The Gamer's Brain

How Neuroscience and UX can impact Design

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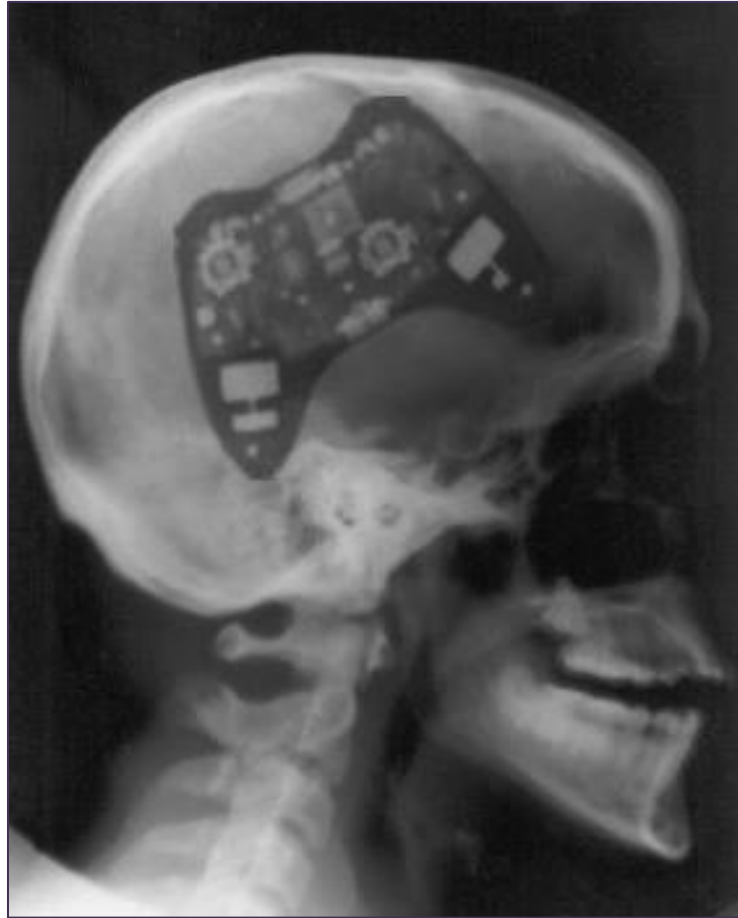
@CeliaHodent

GAME DEVELOPERS CONFERENCE®
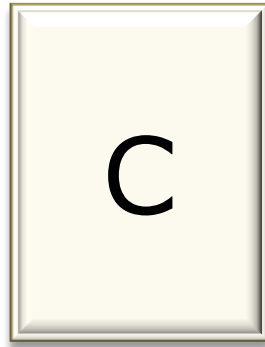MOSCONE CENTER · SAN FRANCISCO, CA
MARCH 2-6, 2015 · EXPO: MARCH 4-6, 2015

Each card has a letter on one side and a number on the other side.
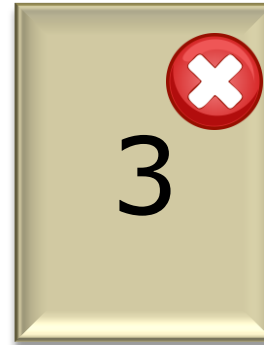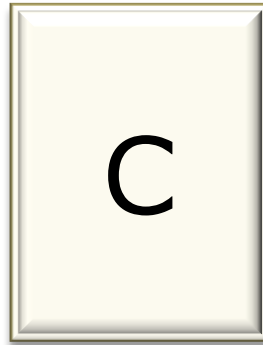
| A | C | 3 | 7 |

(Wason, 1966 / Evans, 1993)

Which card(s) do you need to turn over to determine whether the following claim is true:

"If the card has a **A** on one side,
then it has a **3** on the other side".

