HCI & Games Research
An Overview

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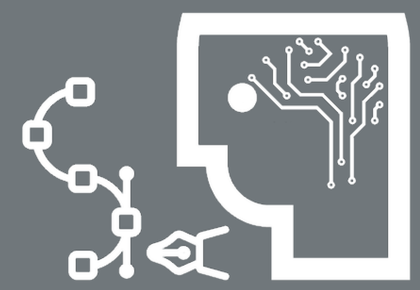


The dominant research questions in this field have yet to be defined.

It is an exciting time to get involved with games research!

UX Lab, Epic Games ©

What's in a Game?

game */gām/ n. (pl.* **-games***)* a series of rules that involves a structured conflict representing a subset of the world.

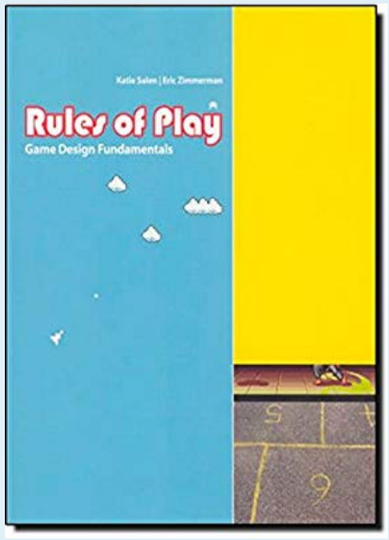
```
{"<start>" : "<template>",

 "<template>" :
 "<object> in which players <engagement>.
| <object> that involves <characteristics>.
| <object> <constraints>.
| <object> characterized by <relationship>.",

"<object>" :
…
}
```

molleindustria. http://www.gamedefinitions.com/

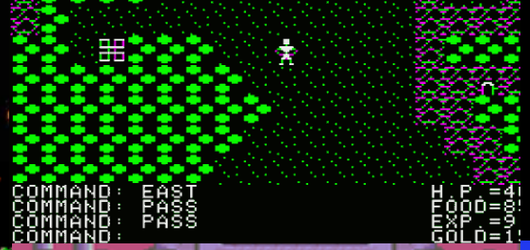
An Operational Definition

A game is
a system in which players engage in an
artificial conflict,
defined by rules,
that results in a quantifiable outcome.

–Eric Zimmerman and Katie Salen, Rules of Play




-LIFE-


COMMAND: EAST
COMMAND: PASS
COMMAND: PASS
COMMAND:
H.P =4
FOOD=8
EXP =9
GOLD=1


POW
P-0


fe fe fe fe
fe fe fe fe
fe fe fe fe
fe fe fe
fe fe fe
fe fe fe fe


WORLD 3
$71
0092080
276


4900 MIN
50000 INSERT COIN
KO
37
KEN


FLOOR 5
SCORE 102500
LIVES 4
HEALTH 84%
AMMO 27


×2
SHIELD
OUT OF MY WAY!!


36
LAW
YOSHIMITSU


×5
×7
×31


Attack
Element
Defend
RunAway
Serge
243/243
Kid
214/214
Mel


15:42
$00595576
012 097
3946-20


PAUSED
PRESS THE PAUSE BUTTON TO CONTINUE


Position
4
Lap
1/2
0'11.460
Best Lap
Last Lap

ara: The human subconscious instinctively resists the joining, Commander. A strong p
like yours makes it even harder.

Hero
Conduit Defeated 25 XP

HCI & Games Research: An Overview

- Past: Understanding Player & Game
- Present: A Fragmented Field
- Future: The Science of Game Design

HCI & Games Research: An Overview

- Past: Understanding Player & Game

Understanding Player & Game

- Piaget's (1962) *Play, dreams, and imitation in childhood*
  - Child development involves schema building
  - Play environments lead to richer schemas

Understanding Player & Game

- Malone's (1981) *Heuristics for designing enjoyable user interfaces*
  - Challenge
  - Fantasy
  - Curiosity

Table 2
Heuristics for Designing Enjoyable User Interfaces

I. Challenge

A. *Goal.* Is there a clear *goal* in the activity? Does the interface provide *performance feedback* about how close the user is to achieving the goal?

B. *Uncertain outcome.* Is the outcome of reaching the goal uncertain?

1. Does the activity have a *variable difficulty level*? For example, does the interface have *successive layers of complexity*?

2. Does the activity have *multiple level goals?* For example, does the interface include *score-keeping*?

II. Fantasy

A. Does the interface embody *emotionally appealling* fantasies?

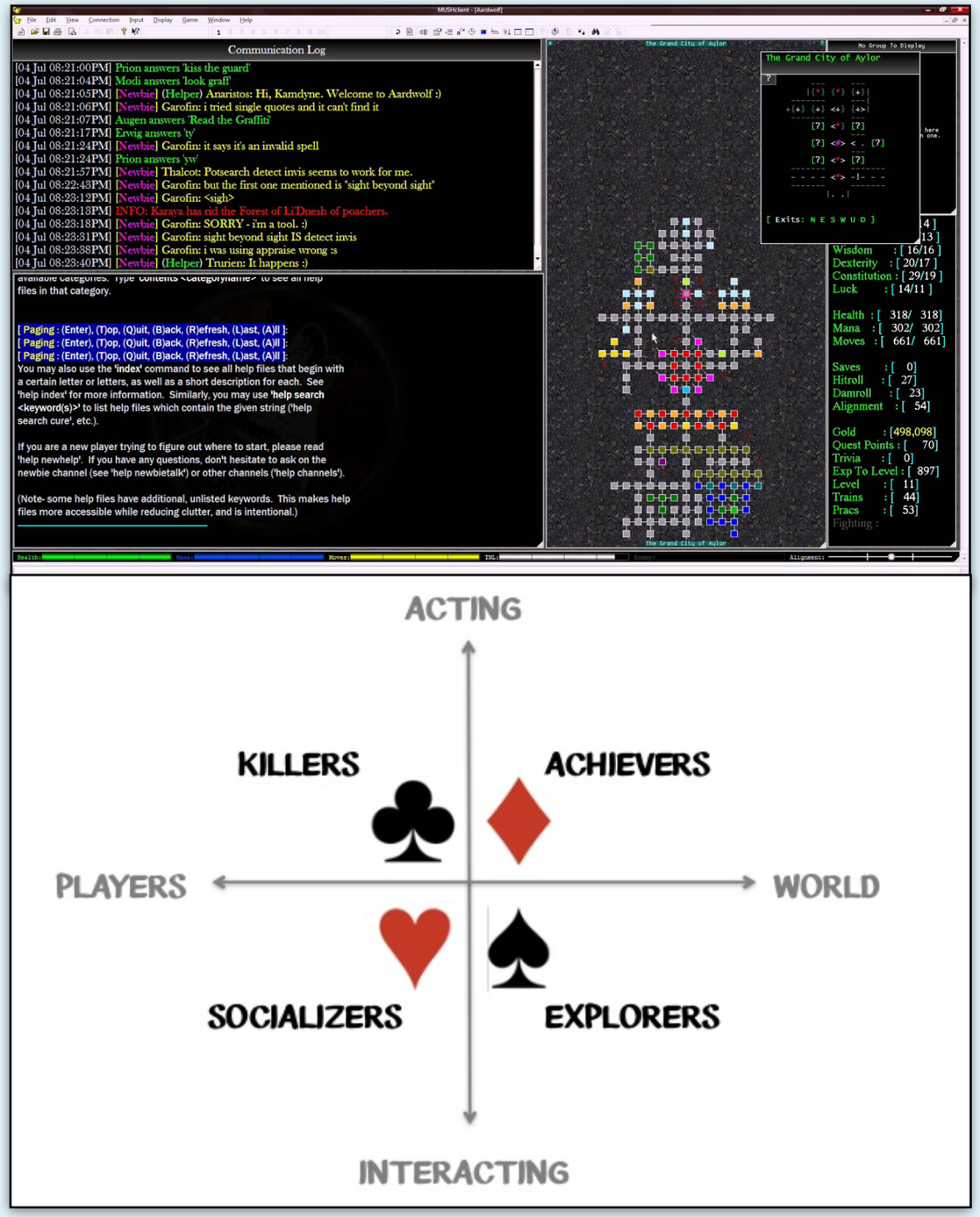
B. Does the interface embody *metaphors* with physical or other systems that the user already understands?

