Game Analysis and Research
(a.k.a The Science of Game Design)

Prof. Perttu Hämäläinen 2023

Course contents

- Week 1: Game design & research intro, MDA & emergence
- Week 2: Game design math, balancing, analytics
- Week 3: Games Now! Event week – Games as poetry and other topics
- Week 4: Psychology of game design: Behavioral game design, behavioral economics, monetization & sales psychology
- Week 5: Psychology of game design: Intrinsic motivation, emotion
- Week 6: Understanding the human body: Motor learning and performance for action game design, movement-based games. We end by testing some physical games at **Valo Motion showroom or HopLop Pasila (TBD)**

Lecture slides, code & spreadsheets:
https://github.com/PerttuHamalainen/GameAnalysis

Passing the course: Final assignment

- Option 1: Make a small game or game poem that explores a theme or themes discussed on the course, e.g., how to elicit a particular emotion

- Option 2: Technical/mathematical analysis exercise, e.g., analyze the balance of a game based on data that you scrape from the game's wiki

- Option 3: Read a book, write a learning diary

- Option 4: Literature survey of a topic you're interested in

For details, see final_assignment_instructions.pdf in the course Github

Contents (today)

- What are games?
- Why research & theory?
- How to read and understand research?

What are games?

Costikyan 2002

"Interactive structure of endogenous meaning that requires players to struggle toward a goal"

Caillois 1961

"An activity which is essentially:

- Free (voluntary)
- Separate (in time and space)
- Uncertain
- Unproductive (as opposed to work)
- Governed by rules (different that ordinary laws)
- Make-believe (accompanied by an awareness of a second reality)

Caillois' 4 types of play

- Agon, or competition. (Chess)
- Alea, or chance. (Slot machines)
- Mimicry, or role playing.
- Ilinx (Greek for "whirlpool"), or *vertigo*

Schell

"A problem-solving activity approached with a playful attitude"

Suits 1978

"The voluntary attempt to overcome unnecessary obstacles"

Then again…

https://www.gamepoemsbook.com/
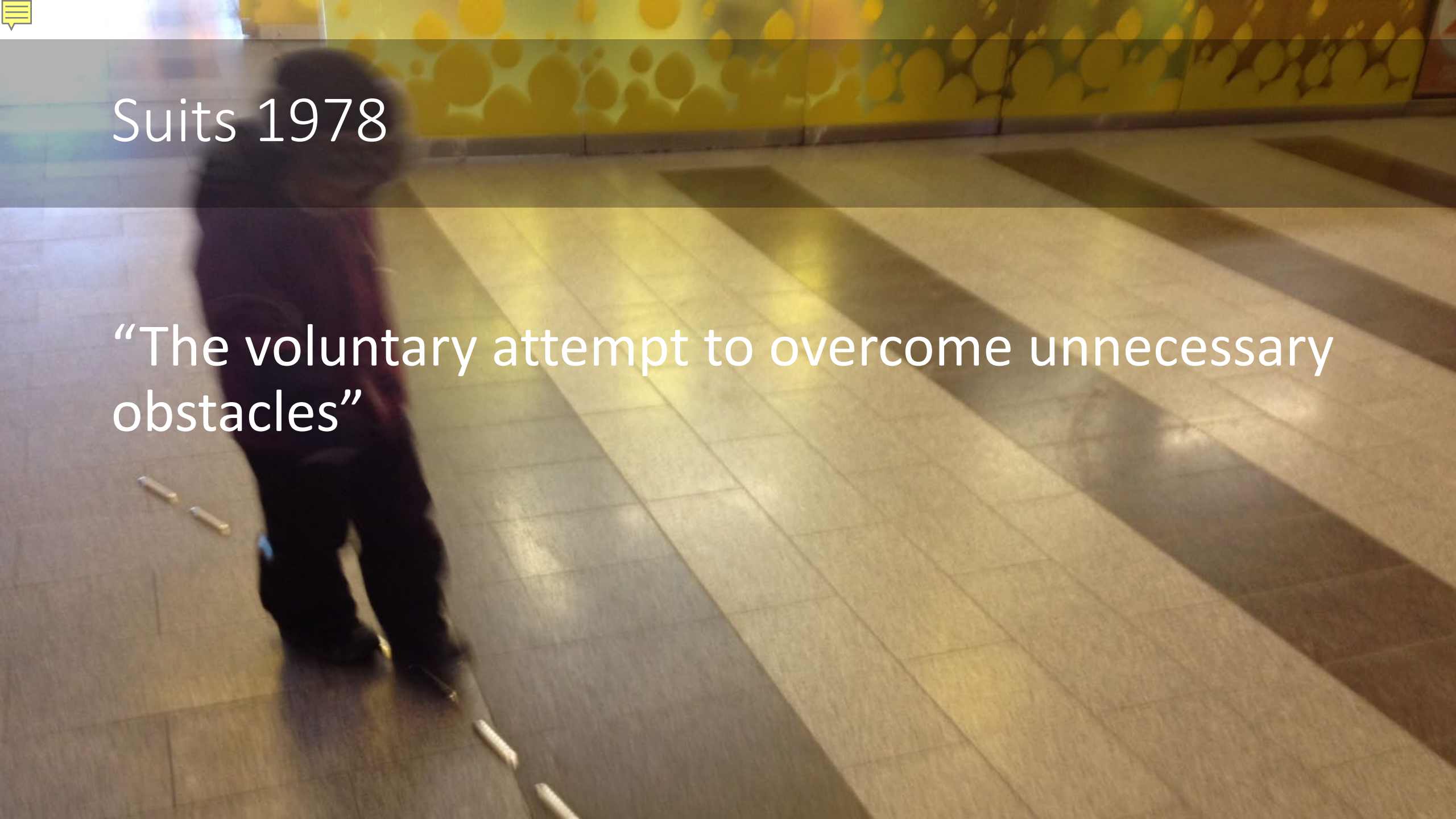
Jordan Magnuson will be here as a Games Now! speaker on Tuesday 7th Nov

Let's play some game poems

https://jordanmagnuson.itch.io/

https://www.poeticvideogames.com/
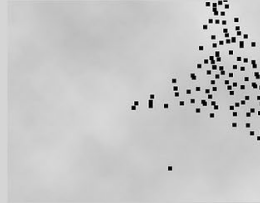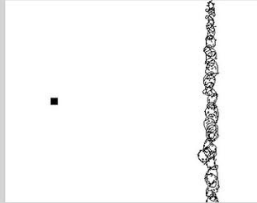

Jordan Magnuson www.necessarygames.com @JordanMagnuson

Hi, I'm Jordan! I make little game poems and notgames and things. I'm particularly interested in using basic bits of interaction and computation to explore subjective experiences, difficult topics, and complex emotions with games.