If **A** then → **3**

A ✓   C   3 ✗   7 ✓

(Wason, 1966 / Evans, 1993)

Correct answer: **A - 7**

Correct answers **< 10 %** in Wason's study

UX

How the brain processes info

PERCEPTION
(input)

ATTENTION

Emotion/ Motivation

INFLUENCING FACTORS

INFO PROCESSING

MEMORY
(synaptic modification)

Perception: How it works

Information is organized through a 3-level process (example of vision):

COGNITION
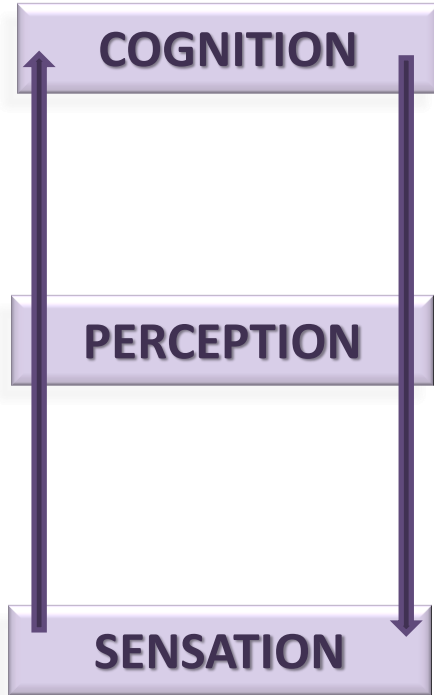
Knowledge: access to semantics

PERCEPTION

Organization of the visual field: the brain likes meaningful patterns (shape)

SENSATION

Physics: orientation, spatial frequency, brightness …
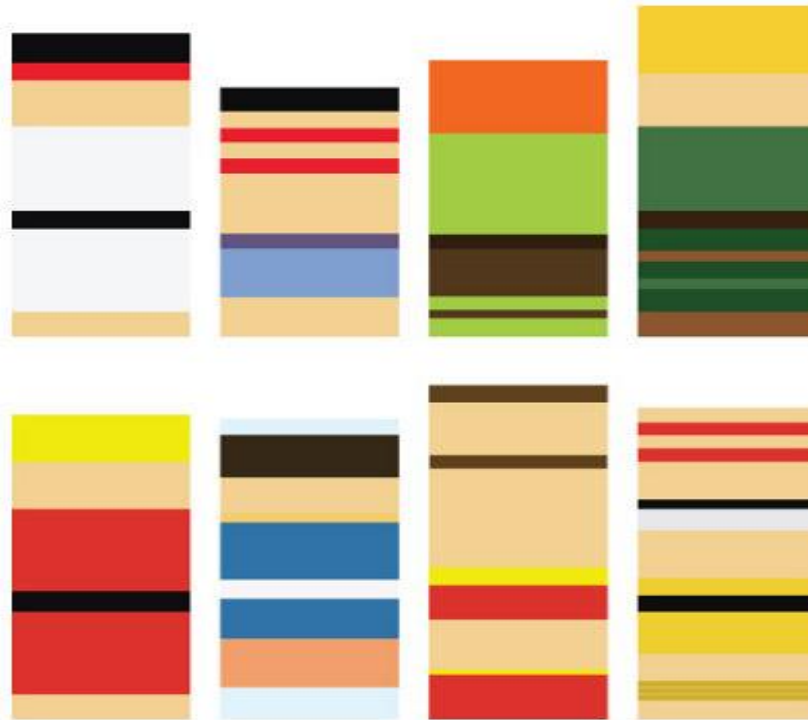
→ Top-down process in perception … the geek version

Street Fighter II characters as minimalized by artist Ashley Browning

Perception: Gestalt Theory

Law of Proximity

Objects that are near one another in space or time are perceived as belonging together.