III. Curiosity

A. Does the activity provide an *optimal level of informational complexity?*

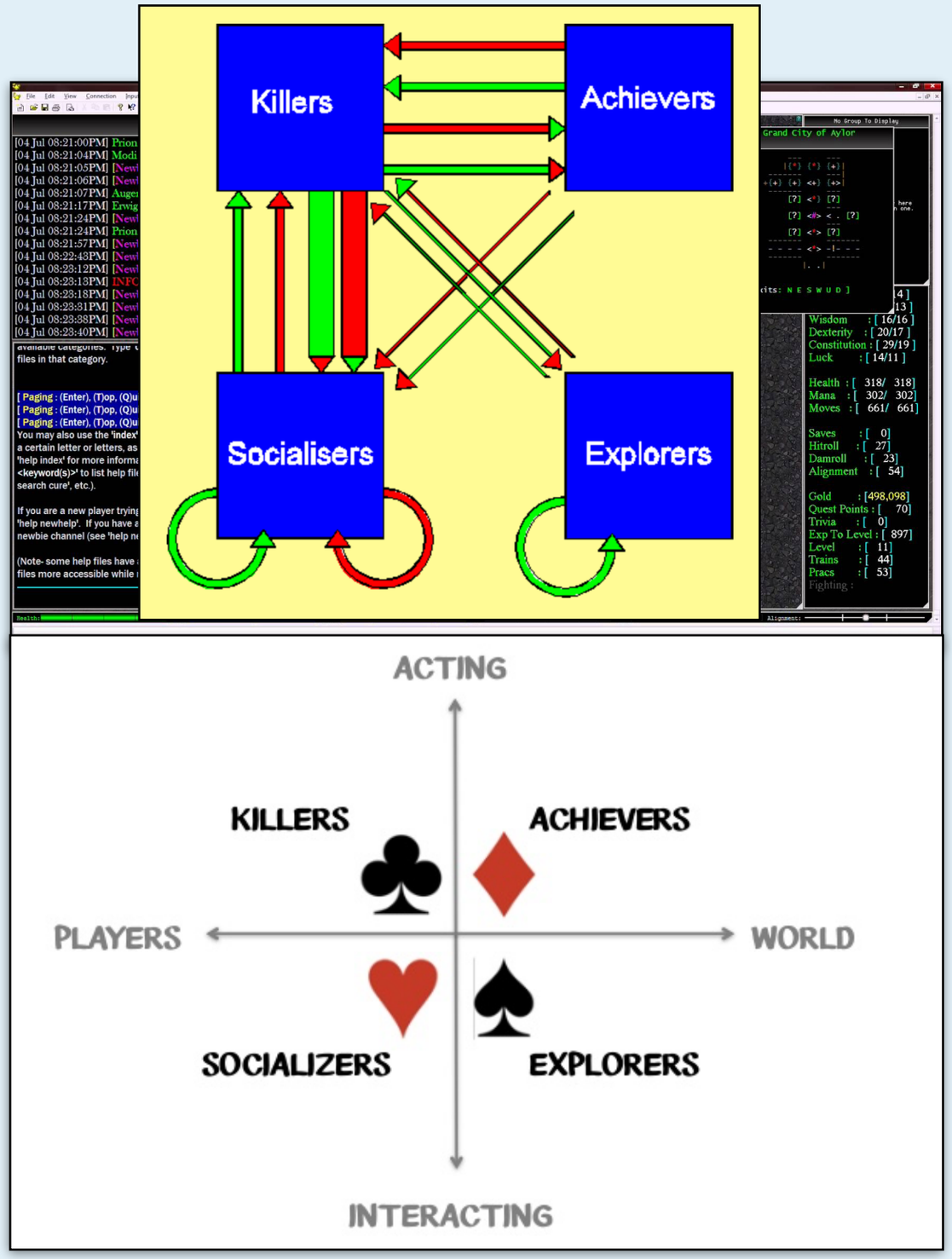
Understanding Player & Game

- Bartle's (1996) *Players Who Suit MUDs*
  - Different players value challenge, fantasy, curiosity <u>differently</u>



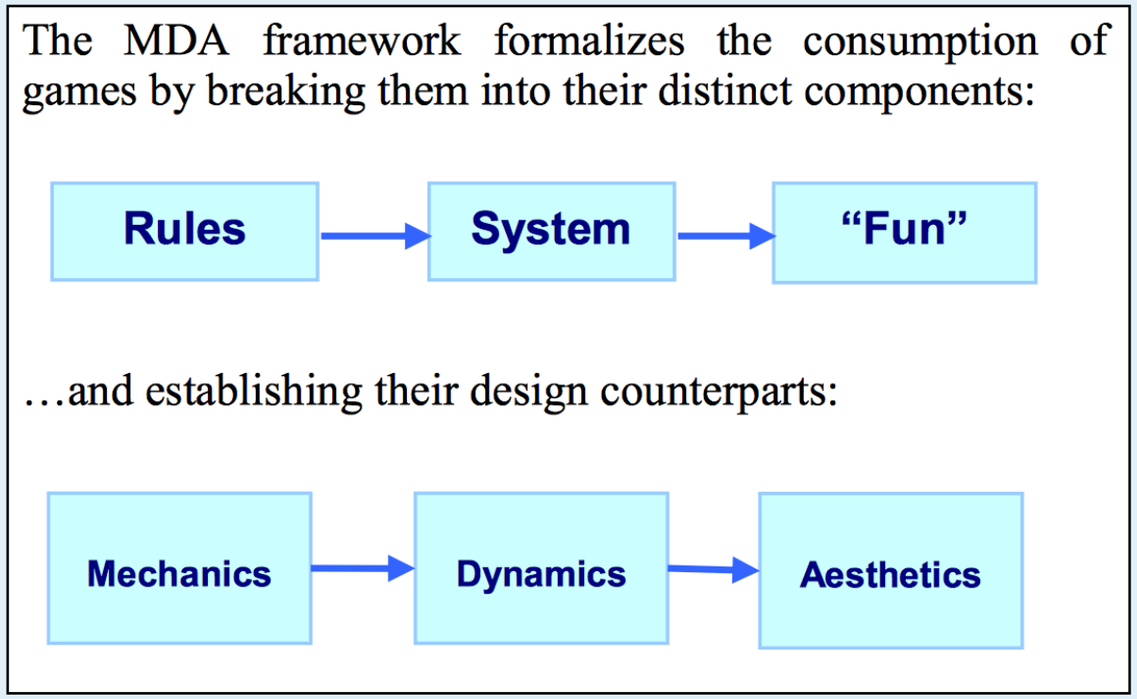
Understanding Player & Game

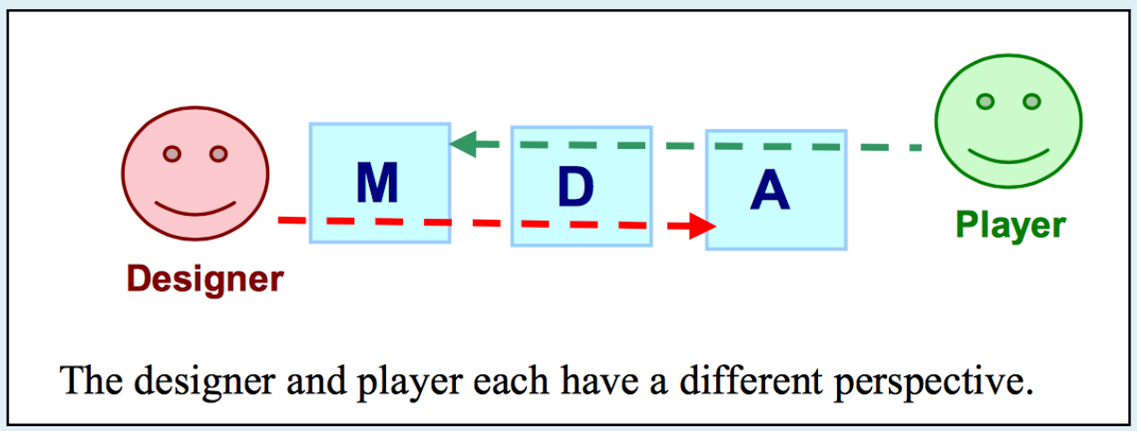
- Bartle's (1996) *Players Who Suit MUDs*
  - Different players value challenge, fantasy, curiosity <u>differently</u>
  - Tradeoffs for experience



Understanding Player & Game

- Hunicke, LeBlanc, and Zubek's (2004) *MDA*
  - Mechanics
  - Dynamics
  - Aesthetics
- The indirect-design problem





HCI & Games Research: An Overview

- Past: Understanding Player & Game
- Present: A Fragmented Field

Human-Computer Interaction v. Player-Computer Interaction

- Lazzaro's (2008)
  Gameplay Experience Goals

  - HCI
    - Task Completion
    - Reduce Error
    - External Reward
    - "Intuitive"
    - Reduce Workload
  - PCI
    - Entertainment
    - Fun-to-beat obstacles
    - Intrinsic Reward
    - New Things to Learn
    - Increase Workload

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*

Welcome

CHI PLAY is an international and interdisciplinary conference (by ACM SIGCHI) for researchers and professionals across all areas of play, games and human-computer interaction (HCI). We call this area "player-computer interaction."