Oh, and I recently wrote a book about making these sorts of games. Check it out at gamepoemsbook.com -- It's free!

My Most Played Games

Loneliness
A microgame about... loneliness
Role Playing
Play in browser

Freedom Bridge
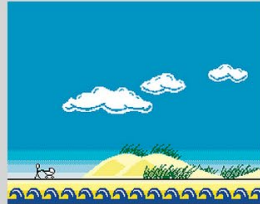A tiny documentary game
Survival
Play in browser

The Killer
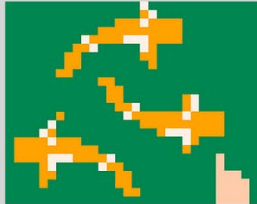A game about a walk and a choice
Shooter
Play in browser

Gametrekking Omnibus
Small games inspired by travel
Adventure

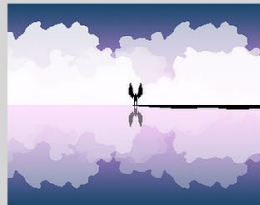## Game Poems Inspired by Parenthood

Walking with Magnus
A gamepoem about joy and tiredness
Rhythm
Play in browser

Portraits of My Child
A collection of game poems
Puzzle
Play in browser

Game Poems Inspired by Written Poetry

Icarus Also Flew
A game about failing . . . and flying
Puzzle
Play in browser

When Gold Is in the Mountain
A digging simulator
Simulation
Play in browser

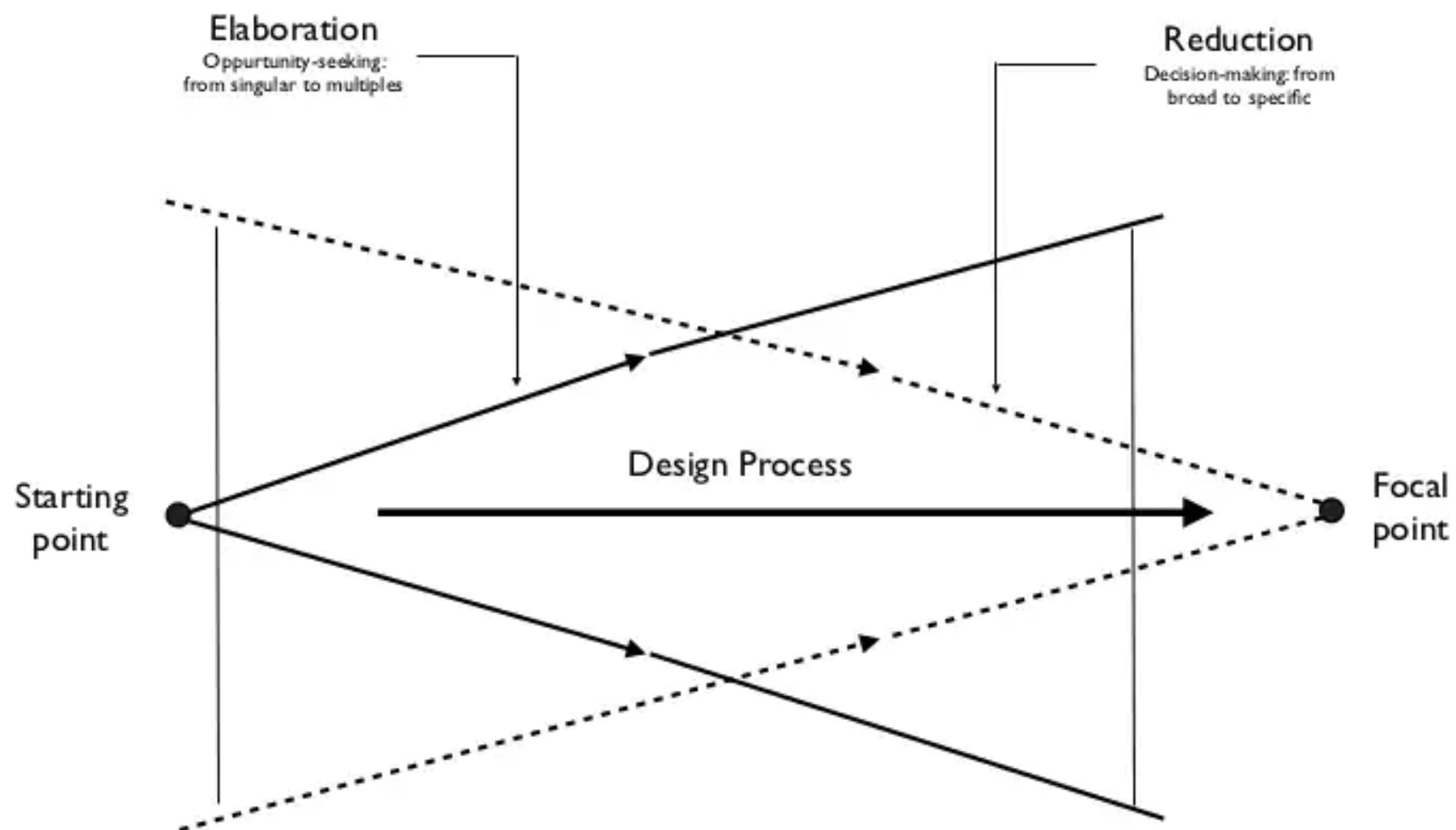# Discuss

Why research and theory?
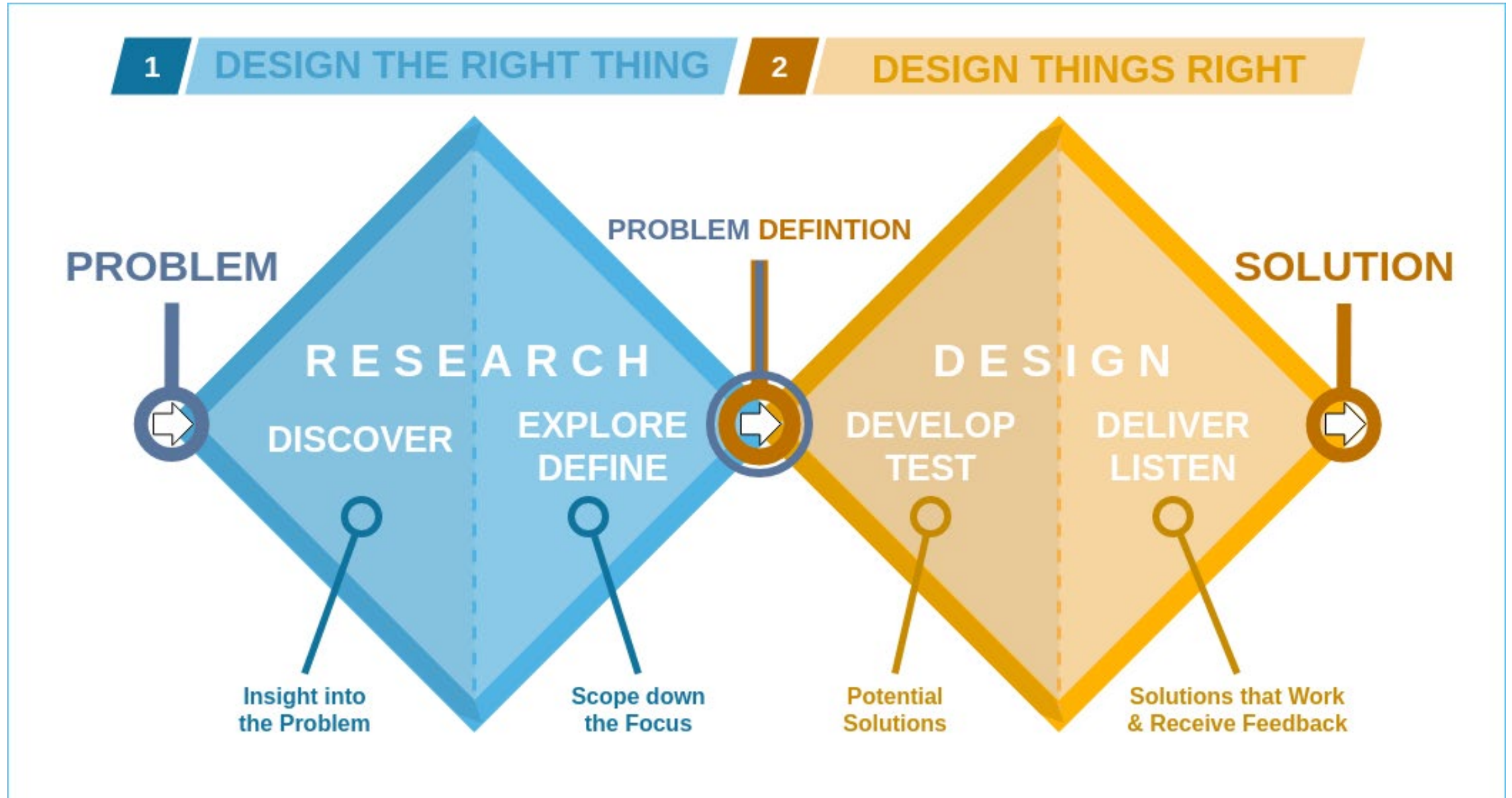
