Mechanics, Dynamics, Aesthetics & Emergence

Aalto University's Game Analysis course

Prof. Perttu Hämäläinen 2023

Contents

- (Some) game design & analysis frameworks
- Mechanics, Dynamics & Aesthetics (MDA)
- Emergence

Game design and analysis frameworks

Yesterday, we (briefly) covered

- Game definitions: Costikyan, Schell, Suits, Callois
- Callois’ 4 types of play
- Games as poetry

Data-driven analyses

- What topics do reviews address? What adjectives are used? What negatives and positives are highlighted?
- What do players discuss on Reddit, Discord etc?
- Quantifying how things like difficulty evolve over games
- Zagal & Tomuro: Natural Language Processing (NLP) analysis of 100k+ user-submitted game reviews
- DeSurvire & Wiberg: Deriving design heuristics from reviews (previous lecture)

The Aesthetics of Gameplay: A Lexical Approach

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ABSTRACT
What does it mean to appreciate gameplay? When we judge a game's gameplay, what are the elements or characteristics of gameplay that we should focus our attention on? We report on a study that analyzed the use of the term gameplay in hundreds of thousands of user-submitted game reviews on a popular online website. Using Natural Language Processing (NLP) techniques we identified and extracted the adjectives that modified "gameplay", and then clustered those adjectives based on the words (nouns, verbs and adjectives) which appeared in the surrounding contexts. Our analysis of the resulting clusters shows a surprising richness in the variety of words used to describe gameplay, but more importantly we identify a popular aesthetic of gameplay. The primary elements of gameplay aesthetics are pacing, complexity, cognitive accessibility, scope, demand, and impact. This aesthetic provides two things: empirical support for the importance and centrality of the concepts we've outlined towards understanding gameplay, and evidence of the differences in language for describing gameplay between players and designers/scholars.

Categories and Subject Descriptors
K.8.0 [**Personal Computing**]: General - *Games*

Keywords
Videogames, reviews, aesthetics, gameplay, natural language processing, lexical analysis

1. INTRODUCTION
What does it mean to appreciate gameplay? Does it make sense to speak of beauty in gameplay and of how it gives us pleasure and satisfaction? We believe the answer is a resounding yes. However, much work is still necessary in order to better understanding what aspects of games are the ones that give us pleasure and satisfaction. How do we appreciate gameplay? What does it mean to have good taste in gameplay? When we judge a game's gameplay, what are the elements or characteristics of gameplay that we should focus our attention on? If music's aesthetic elements include harmony, rhythm, and mood, and film includes elements such as montage and lighting, what are the key elements for gameplay?

These questions have most often been explored by proposing things as central to gameplay and arguing why they are important. These proposals are often based on theories, observations, and experience with games and gameplay. This has been the primary mode of discussion of gameplay from academics as well as game designers and practitioners. The former often offer theories and frameworks for describing the medium of videogames and those elements that define it as distinct [e.g. 1, 13, 23] while the latter generally provide normative rules or guidelines that serve to separate gameplay that is aesthetically pleasing from that which may not be [e.g. 5, 8, 26]. Both these approaches have been valuable and productive. In this article we propose a different approach.

We seek to answer the questions of how we appreciate gameplay and what matters when talking about gameplay by broadly examining how people who play games describe gameplay. We will present the results of our analysis of close to 400,000 online game reviews written by more than 100,000 people for over 8,000 different game titles. Game reviews, written by game fans, aficionados, and non-professional writers, are a popular form of discourse that provides a window into the thoughts and feelings on gameplay as understood in the broad sense of popular culture. Game reviews provide us with insights on gameplay as it is commonly understood, used, and negotiated by players in practice. Our findings illustrate an alternate way of understanding gameplay while also providing empirical evidence to support many of the existing ideas surrounding gameplay.

1.1 Natural Language Processing and Lexical Analysis
Thanks to the rapid adoption of the world wide web, especially those services which facilitate information sharing and social networking among users, a huge amount of 'content' is generated every day on the internet. A large portion of such content is text. These texts are vast, ideal data resources that can be used to analyze player language and discourse on games and gameplay. By analyzing how players refer to gameplay, the words they use, and how they use them we can identify those elements of gameplay that are, in practice, an aesthetic of gameplay. However, analyzing these texts manually is intractable because of sheer volume. Printing 400,000 game reviews, each on a single sheet of paper, would result in a stack of paper almost 38 meters tall! How could we read all of these reviews, let alone find or discover information from them? Fortunately, there are tools and techniques for automated analysis.

MindTrek 2010, October 6th-8th 2010 Tampere, FINLAND

Table 3 - Primary Elements of Gameplay Aesthetics

Pacing - The perception of how often game events occur.	**Scope -** The size of the possibility space afforded by a game.
Complexity - The measure, or sense, of the number of parts in a system and how they are interrelated.	**Demands -** The requirements imposed upon the player by the gameplay
Cognitive Accessibility - The measure, or sense, of the opacity of a system and the challenges it poses in understanding it.	**Impact -** What we feel games "do to us" when we play them, and how they make us feel.

Novel points of view

Figure 2. Falling off the Broncomatic

Breath Control of Amusement Rides

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ABSTRACT
Emerging robotic technologies are enabling the control of individual seats on rollercoasters and other thrill rides. We explore the potential of breathing as an effective and engaging way of driving this. Observations and interviews from trials of an enhanced bucking bronco ride show that breath-control is fun, challenging and intelligible, and reveal riders' tactics as they battled the machine. We conclude that breath control is feasible and appropriate for controlling rides, unpack its important characteristics, and consider how it might be built into future ride systems. We argue that the combination of voluntary and involuntary factors in breathing is especially appealing for controlling rides as it balances game-like elements of skill and learning against the thrill of surrendering control to the machine.

Author Keywords
Breathing, breath control, amusement ride, biosensing, affective computing, bucking bronco, thrill, themepark

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI)

General Terms
Design

INTRODUCTION
The earliest fairground rides were small-scale affairs in which human operators directly controlled speed and duration in response to riders' expressions of excitement and fear, especially screams [1]. Some even allowed fine-grained tuning such as when 'gaff lads' who collected money on 'waltzers' gave a carriage an extra spin. Driven by a desire for ever greater thrills, coupled to demands for increasing throughput, ride technology has since evolved into large-scale computer-controlled 'thrill rides' (rollercoasters and large 'spin rides') that provide riders with an identical experience. However, a new generation of ride technologies is emerging in which computer-controlled robotic systems steer individual carriages or seats. The Robocoaster G1, for example, consists of a pair of seats on the end of a large flexible robotic arm, while the G2 and G3 attach several arms to shuttles to create a rollercoaster in which small groups of seats can be moved around the track as the ride unfolds [22]. Looking forwards, future rides are likely to deliver thrilling but also highly personalized experiences. They might even learn about riders' reactions and adapt themselves on subsequent visits.

The key question now becomes: on what basis might such real-time control be achieved? How can a human interact with a robotic system that is pushing them around under high G-forces when they are also feeling excited or scared? What form of control might enhance the experience of a thrilling ride? One strategy is to give riders voluntary control over some aspects of their movement, allowing them to partially steer their own seats. An alternative is to use biosensing to measure the rider's involuntary responses and automatically adapt the ride accordingly, mirroring the role of the traditional human operator.