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*

Welcome

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A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*

In order to identify the relevant papers for this literature review, we used the following Boolean search string in the ACM Digital Library:

((Title:game*) or (Title:gaming*) or (Title:play*) or (Abstract:game*) or (Abstract:gaming*) or (Abstract:play*)) and (PublicationTitle:SIGCHI Conference on Human Factors in Computing Systems) and PublishedAs:proceeding)

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative
  - Epistemological

Plunkett, Luke. (2010). *Where Board Games and Video Games Come Together*. Kotaku. Available: https://www.kotaku.com.au/2010/07/where-board-games-and-video-games-come-together/

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative
  - Epistemological
  - Ontological

Domínguez *et al.*'s *Mimesis Effect* in CHI2016

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative
  - Epistemological
  - Ontological
  - Practice

Twitch Plays Pokémon

Pokémon Red	12 February 2014	1 March 2014	16 days, 9 hours, 55 minutes, 4 seconds

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative
  - Epistemological
  - Ontological
  - Practice

Instrumentalize games and play for other non-games work

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative
  - Epistemological
  - Ontological
  - Practice

Interested in games and play as disciplines in their own right

Ontological v. Practical Games Research

- Nacke *et al.*'s (2014) *Methods for Evaluating Gameplay Experience*

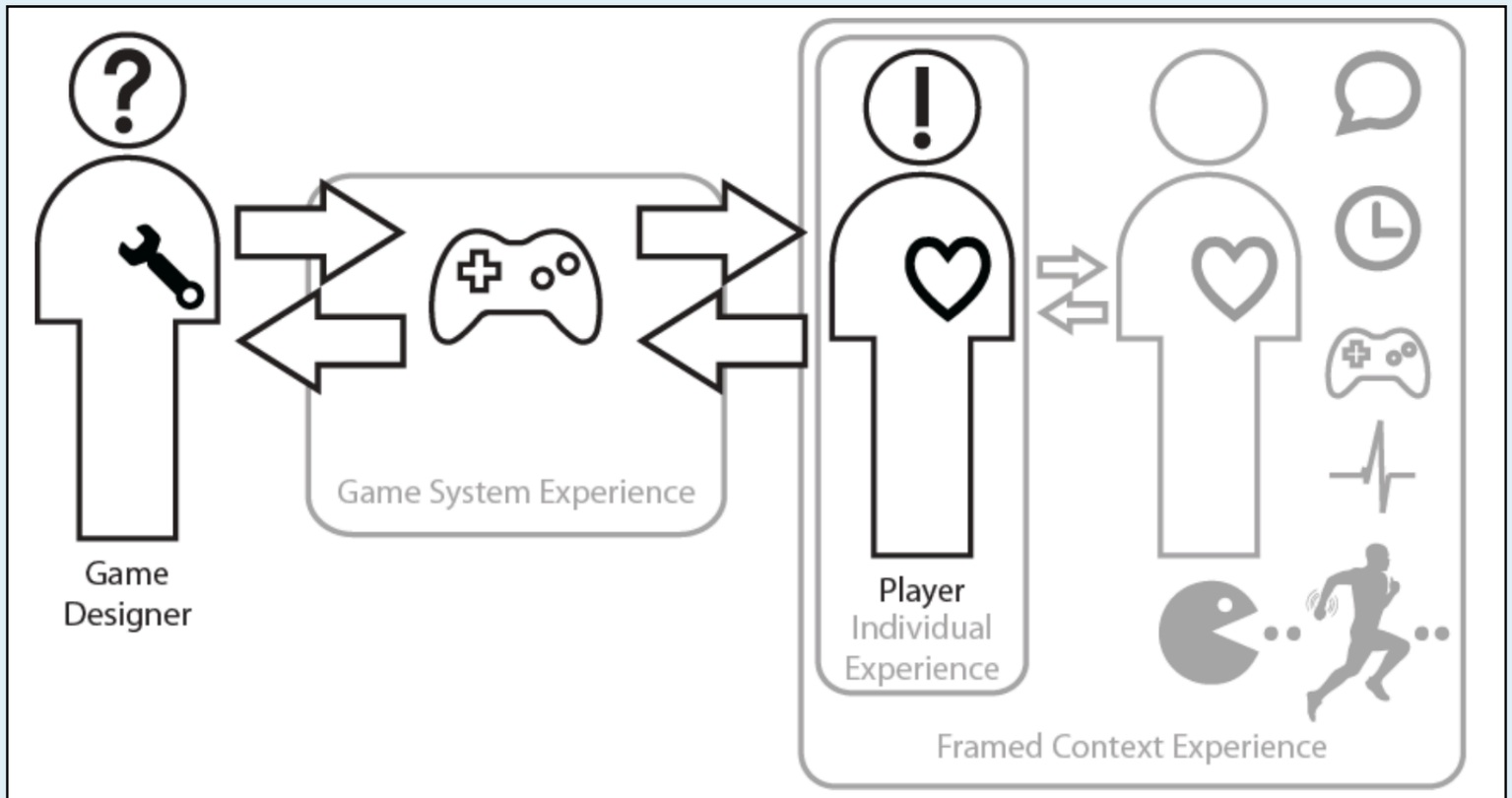

Figure 1. Three methodological frames of gameplay experience in the game development process. For example, game system experience methods are concerned with functional testing of the game; player experience methods ideally use sensor technology (or usability and playtesting) to assess emotion and enable player-game interaction, and finally logging metrics methods (among others) enable assessing game context experience.

Ontological v. Practical Games Research

- Nacke *et al.*'s (2014) *Methods for Evaluating Gameplay Experience*
  - Psychophysiological Player Testing (*e.g.* EDA, EEG)
  - Eye Tracking
  - Persona / Player Modeling
  - Game Metrics Behavior Assessment
  - Rapid Iterative Testing and Evaluation

Ontological v. Practical Games Research

- Nacke *et al.*'s (2014) *Methods for Evaluating Gameplay Experience*
  - Ethnography
  - Cultural Debugging
  - Playability Heuristics
  - Qualitative Interviews and Questionnaires
  - Multiplayer (social) Game Metrics

A Fragmented Field

- Carter *et al.*'s (2014) *Paradigms of Games Research in HCI*
  - Operative
  - Epistemological
  - Ontological
  - Practice

HCI & Games Research: An Overview

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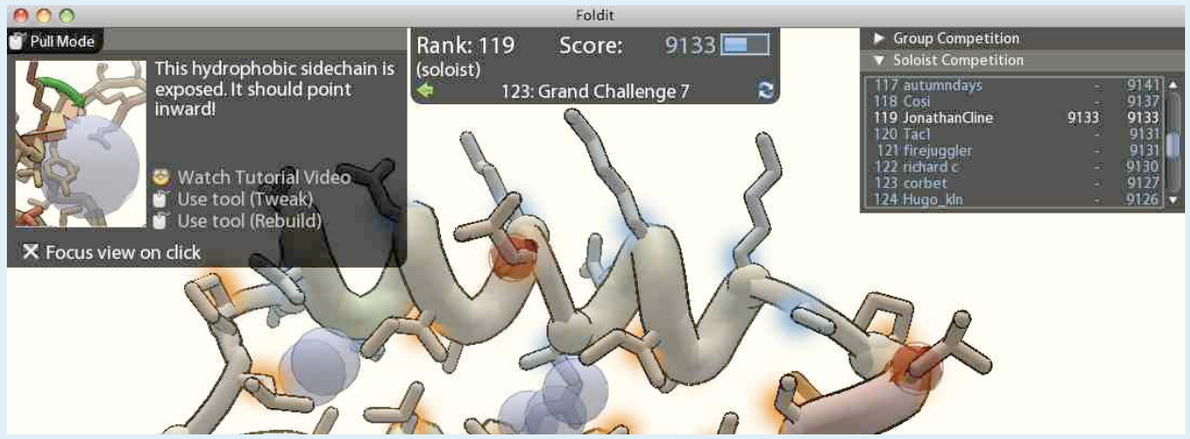
- Future: The Science of Game Design