Law of Similarity

Objects with similar attributes (such as shape, color, size, or brightness) are perceived as belonging together.
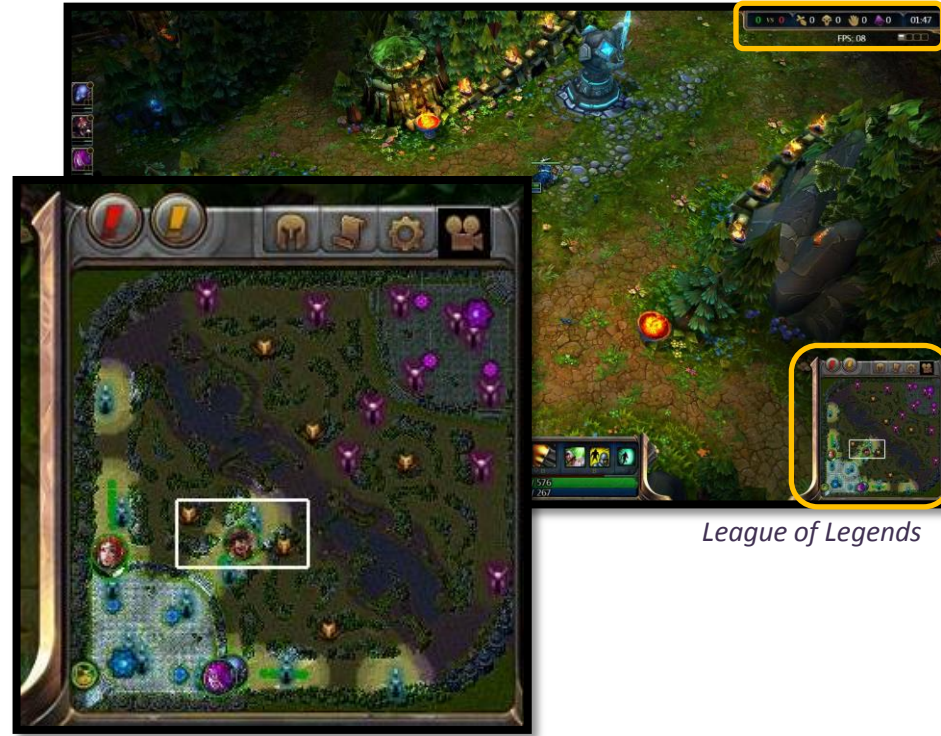
League of Legends

Application: Gestalt laws in menus

Far Cry 4
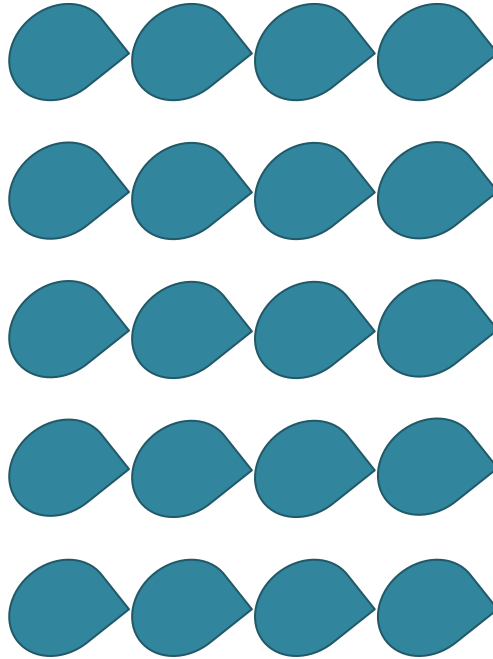
Perception: Form Follows Function

Affordance = no need to learn
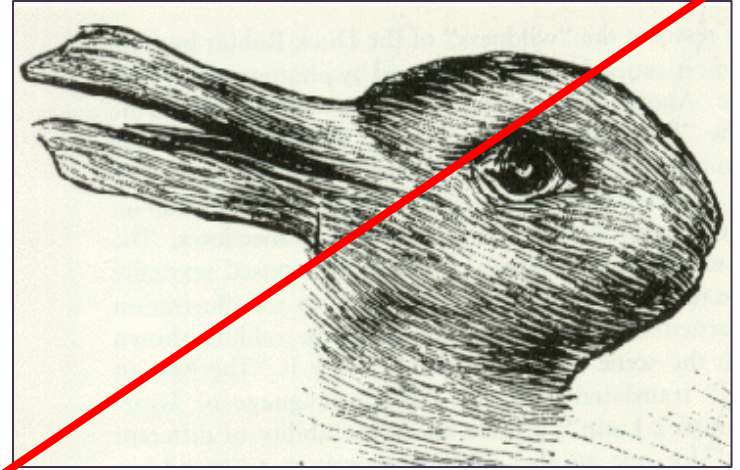
Avoid multistability ...