In this paper, we explore how both strategies can be combined through the use of breath control. We have four motivations for this: breath control offers an intriguing balance between voluntary and involuntary control; it responds to the ride pushing back at the rider, creating a direct physical feedback loop between human and machine; riders can be highly aware of their own breathing; and it may be feasible to measure it with sufficient reliability, even under the extreme conditions of an amusement ride. We have therefore developed a small-scale prototype ride and conducted public trials in order to explore the opportunities and challenges associated with breath-controlled rides. Our contributions are to demonstrate the feasibility of this approach; to explore what kinds of control are possible and how they feel; and then to consider how the approach might be deployed on future rides. More generally we seek to extend HCI's appreciation of the nuances of breath control as an interaction technique and to highlight the potentially productive tensions between voluntary and involuntary control of interactive systems.

RELATED WORK
Although amusement rides are a popular and commercially significant form of entertainment, they have received scant attention within HCI and related fields. Previous work has focused on designing virtual reality rides [19], technologies for controlling animatronics, lighting and sound on 'dark rides' [7], and revealing riders' physiological responses to spectators [24]. Our paper adopts a distinct focus on how

CHI 2011, May 7–12, 2011, Vancouver, BC, Canada.

Novel points of view

Figure 1. Driver and player in GPA

Grand Push Auto: A Car Based Exertion Game

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Abstract
Grand Push Auto is an exertion game in which players aim to push a full sized car to ever increasing speeds. The re-appropriation of a car as essentially a large weight allows us to create a highly portable and distributable exertion game in which the main game element has a weight of over 1000 kilograms.

In this paper we discuss initial experiences with GPA, and present 3 questions for ongoing study which have been identified from our early testing:

How might we appropriate existing objects in exertion game design, and does appropriation change how we think about these objects in different contexts, for example environmental awareness?

How does this relate to more traditional sled based weight training?

How can we create exertion games that allow truly brutal levels of force?

Author Keywords
Car; game; exertion; exertion game;

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

Novel points of view

"We argue for deliberately and systematically creating uncomfortable interactions as part of powerful cultural experiences."

Uncomfortable Interactions

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ABSTRACT
We argue for deliberately and systematically creating uncomfortable interactions as part of powerful cultural experiences. We identify the potential benefits of uncomfortable interactions under the general headings of entertainment, enlightenment and sociality. We then review artworks and performances that have employed discomfort, including two complementary examples from the worlds of entertainment and performance. From this, we articulate a suite of tactics for designing four primary forms of discomfort referred to as visceral, cultural, control and intimate. We discuss how moments of discomfort need to be embedded into an overall experience which requires a further consideration of the dramatic acts of exposition, rising action, climax, falling action, and dénouement. Finally, we discuss an ethical framework for uncomfortable interactions which leads us to revisit key issues of consent, withdrawal, privacy and risk.

Author Keywords
Discomfort; pain; suffering; visceral; culture; performance; rides; live art; entertainment; control; voyeurism; ethics

ACM Classification Keywords
H.5.2 [Information Interfaces And Presentation]: User Interfaces - Interaction styles

General Terms
Human Factors; Design

INTRODUCTION
HCI's engagement with cultural experiences such as art installations, performances, guides and games has inspired some unconventional approaches that turn traditional interactional design on its head. Notable examples include celebrating the role of ambiguity rather than clarity [15], provoking interpretation rather than giving information [33], and transforming system limitations into resources through 'seamful design' [5]. In this paper, we explore a further unconventional approach that arises in cultural experiences – deliberately engineering discomfort as a way of creating intense and memorable interactions and engaging with dark and challenging themes. Discomfort is generally considered 'bad', being a mild form of pain (physical or emotional) and traditional usability-focused interaction design would try to minimise it. In contrast, we shall argue that *uncomfortable interactions* – carefully and ethically managed – are an important tool in a designer's armoury that can help realise positive long-term values related to entertainment, enlightenment and sociality.

Our initial motivation for writing this paper arose from many years of working with artists to create, tour and study interactive artworks, during which time we were often questioned about their seemingly 'dark' nature, and our own ethical position. In what follows, we draw on this experience, literature from HCI and performance studies, and also on two recent projects, to reveal how discomfort can be creatively engineered across a range of experiences from highbrow art to mainstream entertainment. In so doing, we answer the following key questions:

- What are the potential benefits of uncomfortable interactions?
- What forms can such interactions take?
- What tactics can be used to create discomfort?
- How can uncomfortable interactions be embedded into an overall cultural experience?
- What ethical frameworks can guide us when employing discomfort in these ways?

These questions, taken in turn, define the structure of our paper. Our contribution in answering them is to sensitise HCI to the potential value of uncomfortable interactions as part of designing cultural experiences while also providing guidance as to how this can best be achieved in practice.

WHY UNCOMFORTABLE INTERACTIONS?
Uncomfortable interactions are those that cause a degree of suffering to the user. This may be physical suffering such as physical stress, tiredness or pain, but might also involve mental suffering due to fear and anxiety, either experienced directly or empathically on behalf of others. Our core argument is that these kinds of uncomfortable interactions may be usefully designed into cultural experiences, rather than merely being accidental side effects of them. This is not to say that the overall aim of such experiences is to create discomfort, but rather that uncomfortable interactions may be a useful 'means to an end' – a way of promoting certain other benefits, values or worth [6] as we now discuss. Specifically, we propose that uncomfortable

Novel points of view

- Why and how to design not just for the user experience, but also the spectator experience

Designing the Spectator Experience

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ABSTRACT
Interaction is increasingly a public affair, taking place in our theatres, galleries, museums, exhibitions and on the city streets. This raises a new design challenge for HCI – how should spectators experience a performer's interaction with a computer? We classify public interfaces (including examples from art, performance and exhibition design) according to the extent to which a performer's manipulations of an interface and their resulting effects are hidden, partially revealed, fully revealed or even amplified for spectators. Our taxonomy uncovers four broad design strategies: 'secretive,' where manipulations and effects are largely hidden; 'expressive,' where they tend to be revealed enabling the spectator to fully appreciate the performer's interaction; 'magical,' where effects are revealed but the manipulations that caused them are hidden; and finally 'suspenseful,' where manipulations are apparent but effects are only revealed as the spectator takes their turn.

ACM Classification
H1.2 User/Machine Systems; H5. Information Interfaces and Presentation.