Science of game design?

- Core problem: How can we elicit desired player behavior and experience?

- Example of what is desired: player stays motivated and completes the game, and has a strong emotional experience that they reflect and discuss with their friends.

- We can only indirectly affect the behavior and experience, through the game's design

- Behavior and experience are hard to predict => slow and iterative trial-and-error design process.

- Research, books and papers can help us **ask the right questions** and **make predictions** such as if you do A, players are likely to do and experience B

- These can help in **generating, improving, and pruning ideas**

Generating, improving, and pruning ideas

Elaboration
Oppurtunity-seeking:
from singular to multiples

Reduction
Decision-making: from
broad to specific

Design Process

Starting
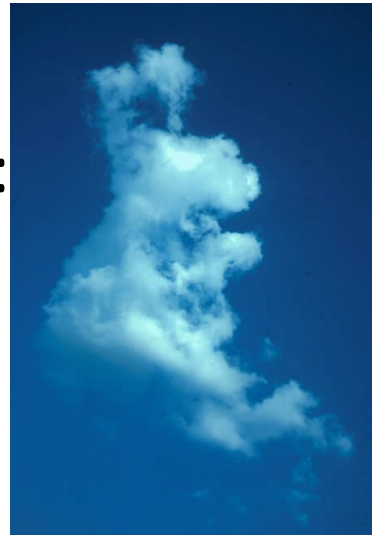point

Focal
point

The Double Diamond Method

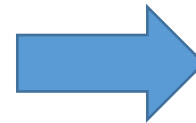# Asking the right questions to generate ideas