Perception: Form Follows Function

Mail

Camera

→ Stereotypes to help identify the function

Game Center

Photos

→ Need to be learned

Music

iTunes Store

→ Similar form for 2 different functions

iPhone OS 7

Application: FFF in icon testing

Fortnite (pre-alpha)

FORM = "It looks like a heart with an EKG graph inside"

FUNCTION = " I expect using this ability would resuscitate my character"

✱5. Looking at the icon above, quickly answer the following questions:

What does it look like? (describe the FORM)

What does it do? (describe the FUNCTION)

Application: FFF in icon testing

Form (UI designer):
"Smoke bomb releasing a plume of smoke"

Function (UI designer):
"Throws a smoke bomb (Ninja ability)"

Survey Answers	
it looks like a bomb with the lit end of the fuse has a heart shape	Partially Correct
A bomb with smoke coming from the fuse.	Correct
A bomb	Partially Correct
bomb with fuse lit	Partially Correct
Smoke bomb	Correct
Bomb with a puff of smoke	Correct
A bomb with a white heart	Partially Correct
Bomb	Partially Correct
smoke bomb	Correct
smoke bomb	Correct
Bomb and smoke	Correct
Bomb	Partially Correct
Bomb with smoke coming out of its fuse	Correct

Survey Answers	
Causes the bombs to not hurt teammates	Incorrect
A smoke bomb.	Correct
explode	Partially Correct
will explode	Partially Correct
To hide or get away from enemies.	Correct
Smoke grenade	Correct
When explodes it affects the opposition, but does not damage them	Incorrect
diffused bomb, fails to explode	Incorrect
A bomb that causes smoke to come out	Correct
obfuscation	Correct
Increases power of bomb	Incorrect
Some kind of thrown bomb	Partially Correct
Smoke bomb	Correct

Form = 60% → to improve

→ Function = 75% because ambiguous form

Application: FFF in icon testing

Form (UI designer):
"Bomb superimposed on an old-timey alarm clock"

Function (UI designer):
"Deploys the Matter Collector, which destroys and returns as materials all objects within a given radius of the 'blast' (Outlander ability)"

Survey Answers	
Bomb inside of a stopwatch	Correct
Looks like a bomb timer	Correct
A bomb inside of a clock.	Correct
Looks like a bomb inside a clock.	Correct
A bomb in a stopwatch	Correct
bomb with timer on it	Correct
Time bomb	Correct
bomb in a clock	Correct
A bomb with a clock	Correct
Bomb with a clock	Correct
timed bomb	Correct

Survey Answers	
Sets off a timed bomb	Incorrect
That this will either explode a remote bomb or will lay down a bomb that will explode after a few seconds	Incorrect
Increases/decreases the time of you bombs.	Incorrect
An ability to set a timed explosion.	Incorrect
Explode after "x" amount of seconds	Incorrect
makes bomb explode faster	Incorrect
A bomb that will go off in X time	Incorrect
time bomb	Incorrect
A skill that allows the user to set a timer for a bomb	Incorrect
Time Bomb	Incorrect
A bomb that has a specific timer on it before it blows up	Incorrect

→ This icon needs a complete redesign.

- Listen to this. How does the batcycle sound? (*The Dark Knight*)

- What is it *really*?
→ Shepard tone
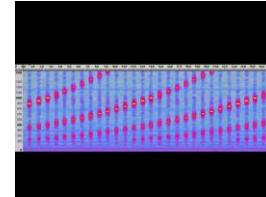
- Shepard tone in *Super Mario 64*

Application: What the player *perceives* is what matters

Fortnite - shooting range gym level

Introduction   **Perception**   *Memory*   *Attention*   *Conclusion*

Perception

How it works (in a nutshell)	Input is processed		
Limitations (examples)	Perception(s) ≠ Reality Perception is subjective		
Applications (examples)	Use Gestalt laws Form Follows Function		