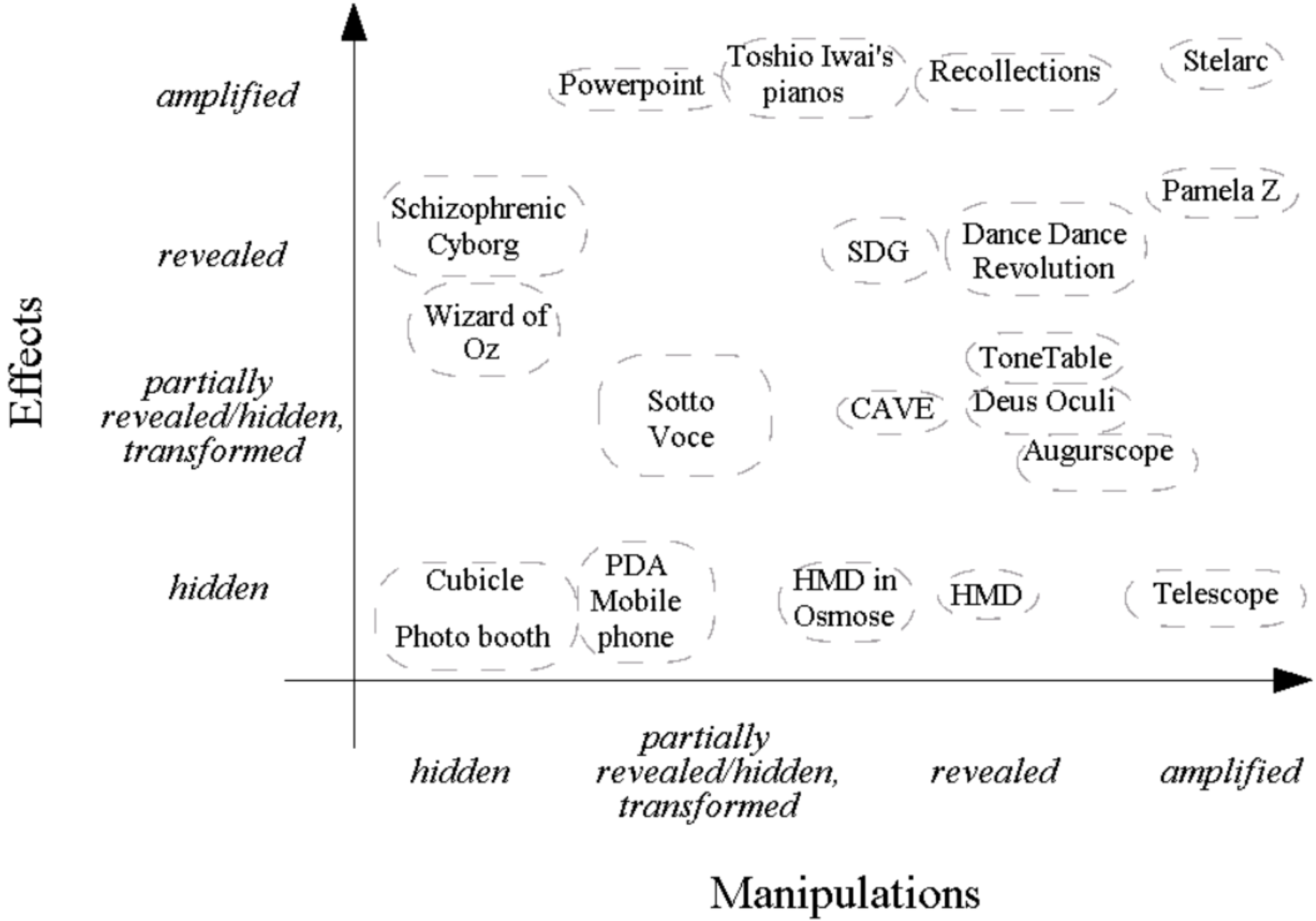
Keywords
Public experiences, spectators, design framework, museums, galleries, art, performance, expression, magic.

INTRODUCTION
The growing interest in cultural, artistic and entertainment applications of interactive technologies in settings such as museums, galleries, theatres and even clubs, combined with the spread of mobile devices into the streets, means that interaction with computers is increasingly a public affair. In this paper, we shall show that crafting interaction for public settings raises a host of new challenges for HCI, shifting the focus of design away from the individual's dialogue with their interface to also consider the ways in which interaction affects and is affected by spectators.

We consider what it means to 'perform' with an interface in a public setting and explore the challenge of designing the spectator experience, answering the key question: *how should a spectator experience a user's interaction with a computer?* While this certainly includes issues already familiar to the HCI community such as mutual awareness and privacy, we shall see that there are also new issues to consider addressing topics such as expression, suspense and magical effect.

We deliberately take a broad view of performance that encompasses explicitly staged interaction by musicians, actors and artists in front of an audience, as well as more implicit performance, where users almost unconsciously perform their interactions for others to see in a public setting. While workplace studies have already shown us that users often subtly conduct their interaction so as to be visible to others, promoting mutual awareness, most notably in control room environments [13], we shall see how this becomes a far more explicitly designed affair in settings such as theatres, exhibitions, galleries amusement arcades, theme-parks and museums, where observing others interact is very much part of the experience. However, one might also apply our analysis to situations where people perform their use of a technology in everyday settings, for example conducting mobile phone conversations in restaurants, on trains and on the streets.

Drawing on a range of example interfaces and previous studies of interaction, especially from interactive art and performance, we will develop a taxonomy that shows how


Effects
amplified
revealed
partially revealed/hidden, transformed
hidden
Powerpoint
Toshio Iwai's pianos
Recollections
Stelarc
Schizophrenic Cyborg
SDG
Dance Dance Revolution
Pamela Z
Wizard of Oz
ToneTable
Sotto Voce
CAVE
Deus Oculi
Augurscope
Cubicle
Photo booth
PDA Mobile phone
HMD in Osmose
HMD
Telescope
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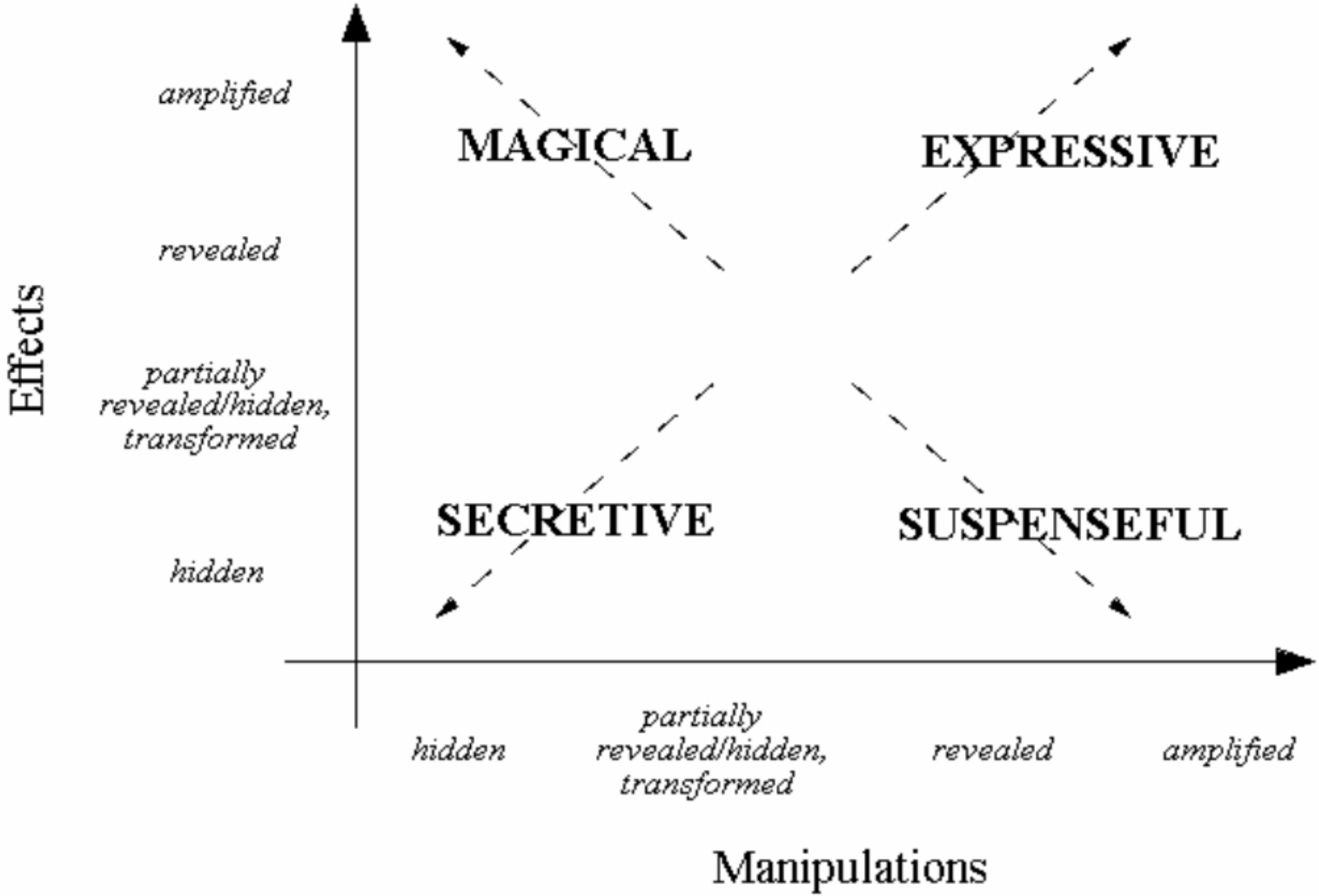
revealed
amplified
Manipulations