A Science of Game Design is Needed

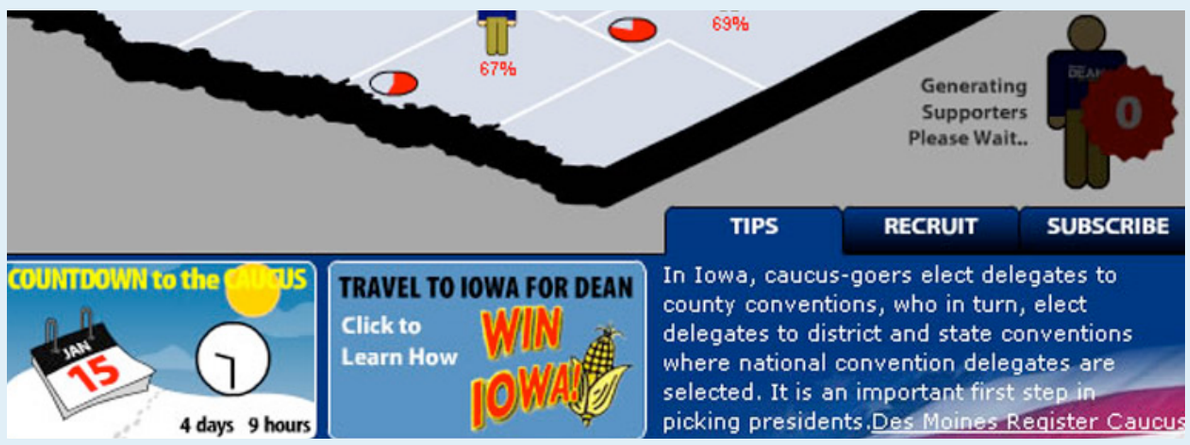
Gamification

Science discovery



Training simulations

Procedural rhetoric



- Games are a Significant Engineering Challenge™
- Advances in technology create more problems
- Research should target both artifact and person