How the brain processes info

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MEMORY
(synaptic modification)

INFO PROCESSING

Memory: How it works

SENSORY MEMORY

Part of perception
Importance of attention

ENCODING

WORKING MEMORY

Short-term – Easily disturbed
Requires heavy attentional resources

STORAGE

LONG-TERM MEMORY

Potentially unlimited
in time and space
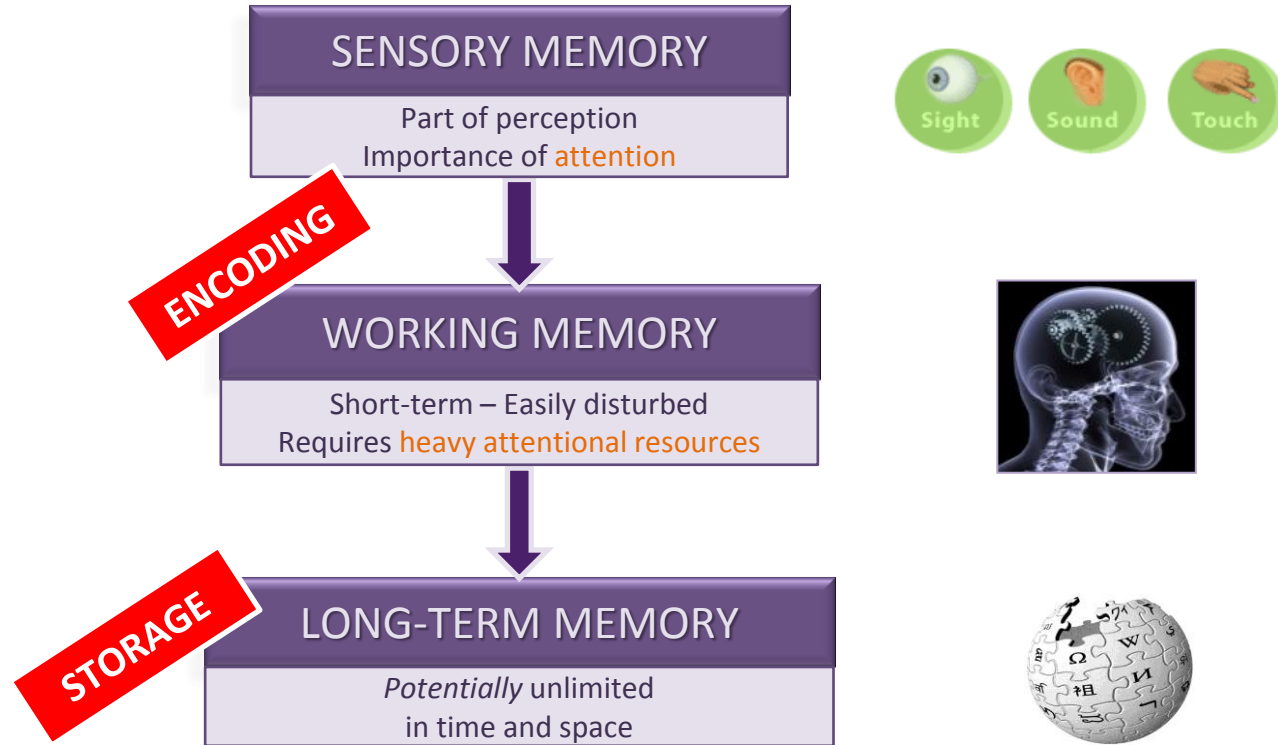
Memory: Limitations

Forgetting curve:

(Ebbinghaus, 1885)

Do you remember the iOS icons I showed you earlier?