MAGICAL
EXPRESSIVE
SECRETIVE
SUSPENSEFUL
Effects
amplified
revealed
partially revealed/hidden, transformed
hidden
hidden
partially revealed/hidden, transformed
revealed
amplified
Manipulations


SCORE 0000028816
HI 0000161636

https://www.youtube.com/watch?v=TN2hodL8Mfk

Utilizing Gravity in Movement-Based Games and Play

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ABSTRACT

This paper seeks to expand the understanding of *gravity* as a powerful but underexplored design resource for movement-based games and play. We examine how gravity has been utilized and manipulated in digital, physical, and mixed reality games and sports, considering five central and gravity-related facets of user experience: realism, affect, challenge, movement diversity, and sociality. For each facet, we suggest new directions for expanding the field of movement-based games and play, for example through novel combinations of physical and digital elements.

Our primary contribution is a structured articulation of a novel point of view for designing games and interactions for the moving body. Additionally, we point out new research directions, and our conceptual framework can be used as a design tool. We demonstrate this in 1) creating and evaluating a novel gravity-based game mechanic, and 2) analyzing an existing movement-based game and suggesting future improvements.

Author Keywords

Gravity; movement-based games; exertion games; exergames; game design; bodily interaction.

ACM Classification Keywords

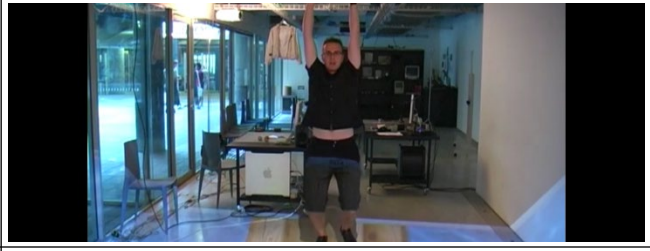
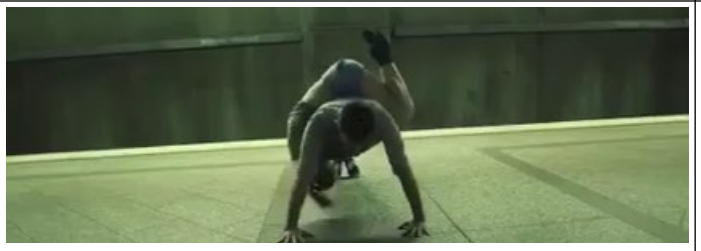
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

INTRODUCTION

Designing for the moving body is an increasingly active area of HCI research. Following the proliferation of low-cost sensors and increasing computing capability, early research into bodily games and HCI (e.g., [26]) has evolved into a diverse and vibrant field of research and practice. Yet, we are only beginning to understand the moving body emotion [6], and the effect of virtual representations (avatars) on the user [47].

In this paper, we aim to promote the understanding of *gravity*, which both constrains human movement and creates meaningful complexity and challenge. Virtual gravity has been used in games and simulations at least since Spacewar, one of the earliest computer games developed in 1962 [1]. Spacewar demonstrated how simple simulations of Newtonian mechanics can lead to the emergence of interesting and complex gameplay. In bodily HCI and movement-based games[1], *real* gravity affects the user, the effects of which we believe are underexplored. We argue that the role of gravity is becoming more complex as gameplay evolves from seated to standing and ultimately all other modalities of balancing and moving, as illustrated in Figure 1. The snowboarding image was chosen to illustrate how 1) living-room movement-based games often pale in comparison to real-life sports, 2) defying gravity is often central to such vivid experiences, and 3) HCI in such experiences is still in its infancy (e.g., [32]).

Figure 1. Varying degrees of embodiment and movement in entertainment experiences, ranging from passive spectatorship to active bodily participation.

	Digital	Physical	Mixed reality
Realism			
Affect			
Challenge			
Movement diversity			
Sociality			

Mechanics, Aesthetics, Dynamics (MDA)

- Mechanics (rules, verbs – what is designed and implemented)
- Dynamics (behavior patterns, strategies emerging from mechanics)
- Aesthetics (emotions & Player Experience emerging from dynamics)

MDA: A Formal Approach to Game Design and Game Research

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Abstract

In this paper we present the MDA framework (standing for Mechanics, Dynamics, and Aesthetics), developed and taught as part of the Game Design and Tuning Workshop at the Game Developers Conference, San Jose 2001-2004.

MDA is a formal approach to understanding games – one which attempts to bridge the gap between game design and development, game criticism, and technical game research. We believe this methodology will clarify and strengthen the iterative processes of developers, scholars and researchers alike, making it easier for all parties to decompose, study and design a broad class of game designs and game artifacts.

Introduction

All artifacts are created within some design methodology. Whether building a physical prototype, architecting a software interface, constructing an argument or implementing a series of controlled experiments – design methodologies guide the creative thought process and help ensure quality work.

Specifically, iterative, qualitative and quantitative analyses support the designer in two important ways. They help her analyze the *end result* to refine implementation, and analyze the *implementation* to refine the result. By approaching the task from both perspectives, she can consider a wide range of possibilities and interdependencies.

This is especially important when working with computer and video games, where the interaction between coded subsystems creates complex, dynamic (and often unpredictable) behavior. Designers and researchers must consider interdependencies carefully before implementing changes, and scholars must recognize them before drawing conclusions about the nature of the experience generated.

In this paper we present the MDA framework (standing for Mechanics, Dynamics, and Aesthetics), developed and taught as part of the Game Design and Tuning Workshop at the Game Developers Conference, San Jose 2001-2004 [LeBlanc, 2004a]. MDA is a formal approach to understanding games – one which attempts to bridge the gap between game design and development, game criticism, and technical game research. We believe this methodology will clarify and strengthen the iterative processes of developers, scholars and researchers alike, making it easier for all parties to decompose, study and design a broad class of game designs and game artifacts.

Towards a Comprehensive Framework

Game design and authorship happen at many levels, and the fields of games research and development involve people from diverse creative and scholarly backgrounds. While it's often necessary to focus on one area, everyone, regardless of discipline, will at some point need to consider issues outside that area: base mechanisms of game systems, the overarching design goals, or the desired experiential results of gameplay.

AI coders and researchers are no exception. Seemingly inconsequential decisions about data, representation, algorithms, tools, vocabulary and methodology will trickle upward, shaping the final gameplay. Similarly, all desired user experience must bottom out, somewhere, in code. As games continue to generate increasingly complex agent, object and system behavior, AI and game design merge.