Two types of thinking

SYSTEM 1: IMPLICIT/UNCONSCIOUS: FAST, ASSOCIATIVE, EFFORTLESS, INTUITIVE
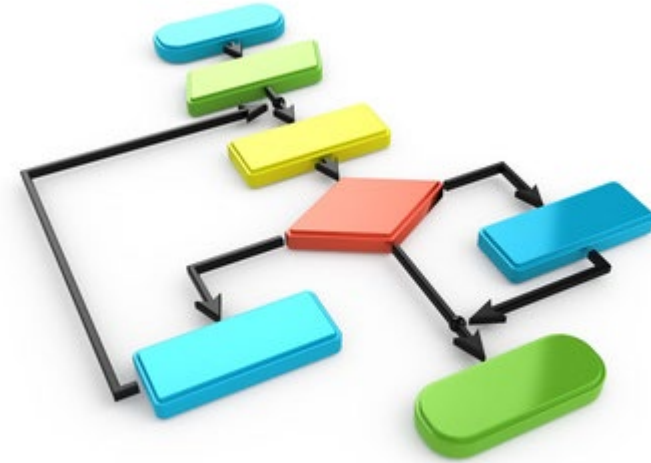
ASSOCIATION

Two types of thinking

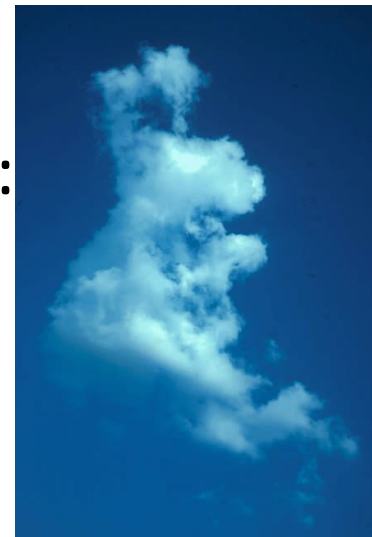SYSTEM 2: EXPLICIT/CONSCIOUS: SLOW, ALGORITHMIC, EFFORTFUL

ATTENTION, PRIMING, INHIBITION
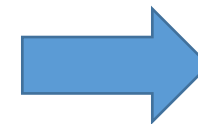
IDEAS, ASSOCIATIONS, IMPULSES (AUTOMATION)

