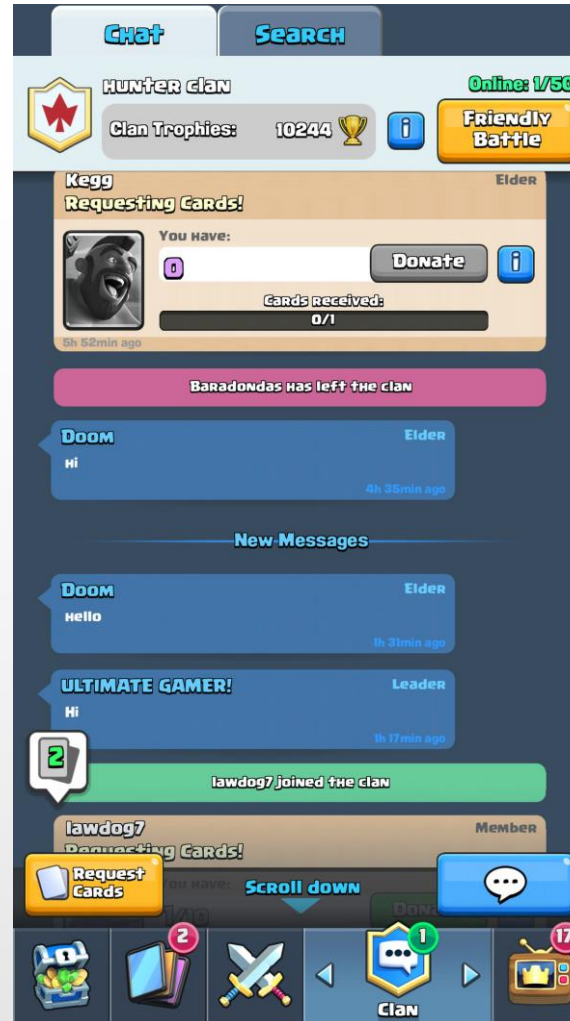
Think again, is It Consistent?



Maximize Readability

- Use color contrast on text
 - Avoid “bad” combination
 - You can find tables online about color combinations to avoid
 - Be sure to help colorblind people
- Use font sizes that are large enough to read
 - Density-independent pixels are there for a reason
- Use various font weights for emphasis
 - Wonderful, but avoid a font chaos
 - Be sure fonts and weight are distinguishable

BAD Readability



Reduce Clutter

- Don't overcrowd the screen
- Include only what is strictly required
 - KISS: Keep It Simple and Stupid
- Make it is easy for users to interact with soft keys/touch points on the screen
 - Do not put small buttons on corners or too close to edges
 - When the device gets old, touch sensitivity will decrease on borders first

Study Material

- A survey on interactive games over mobile networks
online: <https://doi.org/10.1002/wcm.2197>
By Gerla & all.
- Adaptable client-server architecture for mobile multiplayer games
online: <http://dx.doi.org/10.4108/ICST.SIMUTOOLS2010.8704>
by Khan & all.