Systematic coherence comes when conflicting constraints are satisfied, and each of the game's parts can relate to each other as a whole. Decomposing, understanding and creating this coherence requires travel between all levels of abstraction – fluent motion from systems and code, to content and play experience, and back.

We propose the MDA framework as a tool to help designers, researchers and scholars perform this translation.

MDA

Games are created by designers/teams of developers, and consumed by players. They are purchased, used and eventually cast away like most other consumable goods.

The production and consumption of game artifacts.

Designers can only directly control the mechanics

Predicting player behavior becomes even more difficult with multiple players

MDA Aesthetics (≈ player experience)

- Sensation (Game as sense-pleasure)
- Fantasy (Game as make-believe)
- Narrative (Game as drama)
- Challenge (Game as obstacle course)
- Fellowship (Game as social framework)
- Discovery (Game as uncharted territory)
- Expression (Game as self-discovery)
- Submission (Game as pastime)

MDA Aesthetics

- Sensation (Game as sense-pleasure)
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- Expression (Game as self-discovery)
- Submission (Game as pastime)

Basic human psychological needs

- Need for competence
- **Need for autonomy**
- Need for social relatedness
- **Need for novelty (of sensations and experiences)**

Other game pleasures

Anticipation

Delight

Gift giving

Humor

Purification

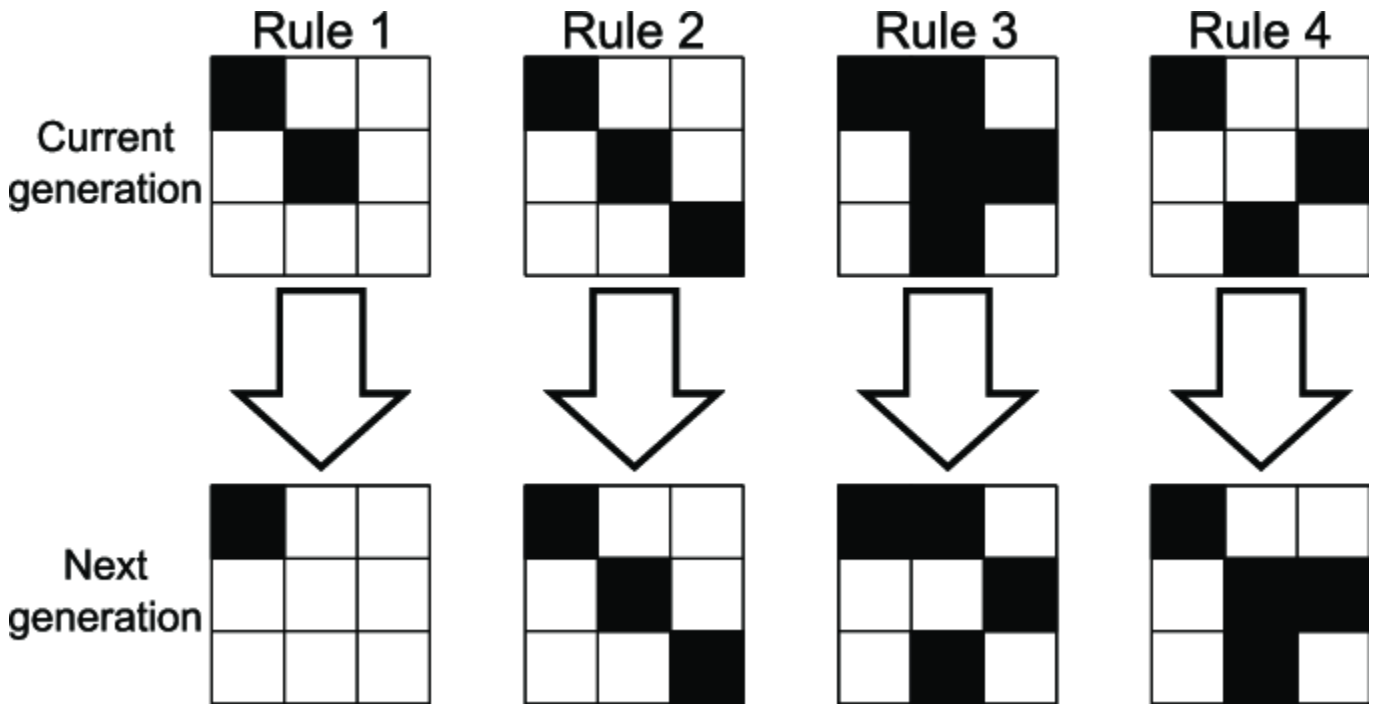
Thrill

Wonder

…

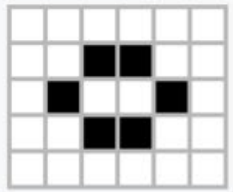
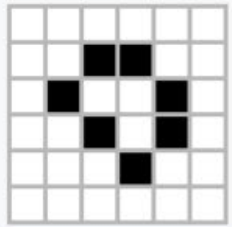
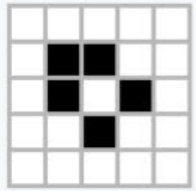
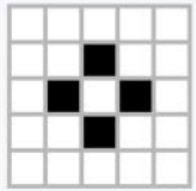
Designing for Emergence: Conway's Game of Life

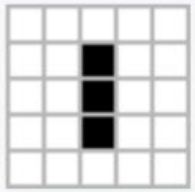
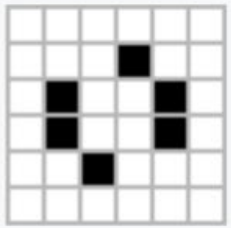
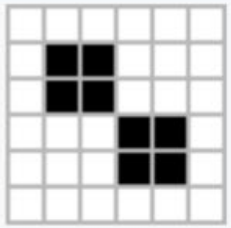
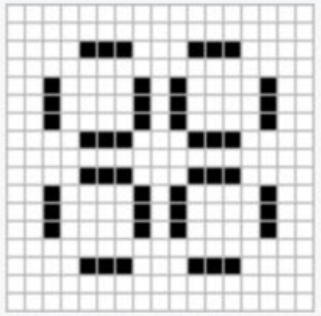
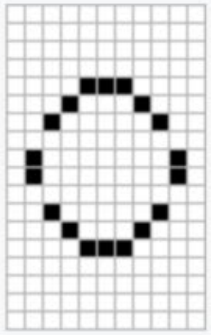
1. A cell with < 2 neighbours dies, as if by underpopulation.
2. A cell with 2 or 3 neighbours lives
3. A cell with > 3 neighbours dies, as if by overpopulation.
4. A dead cell with exactly 3 neighbours becomes alive, as if by reproduction.