SYSTEM 1: IMPLICIT/UNCONSCIOUS: FAST, ASSOCIATIVE, EFFORTLESS, INTUITIVE

ASSOCIATION

©Warren Photographic

Asking the right questions: connect the dots with four connected straight lines
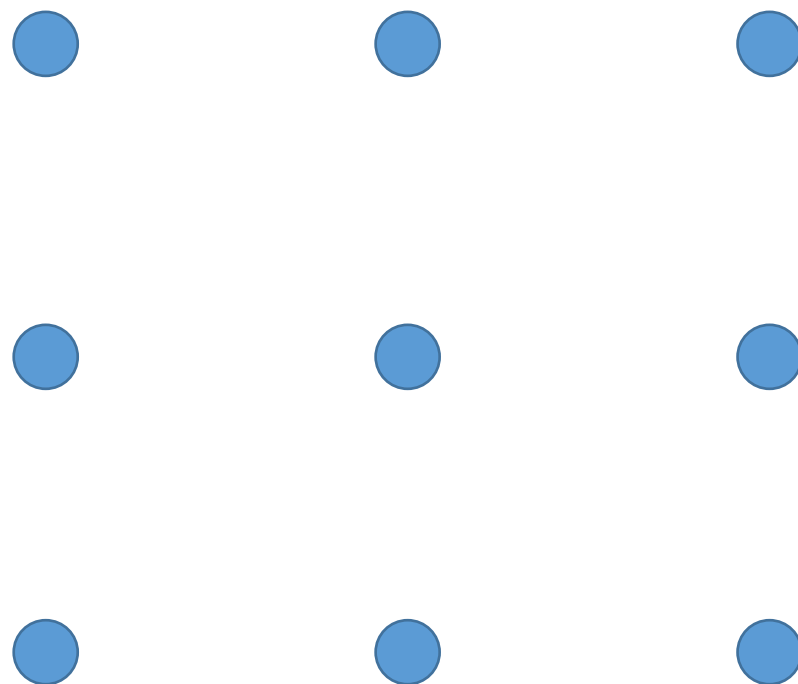
Can you think **outside the box**?
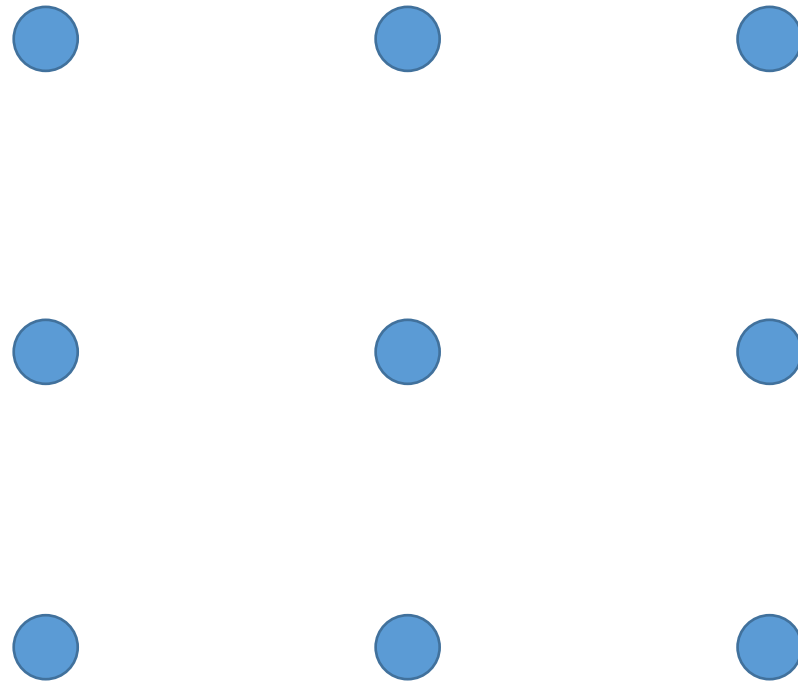
Can you think **outside the box**?
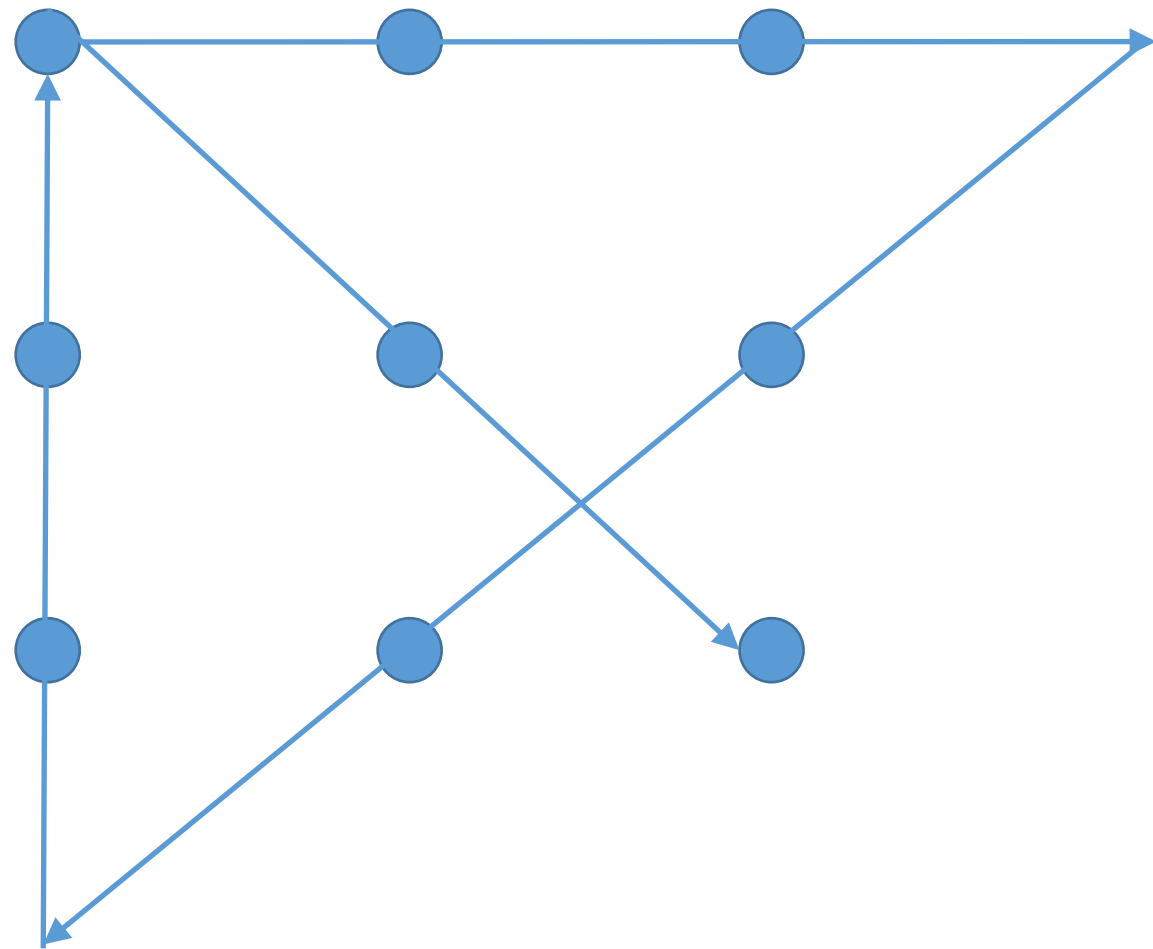
A note on AI idea generation

- Perhaps even more important for human creativity: Live, experience, be inspired by as many things as possible

- AI creativity: Asking the right questions really does matter
  - Provide precise instructions
  - Provide concrete examples
  - https://platform.openai.com/docs/guides/gpt-best-practices

Let's practice: Live demo with GPT-4

- We will compare 3 different prompts in generating game poem ideas
- https://platform.openai.com/playground (needs an OpenAI account)

Asking the right questions to improve ideas

Playability heuristics

- Checklists for evaluating game design

- Represent general best practices

- E.g., "Is the game easy to learn,but harder to master?"

Game Usability Heuristics (PLAY) For Evaluating and Designing Better Games: The Next Iteration

Heather Desurvire

Behavioristics, President Professor, USC, Cinematic Arts, Game Studies Playability/Usability Specialist, 578 Washington Blvd. #179 Marina del Rey, CA 90292 USA +1 310 823 6543; heather3@gte.net

Charlotte Wiberg

Assistant Professor Informatics, Umeå University, SE-901 87 Umeå, Sweden charlotte.wiberg@informatik.umu.se

Abstract. Game developers have begun applying formal human-computer interaction (HCI) principles in design. Desurvire et al [2] adapted a set of Heuristics for productivity software to games. The resulting set, presented at CHI 2004, was *Heuristics to Evaluate Playability* (HEP). Generalization of these heuristics is required to make them applicable to a multiple of game genres and game deliveries. This follow-up study focused on the refined list, Heuristics of Playability (PLAY), that can be applied earlier in game development as well as aiding developers between formal usability/playability research during the development cycle. Heuristics were formed based on their efficacious scores on the popular game review website, metacritic.com. Fifty-four gamers rated High and Low ranked games on 116 potential heuristics. Implications for how these Heuristics will help developers improve game quality are discussed. PLAY has been found useful in design evaluation and elf-report survey format.

http://www.userbehavioristics.com/s/DesigningBetterGames-09HCI-Desurvire.pdf

Exercise: Can you think of a game that is successful but breaks these rules?

I. Category 1: Game Play

A. Heuristic: Enduring Play

A1. The players finds the game fun, with no repetitive or boring tasks

A2. The players should not experience being penalized repetitively for the same failure.