Games are a Significant Engineering Challenge™

- Costly
- Difficult
- Poorly understood

Cost of Most Expensive Games per Year

$200M

$105M

$137M

$140M

$80M

$124M

2011 2012 2013 2014 2015 2016

Time to develop those games

STAR CITIZEN

5 Years

DESTINY

4 Years

grand theft auto V FIVE

4 Years

MGSV

3 Years

MAX PAYNE 3

3 Years

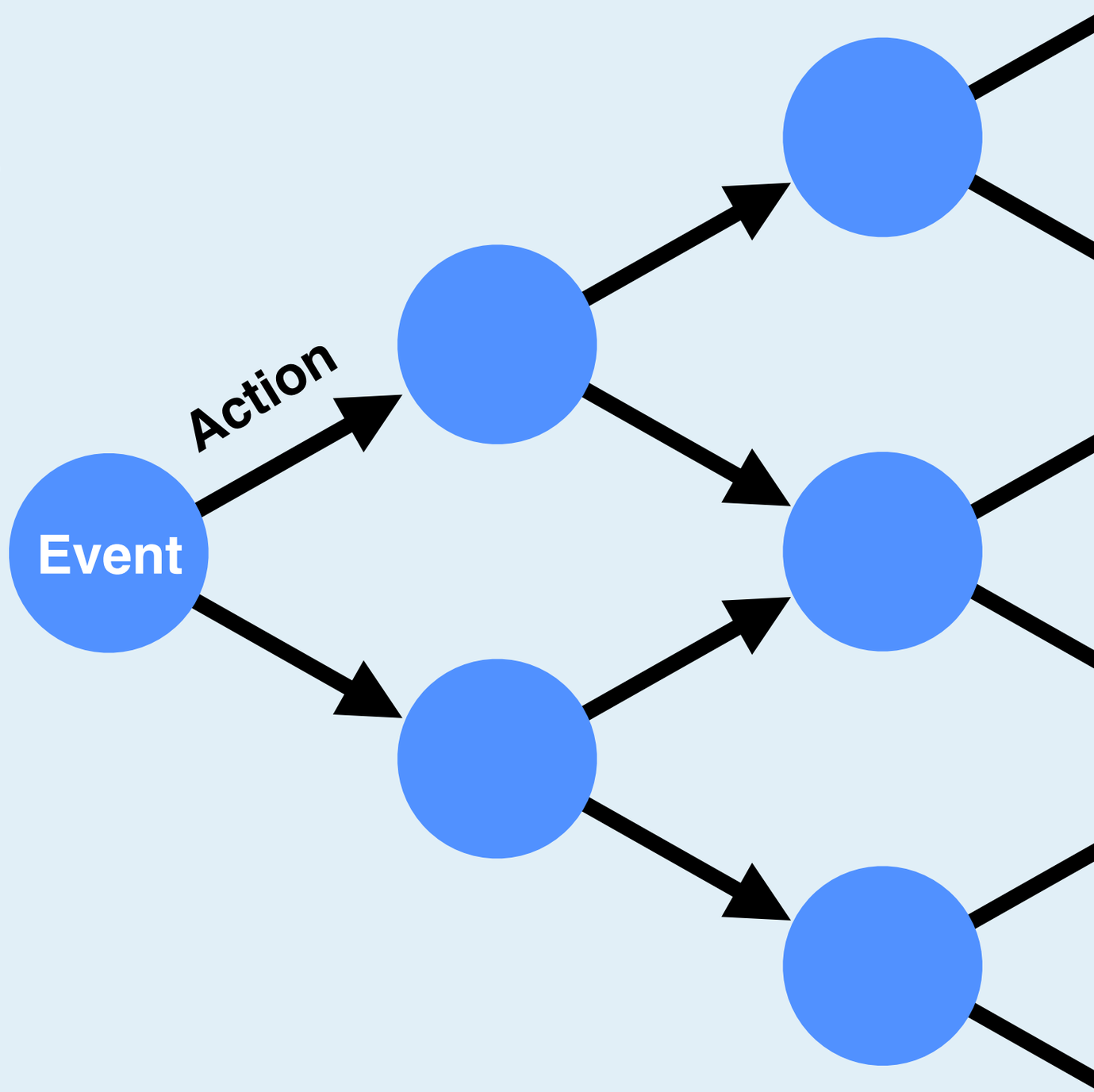
STAR WARS THE OLD REPUBLIC

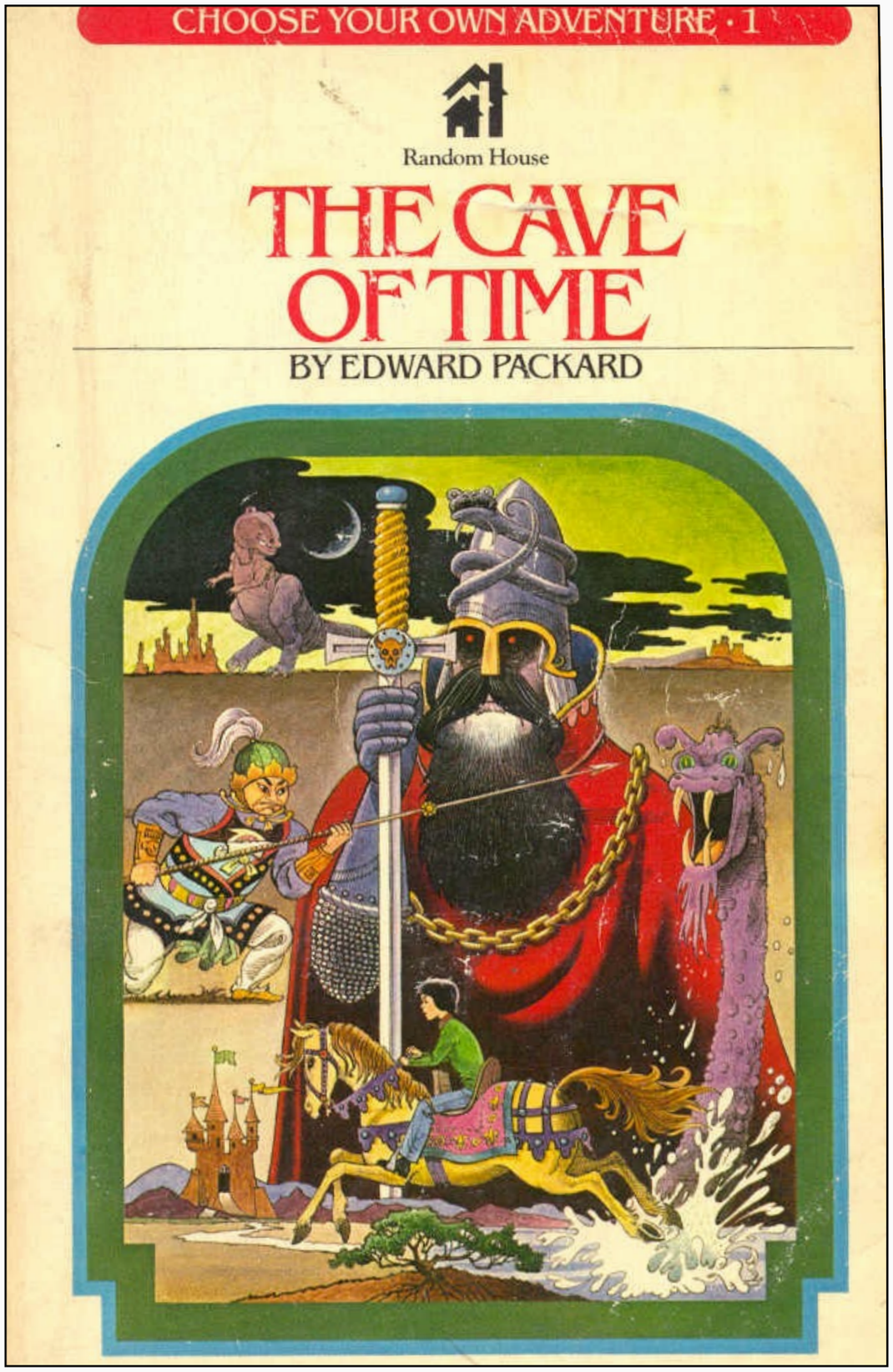
3 Years

2011 2012 2013 2014 2015 2016

Authorial Combinatorics Problem

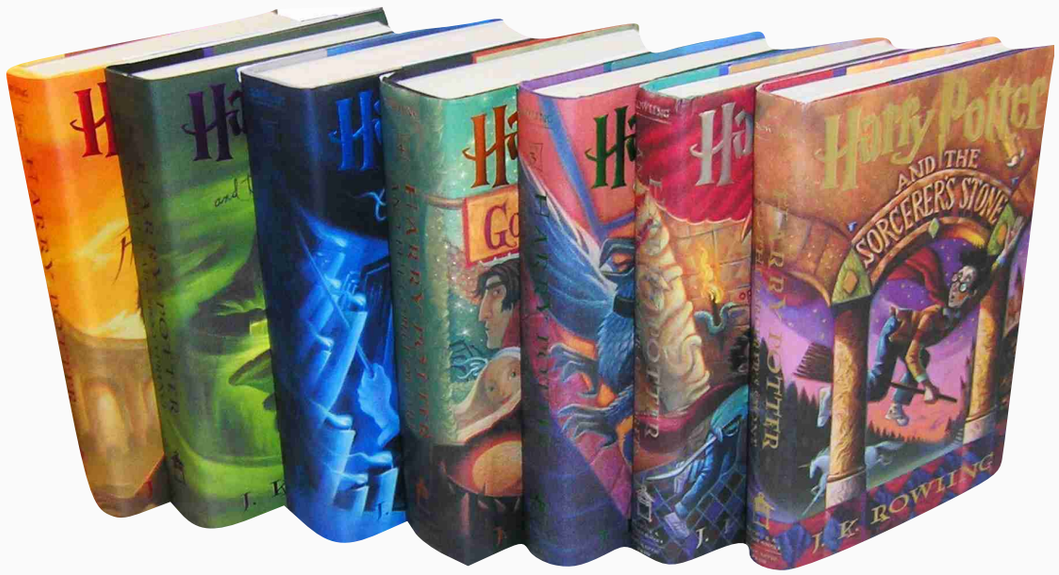
- Bruckman's (1990) *The Combinatorics of Storytelling: Mystery Train Interactive*
  - Content authoring increases exponentially with player choice





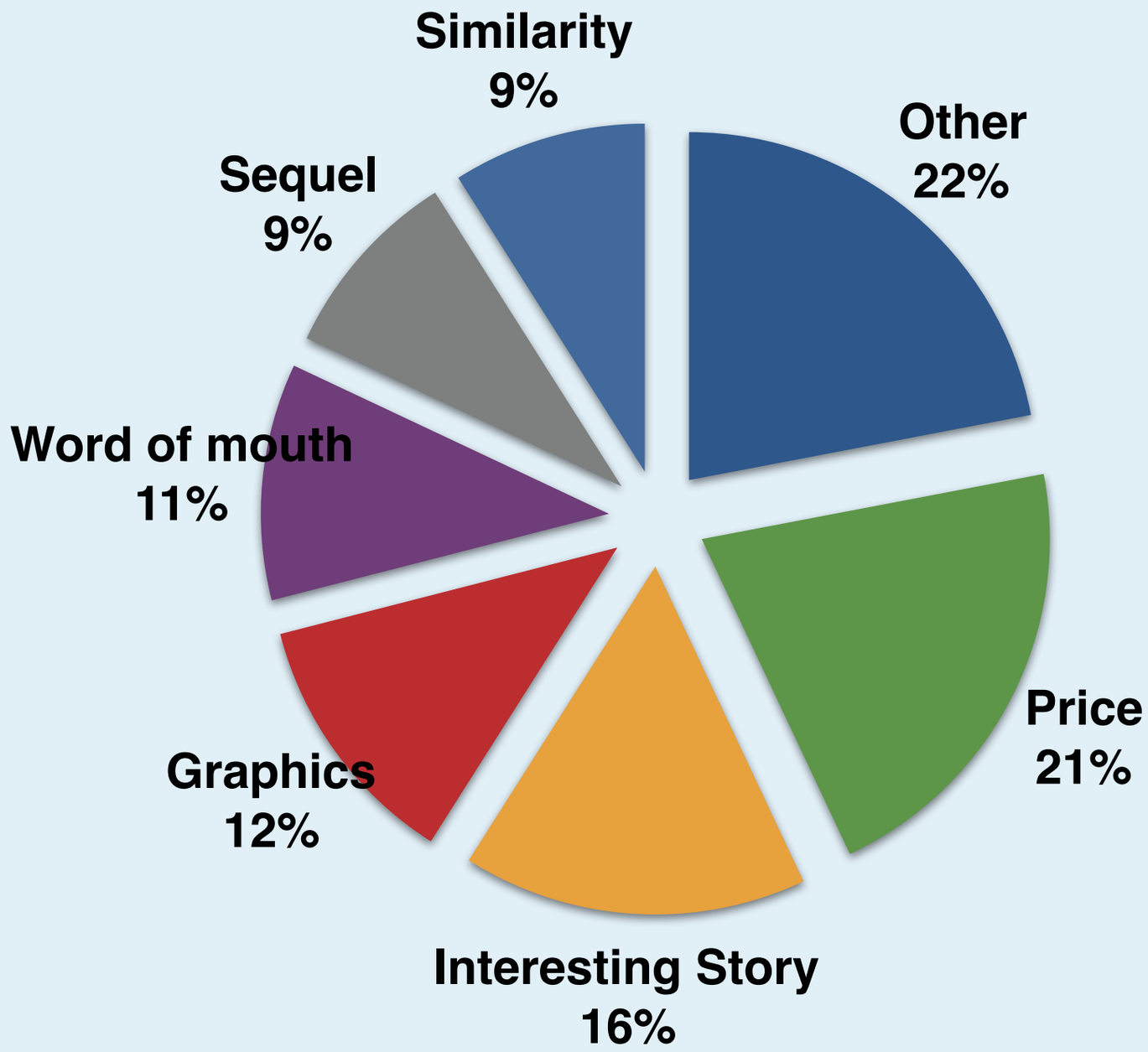
STAR WARS THE OLD REPUBLIC

12 full-time writers + 3 years
= 200,000 lines of dialogue
(approx. 1,000,000 words)