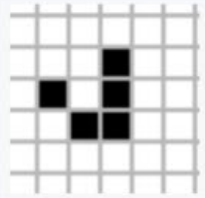
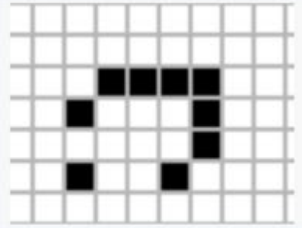
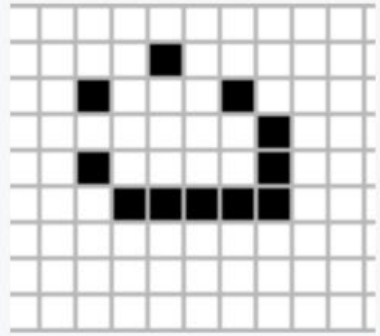
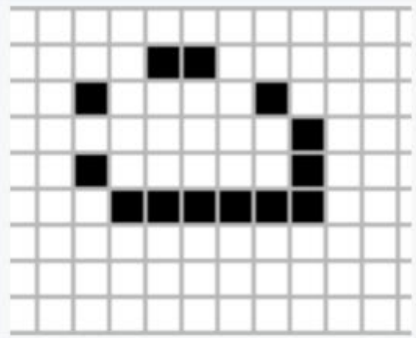


Effect of the rules on a cell (middle) based on the neighbors

https://playgameoflife.com/

Still lifes	
Block	
Bee-hive	
Loaf	
Boat	
Tub	

Oscillators	
Blinker (period 2)	
Toad (period 2)	
Beacon (period 2)	
Pulsar (period 3)	
Penta-decathlon (period 15)	

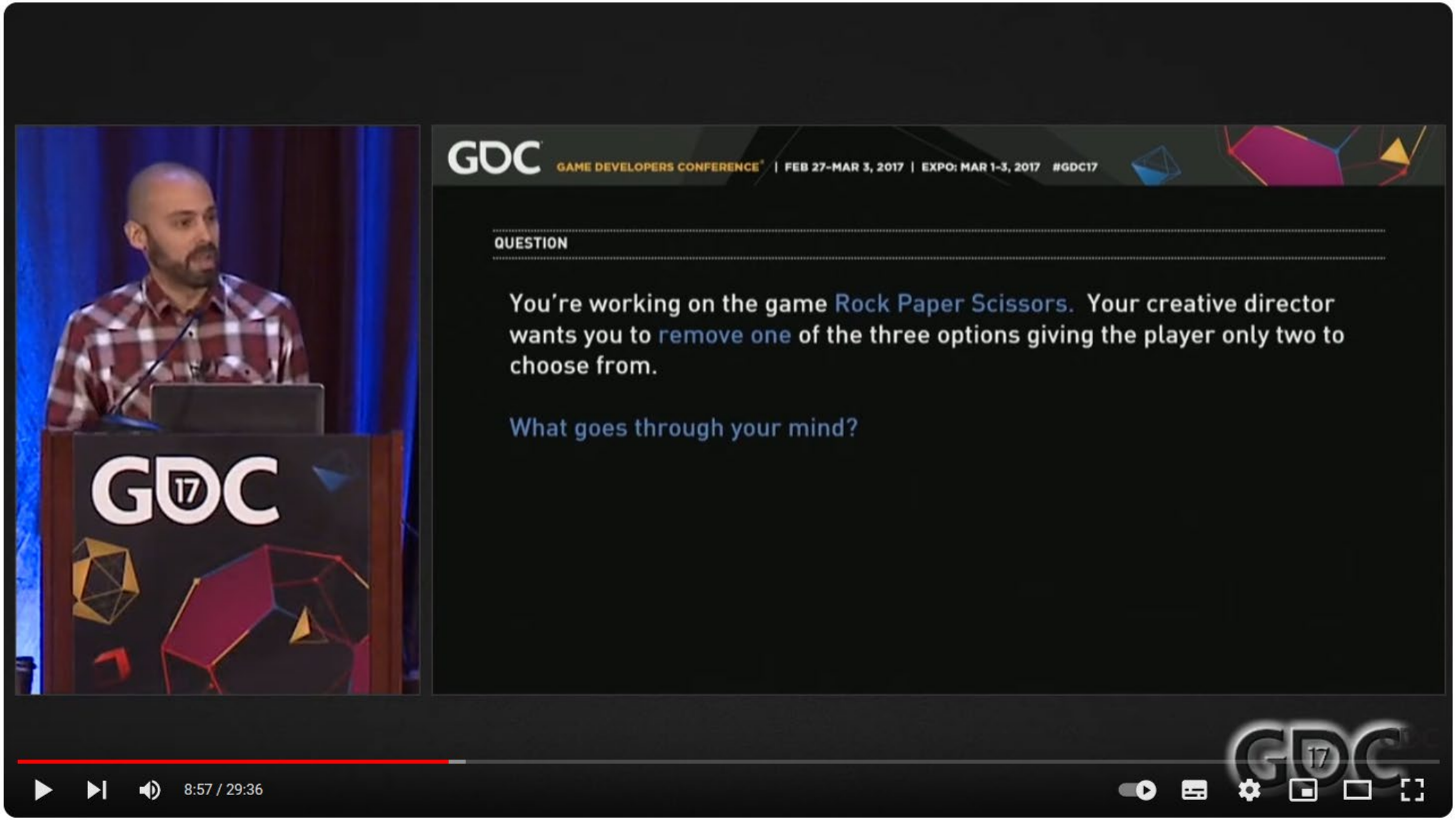
Spaceships	
Glider	
Light-weight spaceship (LWSS)	
Middle-weight spaceship (MWSS)	
Heavy-weight spaceship (HWSS)	

https://github.com/Ben-Avrahami/Conway-s-Game-of-Life

https://www.youtube.com/watch?v=ZBLoffoZLH8

MDA Example: Rock, paper, scissors

- Mechanics: Rock beats scissors, scissors beat paper, paper beats rock
- Dynamics: Random and balanced play (every choice is equally probable to win). Tool for social decision making.
- Aesthetics: Simple social fun.



Interviewing For Game Design

https://www.youtube.com/watch?v=uUQKbowVsIE

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Q You're working on the game **Rock Paper Scissors**. Your creative director wants you to remove one of the three options giving the player only two to choose from. **What goes through your mind?**

Bad Answer

- "I would ask why he wants to change it..."
- "I don't like removing options..."
- "I would try to convince him not to do that..."
- × "I'd get the team together and we'd figure it out..."
- × "I would remove Paper..."

UBM

GDC GAME DEVELOPERS CONFERENCE | FEB 27-MAR 3, 2017 | EXPO: MAR 1-3, 2017 #GDC17

Q You're working on the game **Rock Paper Scissors**. Your creative director wants you to remove one of the three options giving the player only two to choose from. **What goes through your mind?**

Good Answers

- √ "IMPOSSIBLE!!!"
- √ "That would destroy the balance of the game."
- √ "If you remove Paper, then Rock would always win..."
- √ "You can't do RPS with two options...one always wins or it's always stalemate.

So What's Your Response to the Creative Director?

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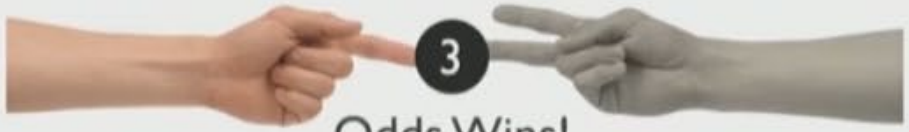
Great Answer



Odds Wins!