A3. The players should not lose any hard won possessions.

A4. Gameplay is long and enduring and keeps the players' interest.

A5. Any fatigue or boredom was minimized by varying activities and pacing during the game play.

Exercise: Schell's lenses

- Pick a game you have made or are making. If you don't have one, pick an existing game that you know well.
- Scrutinize your game using some of the lenses. Here are some recommended ones:
    - #2 (Essential experience)
    - #12 (Resonance)
    - #13 (Infinite Inspiration)
    - #17 (Toy)
    - #100 (Love)
- **Make notes of any interesting insights or new ideas you gain.**
- To access the lenses, **download the Art of Game Design: A Deck of Lenses free app.**
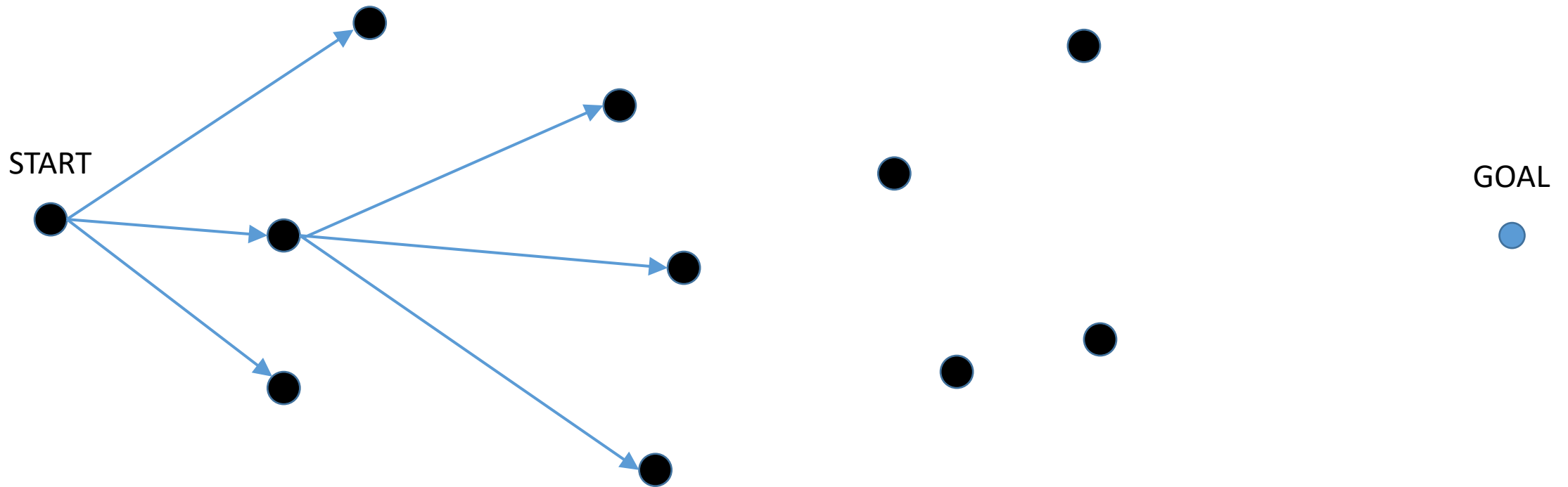
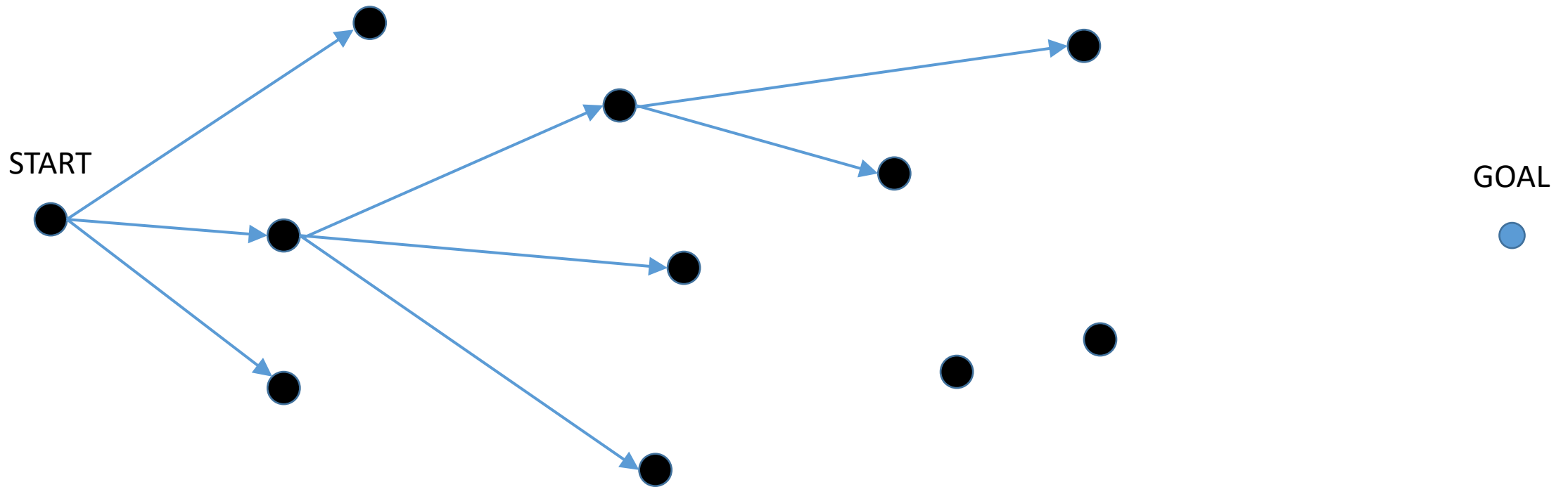Discussion: Which of the lenses were the most useful for you? Why?