Forgetting curve applied to games:

Game difficulty level

Player's mastery

Forgetting curve

→ **Discrepancy when resuming: the player can feel downgraded**

1st game session   x days lag   2nd game session
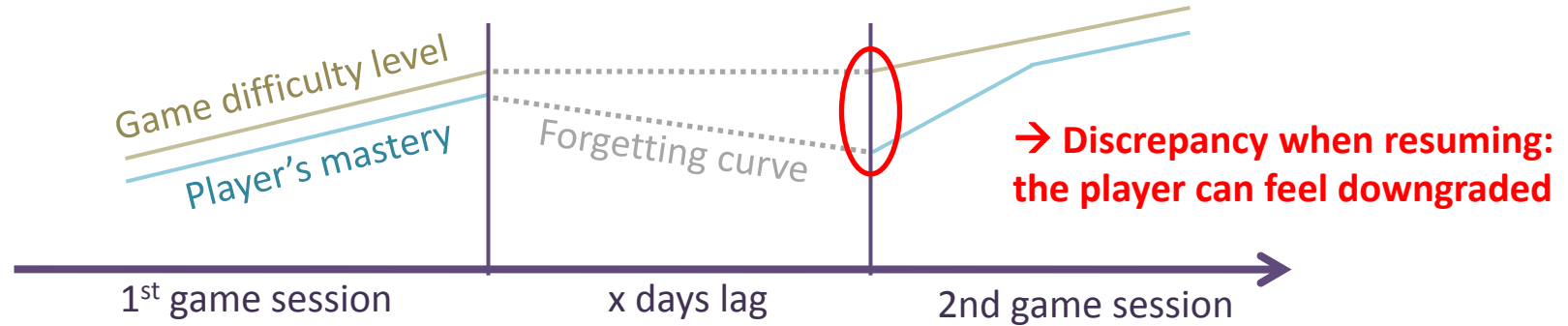
Application: Reduce the memory load

Assassin's Creed

Application: Reduce the memory load

Fortnite
(pre-alpha)

Application: Prioritize learning

Fortnite – pre-alpha

Application: Prioritize learning

Prio	Features to teach	Difficulty	Tutorial order		
2	Core movement and combat	Easy – dynamic tip	2		
2	Scavenging	Easy – dynamic tip	2		
2	Crafting	Medium	2		
2	Building	Hard	4		
1	Home Base is player's persona	Medium	1		
3	Commanding a roster of heroes	Medium	3		

Application: Prioritize learning

| Prio	Features to teach	Difficulty	Tutorial order	Onboarding plan (player's perspective)	Narrative wrapper
1	Home Base is player's persona	Medium	1	This is me in the game. I start by naming and choosing a banner for my Home Base.	Player receives a distress beacon and discovers his/her Home Base to command.
2	Core movement and combat	Easy – dynamic tip	2	I know how to move and shoot, just give me a quick tip if necessary.	N/A
2	Scavenging	Easy – dynamic tip	2	I quite naturally destroy the environment, just give me a quick tip that all is destroyable.	N/A
2	Crafting	Medium	2	Crafting enables me to make more powerful weapons and items. I must know how to do this to have fun in the game.	The player needs a harvesting tool. Safe environment.
3	Commanding a roster of heroes	Medium	3	I'm managing multiple heroes, each having specific skills.	The player has to choose his/her first hero among 2 classes to send it to the 1st mission.
2	Building	Hard	4	Building enables me to make forts that protect me from evil. I must know how to do this to have fun.	The player is in a pit and needs to build stairs to escape and start exploring. Safe environment.

Introduction Perception **Memory** Attention Conclusion

Application: Prioritize learning

Boots on the ground first?

Pros = Exciting action right away

Cons = Player can wrongly believe this first hero is the persistent element

Home Base first?
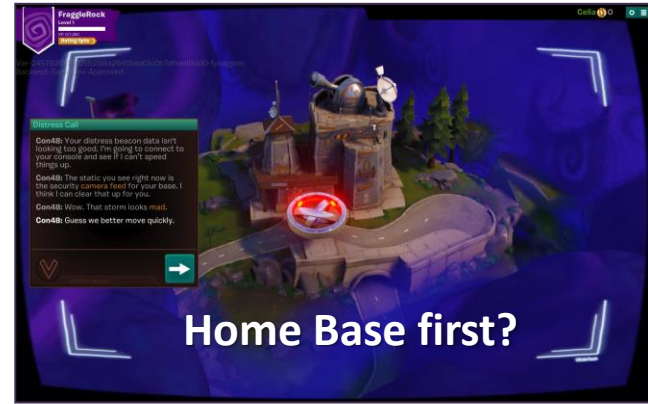
Pros =
- Sets the expectation correctly
- Gives medium-term motivation