Odds

Evens

Extra Step – Select Teams

MDA Example: Monopoly

- Mechanics: movement and transaction rules
- Dynamics: the rich get richer and the course of the game is set very early
- Aesthetics/experience: power fantasy, challenge, fellowship

MDA Example: Monopoly

- Mechanic: Auction (if player does not want to buy a property they land on, it is auctioned)
- Dynamic: All properties are bought early in the game
- Aesthetics/experience: Might feel ”unfair”, but fixes a problem of the game being too long without it

MDA Example: Knizia scoring

- Mechanic: Player counts for scoring only the resources of which he has the least
- Dynamic: Players collect all kinds of resources.
- Aesthetics/experience: Increased variety of gameplay (no motivation to keep hoarding just one resource that one happens to gain early in the game)

MDA Example: Drop item

- Mechanic: Player is able to slough of excess inventory by dropping items on the ground
- Dynamic: Trading, bartering
- Aesthetics/experience: Increased social connection with other players

MDA Example: Chess

- Mechanics: rules such as ”A player cannot move their king into check”
- Dynamics: sacrificing lesser pieces to prevent checkmate or capture the opponent’s queen
- Aesthetics/experience: challenge, discovery, fellowship

MDA Example: Physics/dynamics simulation

- Mechanics: Newton's laws of motion
- Dynamics: Domino effects / chain reactions, shooting a target by bouncing a projectile, stability/instability of buildings...
- Aesthetics: Emergence, surprise, curiosity

Designing for Emergence: PlusMinus

Successful Aalto student game (CHI PLAY game design competition winner, showcased at Experimental Gameplay Workshop 2019). Juuso Toikka's master's theses about the core mechanics: https://aaltodoc.aalto.fi/handle/123456789/39850

On the limits of physics based interaction

- Sometimes too emergent, chaotic, uncontrollable
- In this paper, we explored adding predictivity to the mechanics
- Players can make better decisions if they 1) have more time, 2) can predict the outcomes

Predictive Physics Simulation in Game Mechanics

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Julian Togelius
NYU Tandon School of Engineering
julian@togelius.com

ABSTRACT

INTRODUCTION

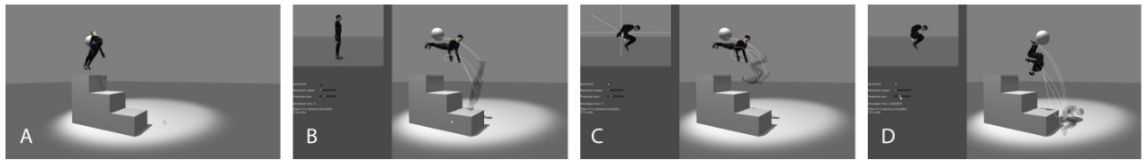


Figure 1. Our "animation as a game" prototype, where the player's goal is to save the falling character. A) Initial situation where the character is hit by a projectile. B) Game interface appears on the left, and the main view shows predictive movement trajectories and future pose; the character will hit its head unless the player acts. C) Using the posing controls (top-left), the player adjusts the future pose. Tucking increases rotation speed, which is predicted and visualized in real-time. D) Once satisfied with the prediction, the player advances the simulation. See the supplemental video at 03:00 for live gameplay.

Computers can now simulate simple game physics systems hundreds of times faster than real-time, which enables real-time prediction and visualization of the effects of player actions. Predictive simulation is traditionally used as part of planning and game AI algorithms; we argue that it presents untapped potential for game mechanics and interfaces. We explore this notion through 1) deriving a four-quadrant design space model based on game design and human motor control literature, and 2) developing and evaluating six novel prototypes that demonstrate the potential and challenges of each quadrant. Our work highlights opportunities in enabling direct control of complex simulated characters, and in transforming real-time action into turn-based puzzles. Based on our results, adding predictive simulation to existing game mechanics is less promising, as it may feel alienating or make a game too easy. However, the approach may still be useful for game designers, for example, as it allows one to test designs beyond one's playing skill.

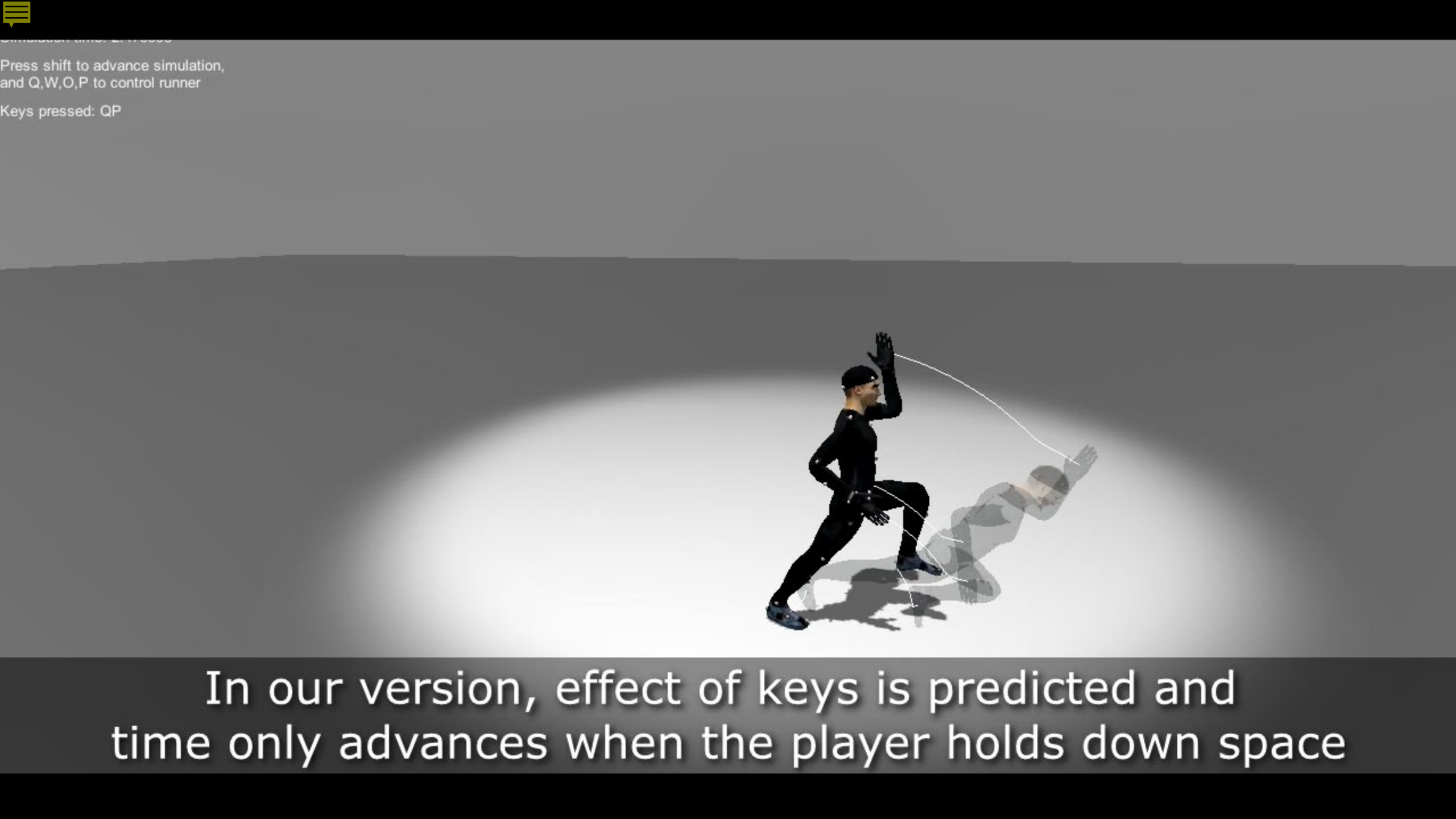
Author Keywords
Game design; visualization; physics simulation;

ACM Classification Keywords
H.5.2. User interfaces: Interaction styles

Simulation of dynamic physical systems utilizes a set of rules that are unambiguous and mathematically well-defined [5], but can at the same time lead to emergent, rich behavior. This has inspired many types of physically based games and game mechanics, with popular examples such as The Incredible Machine [4], Angry Birds [25], Cut the Rope [36], Where's My Water [3], QWOP [2], and Portal [34]. Gradually, game physics has evolved towards more complex systems, i.e., from 2D to 3D, and from rigid bodies (e.g., stacked objects) to soft bodies (e.g., ropes and cloth) and fluids. During recent years, no fundamentally new physics simulation types have appeared, but on the other hand, personal computing devices can now simulate simple systems hundreds or even thousands times faster than real-time. This paper focuses on capitalizing this excess computing power for novel game mechanics and interfaces.