Pruning ideas

Game design as tree search

INITIAL IDEA
OR BRIEF

FINISHED
GAME

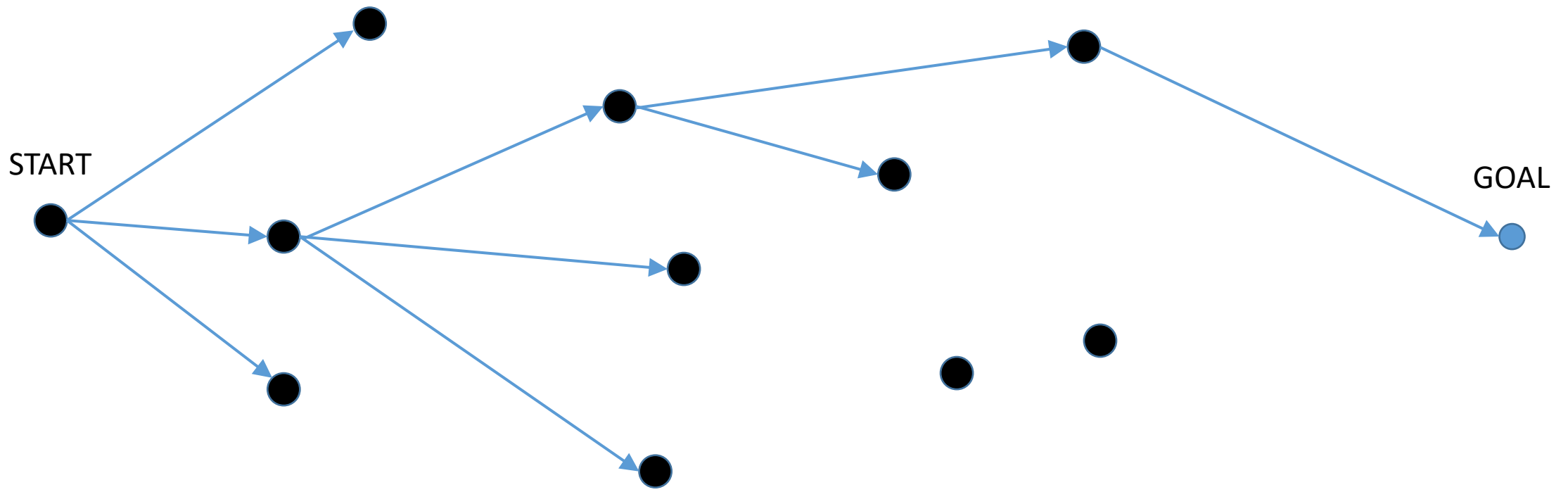# Game design as tree search

START

GOAL

Game design as tree search

Game design as tree search

Tree search efficiency

- Time spent in implementing and evaluating a branch
  - Using agile tools and methods that speed up the feedback cycle
- Search depth
  - Scoping the game.
- Confidence in making decisions and selecting what alternatives to evaluate
  - Research-based best practices
  - Research-based predictions of the player experience and/or behavior resulting from a decision
  - Research-based answers to questions that arise

Science of game design: Of the myriad conscious and unconscious design decisions needed in creating a game, which ones can be informed by research and/or theory, and where does design intuition and agile iteration still provide the best results?

Some questions that research can answer

- Psychology & Cognitive science: How do people make decisions? What motivates us? What are emotions and how they affect behavior and experience?

- Sport & exercise psychology: What motivates people to move? What factors affect motor learning and performance?

- Technical game research: How to enable new types of experiences? How to implement X in the most efficient way possible?

Technical game research
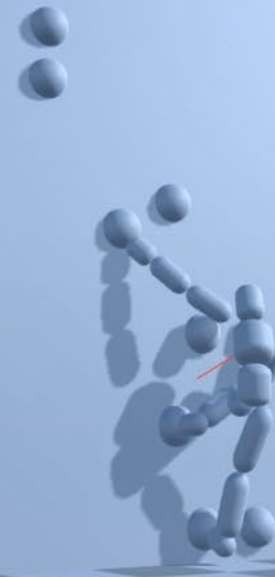
Recommended sources

Books

Second Edition

The Art of Game Design

A Book of Lenses

Books

Games & Animation

Making a successful video game is hard. Even games that are successful at launch may fail to engage and retain players in the long term due to issues with the user experience (UX). In a nutshell, game UX is about considering the gamer's brain: understanding human capabilities and limitations to anticipate how a game will be perceived, the emotions and motivation it will elicit, and how players will interact with it. This book is designed to help readers identify the ingredients for successful and engaging video games, empowering them to develop their own unique game recipe more efficiently.

Key Features:

- Provides a complete overview of how the brain works in a very accessible way.
- Provides a unique game UX framework, using numerous examples from released games.
- Covers design thinking, user research, analytics, and UX strategy.
- This book is a practical tool that any professional game developer or student can use right away and includes the most complete overview of UX in games existing today.

Author Bio:

Celia Hodent, Ph.D in psychology with over ten years of experience in the entertainment industry, is recognized as a leader in the application of user experience and psychology in video games, and in the development of UX strategy in game studios. Celia has worked at Ubisoft, LucasArts, and Epic Games on many projects across multiple platforms, including the *Tom Clancy's Rainbow Six* franchise, *Star Wars: 1313*, *Paragon*, *Fortnite*, and *Spyjinx*

Reviews:

"The beauty of this book is that it is two things at the same time:
  1. An amazingly complete introduction to psychology, using examples from video games to make the concepts clear and memorable.
  2. An amazingly complete introduction to video game design, using psychology to help design more compelling games
So whether you are a game designer, a player, or someone wishing to understand psychology, this is the book for you."

—**Don Norman**, Director, the Design Lab at the University of California, San Diego author of *The Design of Everyday Things*

"By blending up-to-date brain science with game-relevant UX design principles, this book doesn't just give great tips about how to make better games, it gives designers the mental tools to get better at thinking about games. Read this, and suddenly you'll know what you're talking about."