Cons = Longer to start action

Verify your hypotheses in **UX test** early on:

I completely disagree	I somewhat disagree	I'm not sure	I somewhat agree	I completely agree
○	○	○	○	○

- I clearly feel the impact of my progression in the game
- I know what to do to become more powerful in the game
- I clearly know which will be the 2-3 next things I'll unlock in my Homebase
- …

And with **analytics** later on.

Application: Prioritize learning

Prio	Features to teach	Difficulty	Tutorial order	Onboarding plan (player's perspective)	Narrative wrapper
2	Scavenging	Easy – dynamic tip	2	I quite naturally destroy the environment, just give me a quick tip that all is destroyable.	N/A
2	Crafting	Medium	2	Crafting enables me to make more powerful weapons and items. I must know how to do this to have fun in the game.	The player needs a harvesting tool. Safe environment.
2	Building	Hard	4	Building enables me to make forts that protect me from evil. I must know how to do this to have fun.	The player is in a pit and needs to build stairs to escape and start exploring. Safe environment.

Memory: Reminder …

	Perception	Memory	
How it works (in a nutshell)	Input is processed	Encoding and Storage	
Limitations (examples)	Perception(s) ≠ Reality Perception is subjective	Forgetting Curve	
Applications (examples)	Use Gestalt laws Form Follows Function	Reduce memory load Prioritize learning	

How the brain processes info

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MEMORY
(synaptic modification)

Pick one card:

I bet I can guess which card you picked and make it disappear:

Yes, but actually all the cards have changed ...
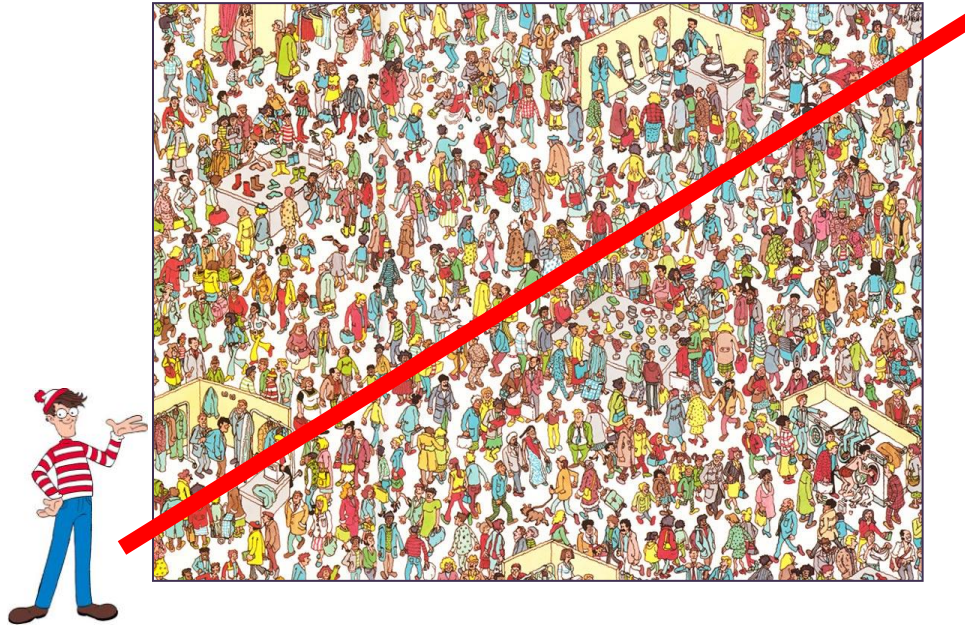
→ *change blindness*
→ *inattentional blindness*

BTW, did you notice the gorilla in this image earlier?