In this paper, we argue that *real-time predictive physics simulation* provides an underexplored tool for game design. Most games simulate physical systems at a fixed rate such as 60 simulation steps per second, and only use simulations in a *reactive* manner to compute the interactions of objects based on player input. In contrast, we denote by predictive simulation a process of:

1) Saving the current simulation state
2) Simulating the physics forward for multiple steps, up to a prediction horizon,
3) Using the simulation results to preview and evaluate the results of player decisions
4) Restoring simulation state back to the saved state, so that the game may continue without discontinuities.


Press shift to advance simulation,
and Q,W,O,P to control runner
Keys pressed: QP
In our version, effect of keys is predicted and
time only advances when the player holds down space

MDA Example: What mechanics make this dynamic emerge?

- Dynamic: Turtling, camping
- Mechanics: predetermined spawn locations (camping where a valuable item is due to spawn)
- More generally: lower cost or higher rewards in passive than active play

MDA Example: What mechanics make this dynamic emerge?

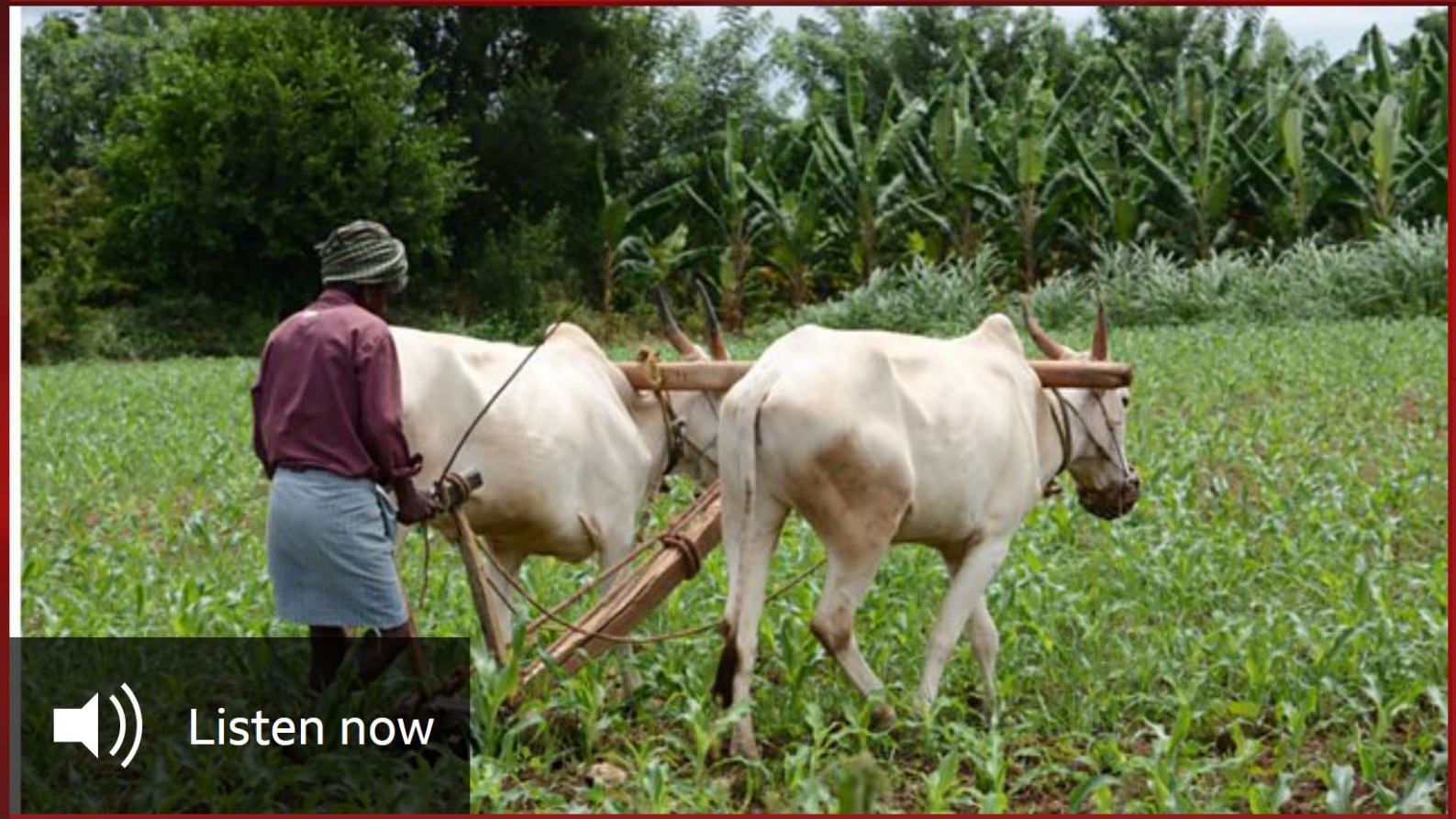
- Dynamic: Button mashing
- Mechanics: Actions with no cost and no cooldown

MDA in the real world

- Mechanics: The plough
- Dynamics: Specialization, trade, rulers and ruled, social inequality, misogyny, tyranny, malnutrition, dense population, disease, war
- Aesthetics: Cultivation, Ownership, Safety, Fear

http://sciencenordic.com/how-heavy-plough-changed-world

50 Things That Made the Modern Economy



The Plough

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How Game Designers Create Systemic Games | Emergence, Dynamic Narrative and Systems in Game Design

https://www.youtube.com/watch?v=OrmyLaLCaIo

The Game Overanalyser
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MDA and explorable explanations exercise

- Play these ”explorable explanations”, alone or together with a pair:
  - Parable of Polygons (https://ncase.me/polygons/)
  - Evolution of Trust (https://ncase.me/trust/)
- Analyze and take notes:
  - What are the mechanics and dynamics?
  - Systemic, strategic, narrative emergence?
  - What do you find most interesting or surprising about the mechanics, dynamics & aesthetics, and why?
- **Short debriefing discussion at 14.45** (take a break if you’re done before that)

MDA & explorable explanations debriefing

- What are the mechanics and dynamics?
- Systemic, strategic, narrative emergence?
- What do you find most interesting or surprising about the mechanics, dynamics & aesthetics, and why?

Preparation for the rest of the course

For week 2:

- Play Clash Royale (reach 1-2 new arenas after the training ground)
- Watch this GDC talk on balancing Clash Royale: https://www.youtube.com/watch?v=bHLQQh8Ctu4

For week 3:

- Play Walking Dead No Man's Land (Complete 1-2 chapters)

Other games discussed, play if you have time: Journey, Thomas Was Alone, Gone Home