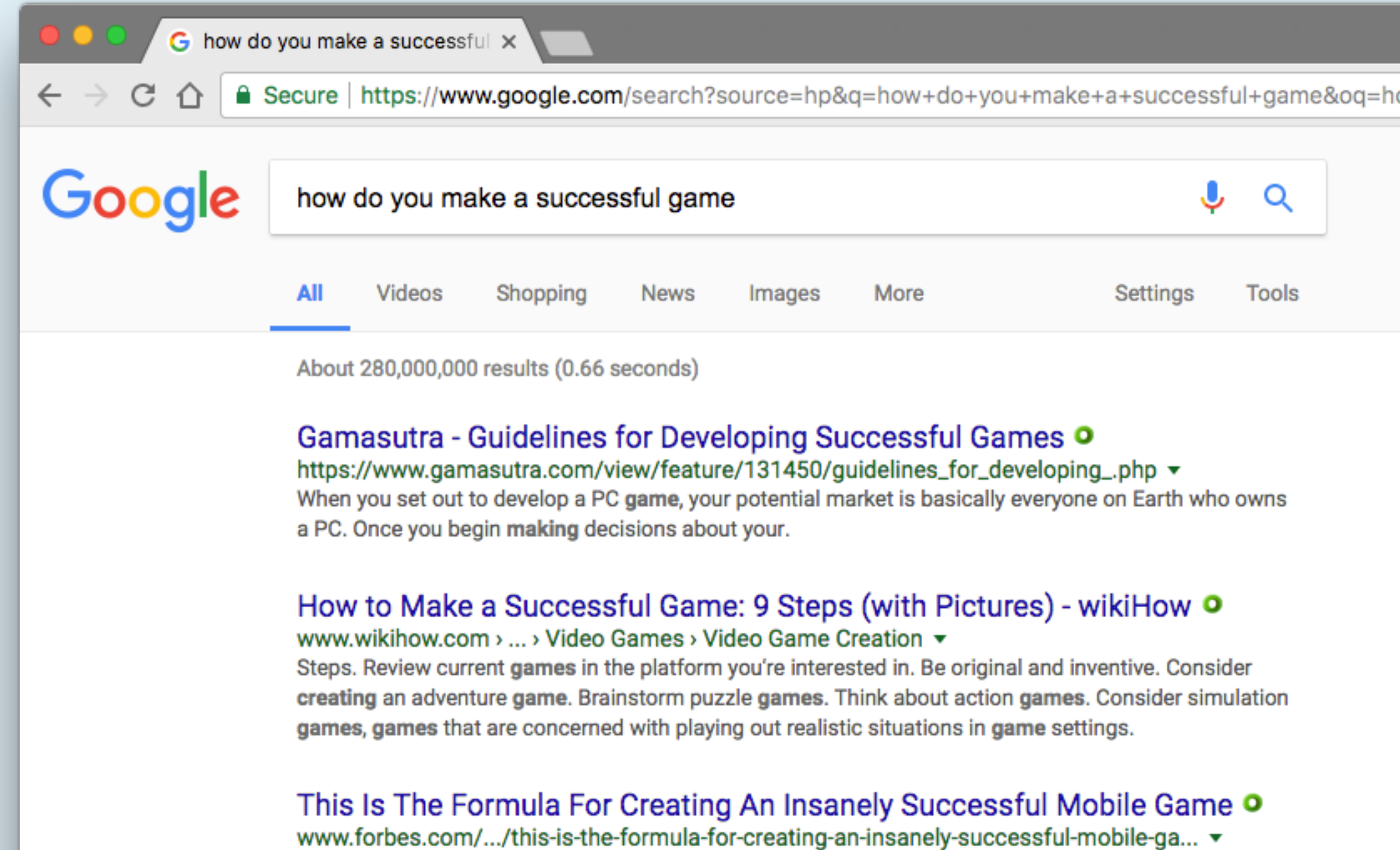
(1,094,170 words)

Factors Influencing the Decision to Buy a Game

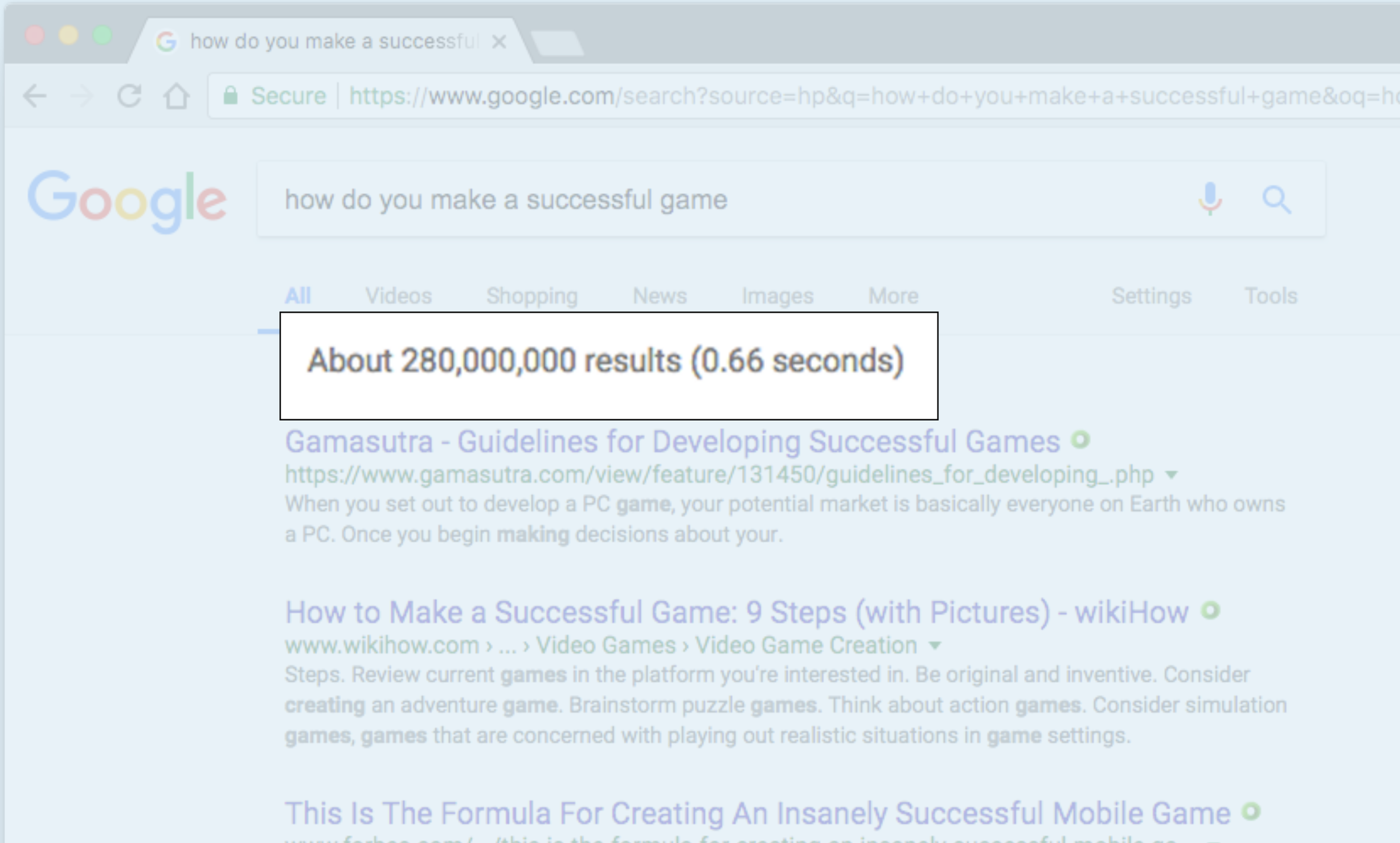


Essential Facts About the Computer & Video Game Industry
(Entertainment Software Association, 2016)

Engineering Successful Games



Engineering Successful Games



UNREAL
ENGINE

unity

FROSTBITE
A DICE TECHNOLOGY

havOK®

GameMaker
Studio

CRYENGINE 3

Cowboys, Ankle Sprains, and Keepers of Quality: How Is Video Game Development Different from Software Development?

Emerson Murphy-Hill
North Carolina State University
Raleigh, North Carolina, U.S.
emerson@csc.ncsu.edu

Thomas Zimmermann and Nachiappan Nagappan
Microsoft Research
Redmond, Washington, U.S.
{tzimmer,nachin}@microsoft.com

There's a lot of hacks and kludges to get things working… I'm sure you would find tons of duplication of effort, definitely. I've been an audio programmer on [X] different games and I've written [X] different audio engines.