We are not carefully scanning all of our environment …

Rather, attention works like a spotlight.

Low attention span   –   Multitasking is a myth …

Fortnite
(Sept 2014)

**We can hardly pay attention to tutorial texts
when busy killing zombies ...**

Multitask

Example of the 'red overload' problem:

Unreal Tournament 3

Application: Minimum workload

Reducing the 'red overload' in Fortnite:

Fortnite (Jan 2014)

(March 2015)

Application: Context and Meaning

The **deeper you process** information (= focus your attention)
the better you learn/retain …

Context = learning by doing
Meaning = worthwhile <u>now</u> (for player's life/mission/goal)

≠ narrative

Far Cry 3: Blood Dragon
No context, no meaning (but hilarious ☺)

Call of Duty 2
Context, yet weak meaning

Uncharted 2
Context and meaning

LEARN THEN DO
(shallow process,
weak motivation)

LEARNING BY DOING
(deeper process when in context,
greater motivation with <u>meaning</u>)

Building tutorial in Fortnite: towards more meaning

Sep 2014

Feb 2015

- Player told to protect a tractor: misleading.
- Build protection around barn: unintuitive.
- Player in stressful situation (timer) and set for failure.
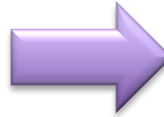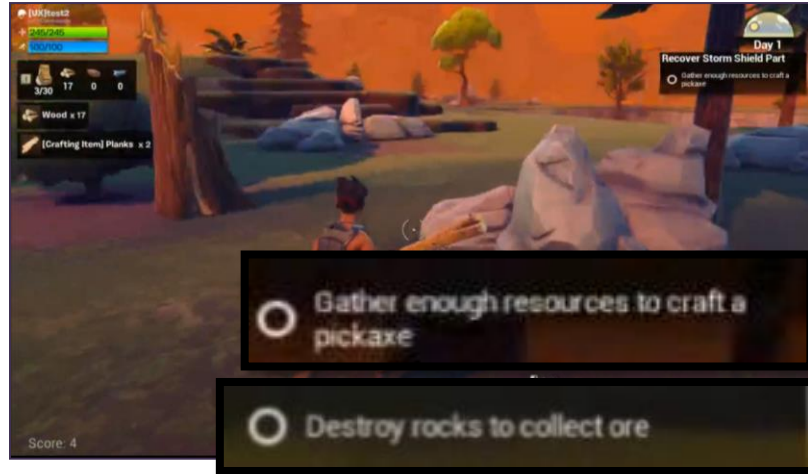
→ in context but poor and misleading meaning

- Player told to build his/her way out.
- Player has all the time needed.
- Set for success.

→ greater meaning

Application: Context and Meaning

Crafting tutorial in Fortnite: towards more meaning

Nov 2014

Feb 2015

- Player is asked to do things step by step without clearly understanding the purpose (craft a pickaxe)

  → in context but poor meaning

- Player is clearly told the purpose for a tutorial.
- Offers more freedom.

  → greater meaning

Attention: Reminder …

	Perception	**Memory**	**Attention**
How it works (in a nutshell)	Input is processed	Encoding and Storage	Spotlight
Limitations (examples)	Perception(s) ≠ Reality Perception is subjective	Forgetting Curve	Inattentional blindness Low attention span
Applications (examples)	Use Gestalt laws Form Follows Function	Reduce memory load Prioritize learning	Minimum workload Context & Meaning

Brain limitations are at the core of UX heuristics …

JUMPING TO CONCLUSIONS

The gamer's brain is heavily biased …

… so is the developer's.

User eXperience

Usability

- ❑ Signs & Feedback
- ❑ Clarity
- ❑ Form Follows Function
- ❑ Consistency
- ❑ Minimum Workload
- ❑ Error Prevention / Recovery
- ❑ Flexibility

GameFlow

- ❑ Perceived Pacing
  (challenge, learning curve, surprises, ...)

- ❑ Motivation
  (competence, autonomy, relatedness)

- ❑ Emotion
  (game feel, implicit motivation, ...)

THANKS!

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