Cowboys, Ankle Sprains, and Keepers of Quality: How Is Video Game Development Different from Software Development?

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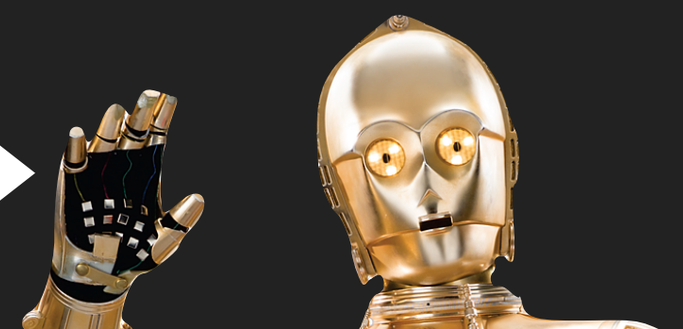
Meaningless Procedural Content Generation

Procedural content generation

- Artificial intelligence for game content creation



Meaningless Procedural Content Generation

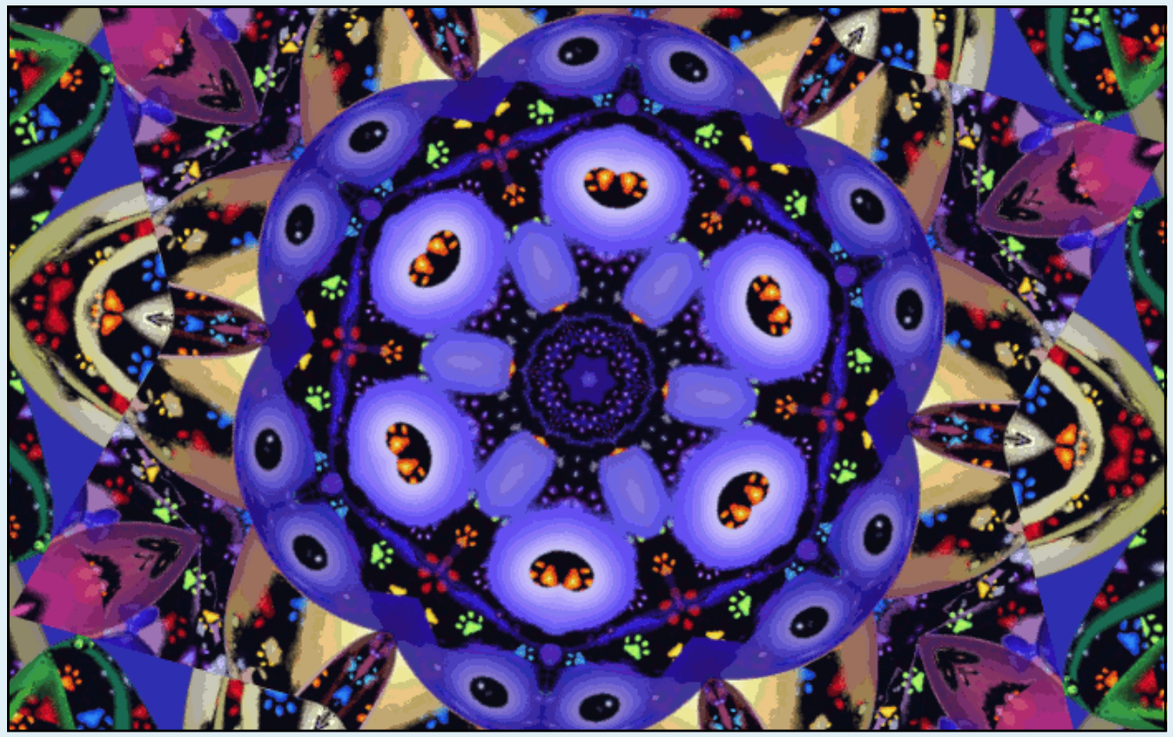
- No Man’s Sky can generate 1.8×10^{19} Planets

The effect is dizzying. But it wasn’t enough. After three years of hype, it took just a few hours for players to start complaining that the game was boring or was missing features they had seen in early trailers. Many asked for refunds. What went wrong?

To answer why *No Man's Sky* fails, we can look at how it misses the target of human exceptionalism. The technology here is impressive, beautiful, and sometimes unforgettable. That tech's basic template, however, sets a level of expectations that maybe no game could ever deliver—and that this one certainly doesn't.

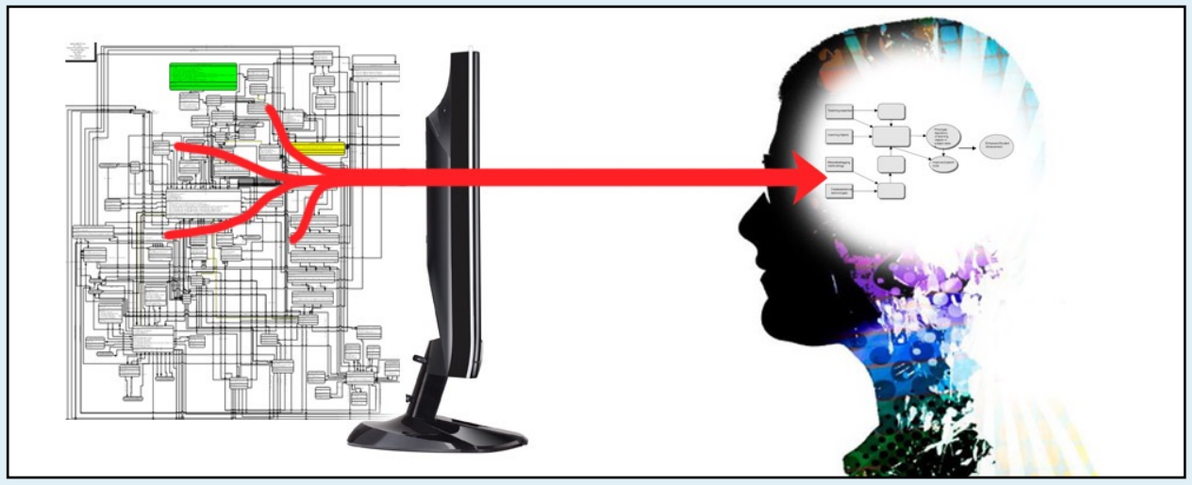
The Kaleidoscope Effect

- Cardona-Rivera's (2017) *Cognitively-grounded Procedural Content Generation*
  - We can summarize expressive range in our heads



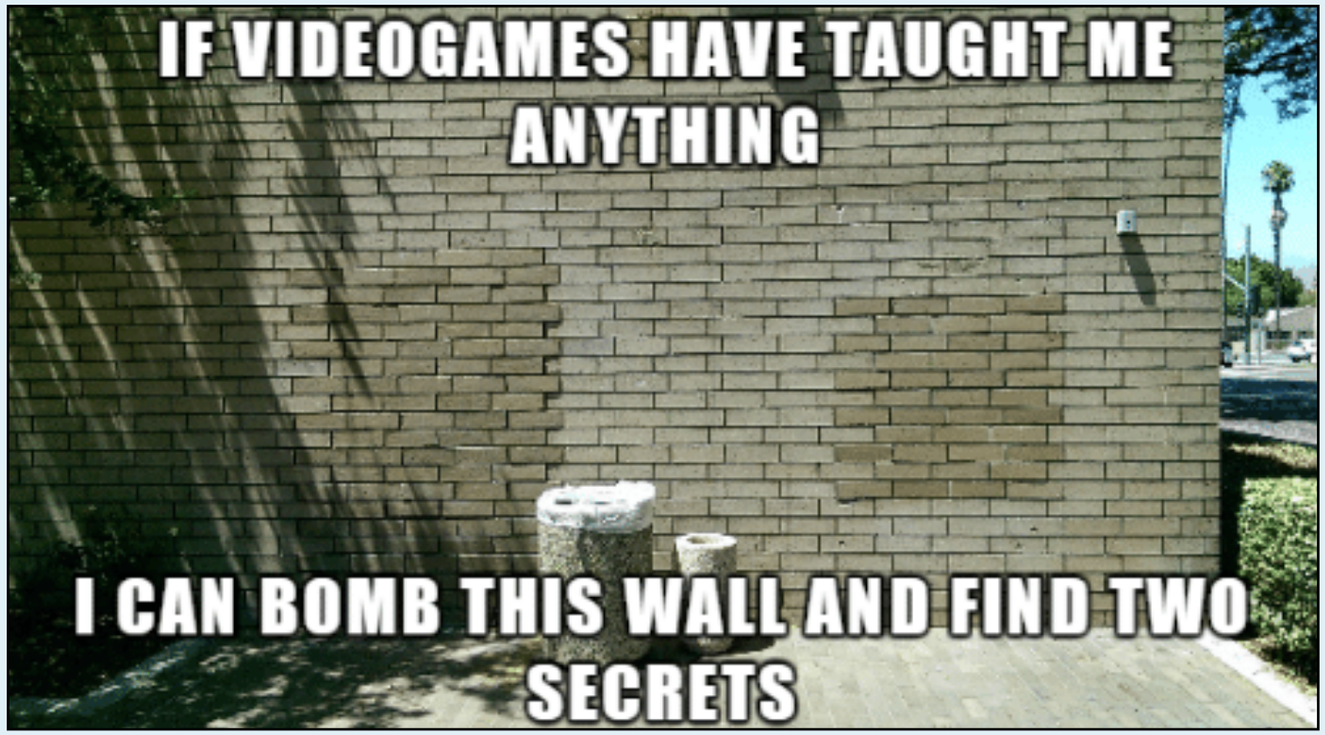
The Player Modeling Principle

- Sylvester's (2013) *The Simulation Dream*
  - "The whole value of a game is in the mental model of itself it projects into the player's mind."



Research should target artifact and player!

Tacit Learning and Expectations

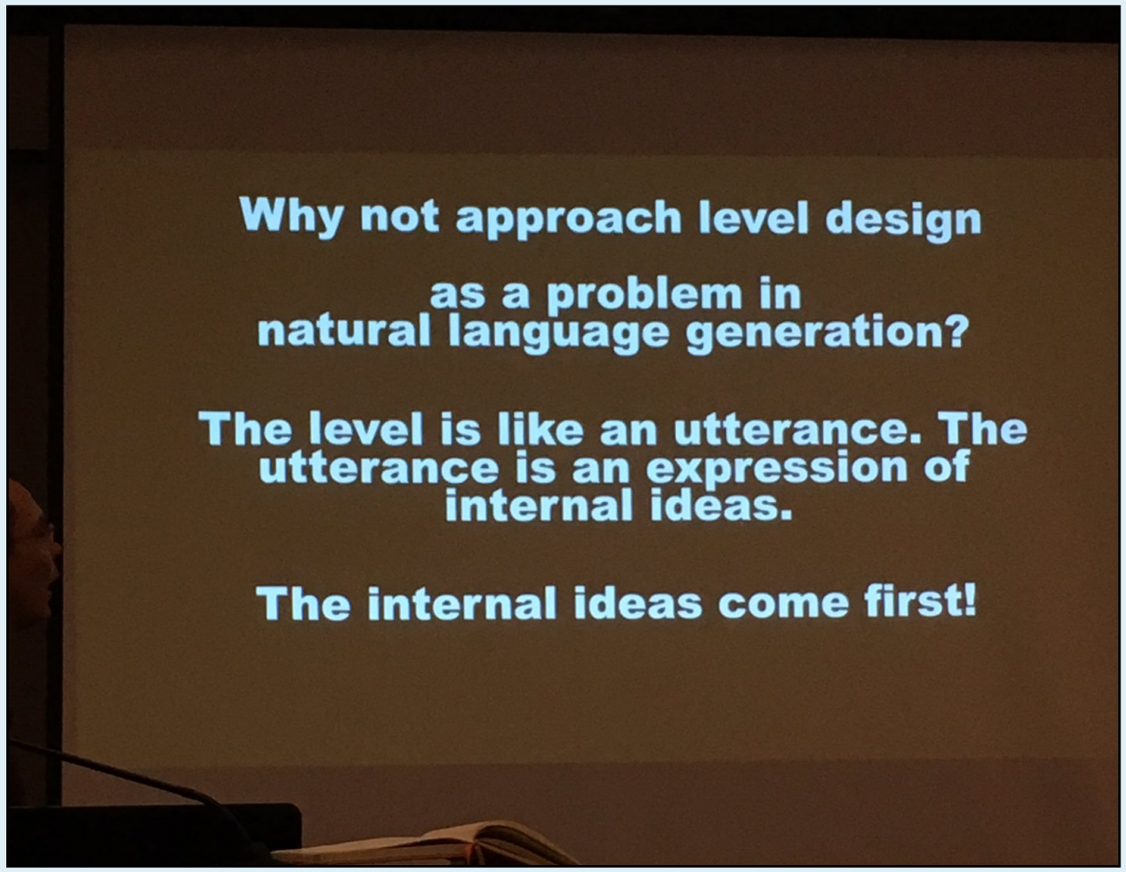


The Bard’s Leap

Bethesda Game Studios; The Elder Scrolls V: Skyrim. Bethesda Softworks, 2011.

Ontological Framework: Games as Conversation

- Cardona-Rivera and Young's (2014) *Games as Conversation*
  - Games are contexts for communicative exchange
- Blow's (2016) AIIDE Keynote
  - Level Design as an NLG Problem



The Science of Game Design

- The systematic organization of design knowledge encompassing game structure and player behavior

- The search for invariant relationships
  - *e.g.* F=ma, Fitts' Law, Hick-Hyman Law
  - My research: AI generation as <u>understanding</u>

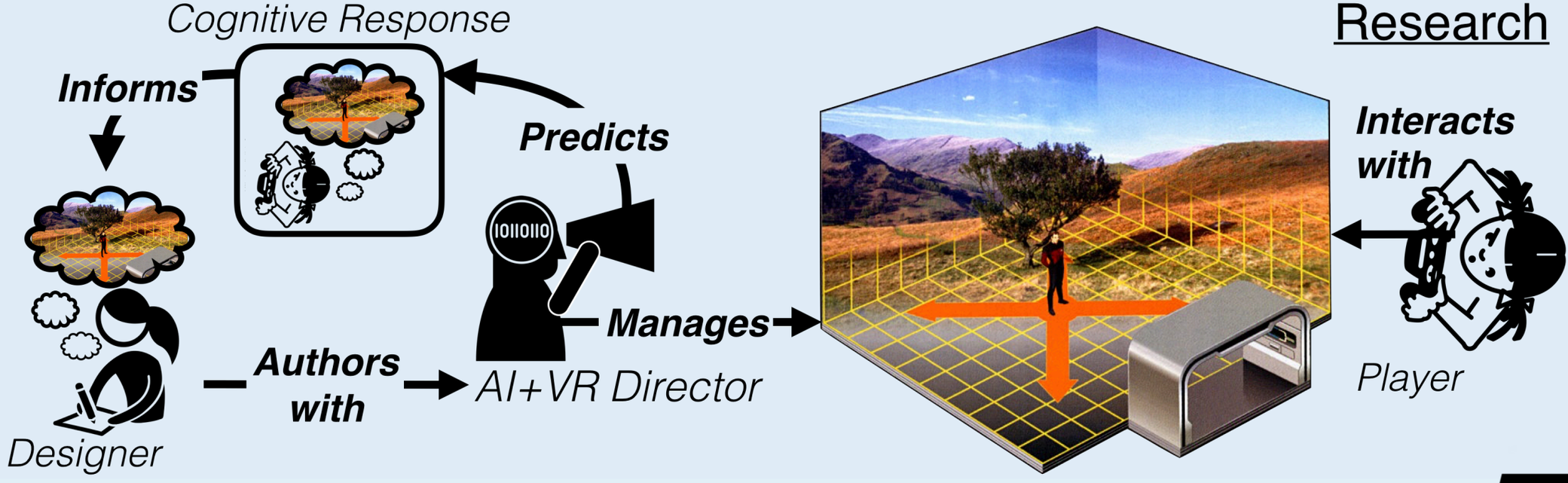
Recap

- Past: Understanding Player & Game
- Present: A Fragmented Field
- Future: The Science of Game Design

Wrap

- Photography used to require expertise
  - Digital camera changed that

- My work targets the science of game design through the invention of its digital camera



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LABORATORY FOR QUANTITATIVE EXPERIENCE DESIGN

Shameless Plug

Spring 2020 Course!

EAE 6900-023: Game AI

In this course we will examine both traditional and modern artificial intelligence (AI) techniques that are used in the design of computer games. We will look for techniques for game playing as well as the design of AI agents tasked with creating targeted experiences for players.