—**Jesse Schell**, Game Designer, author of *A Theory of Fun for Game Design*

"This book is an invaluable asset for game developers, whether you work in game design, user experience, or programming. With a lucid overview of the current best knowledge from cognitive psychology, Hodent provides guidelines and approaches to improve the game experience for players that are based on actual science."

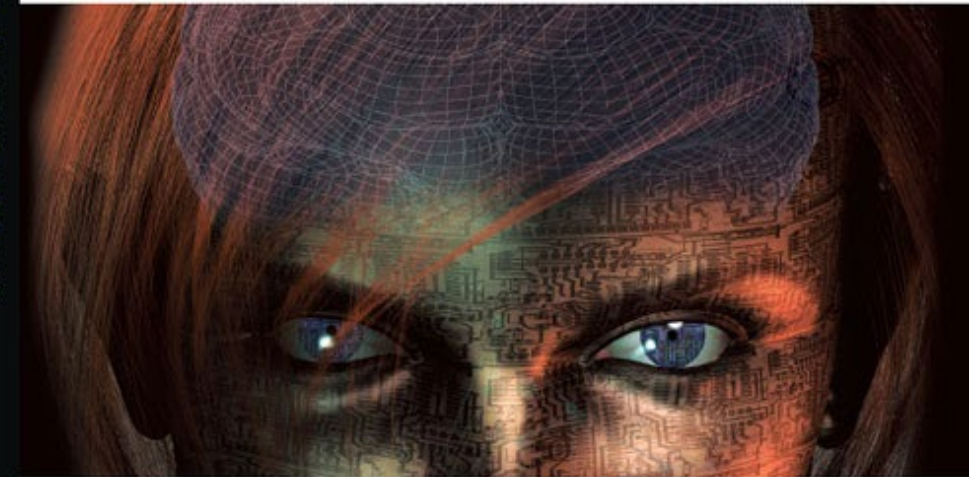—**Raph Koster**, author of *A Theory of Fun for Game Design*

The Gamer's Brain

How Neuroscience and UX Can Impact Video Game Design

Celia Hodent

Foreword by **Brenda Romero**
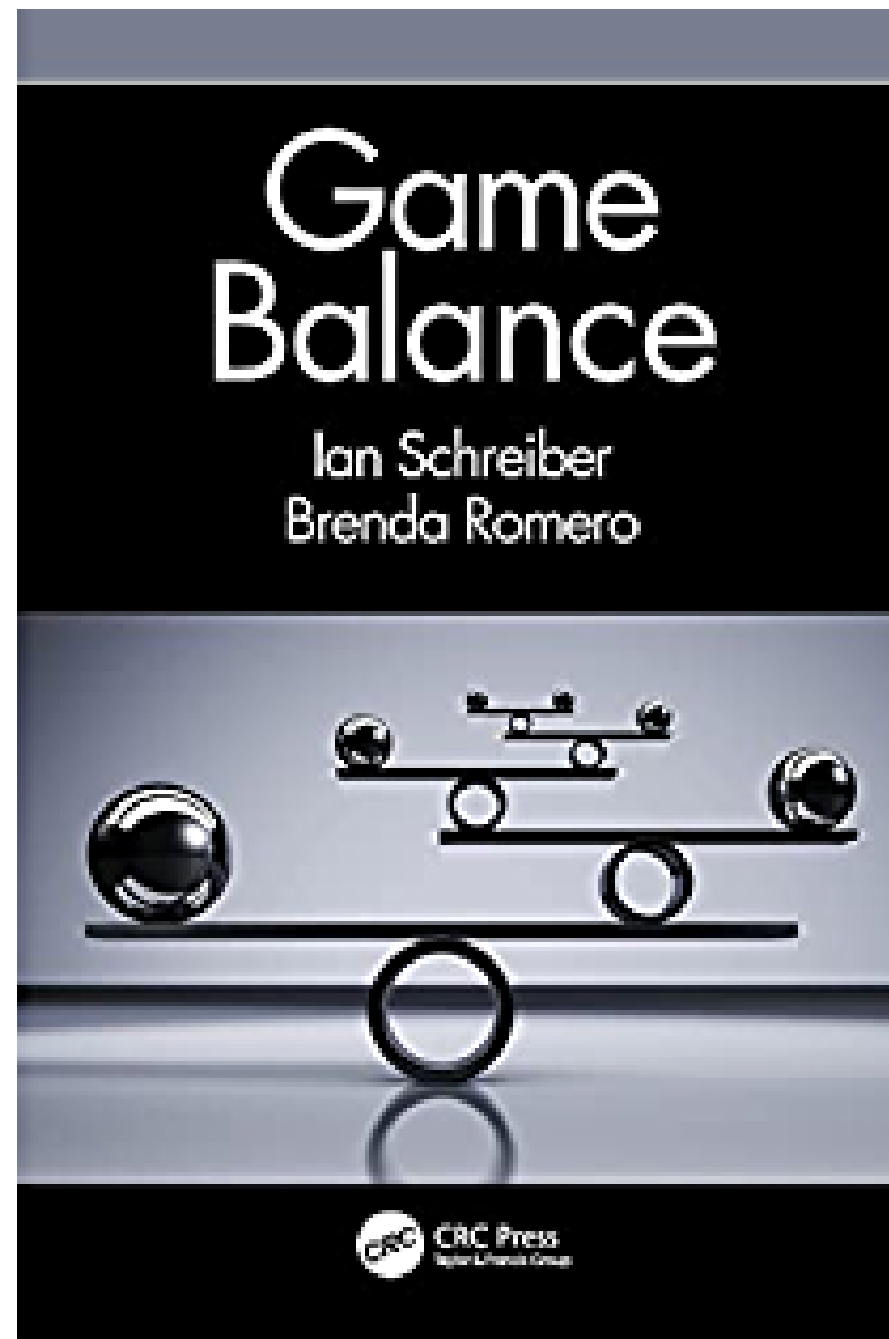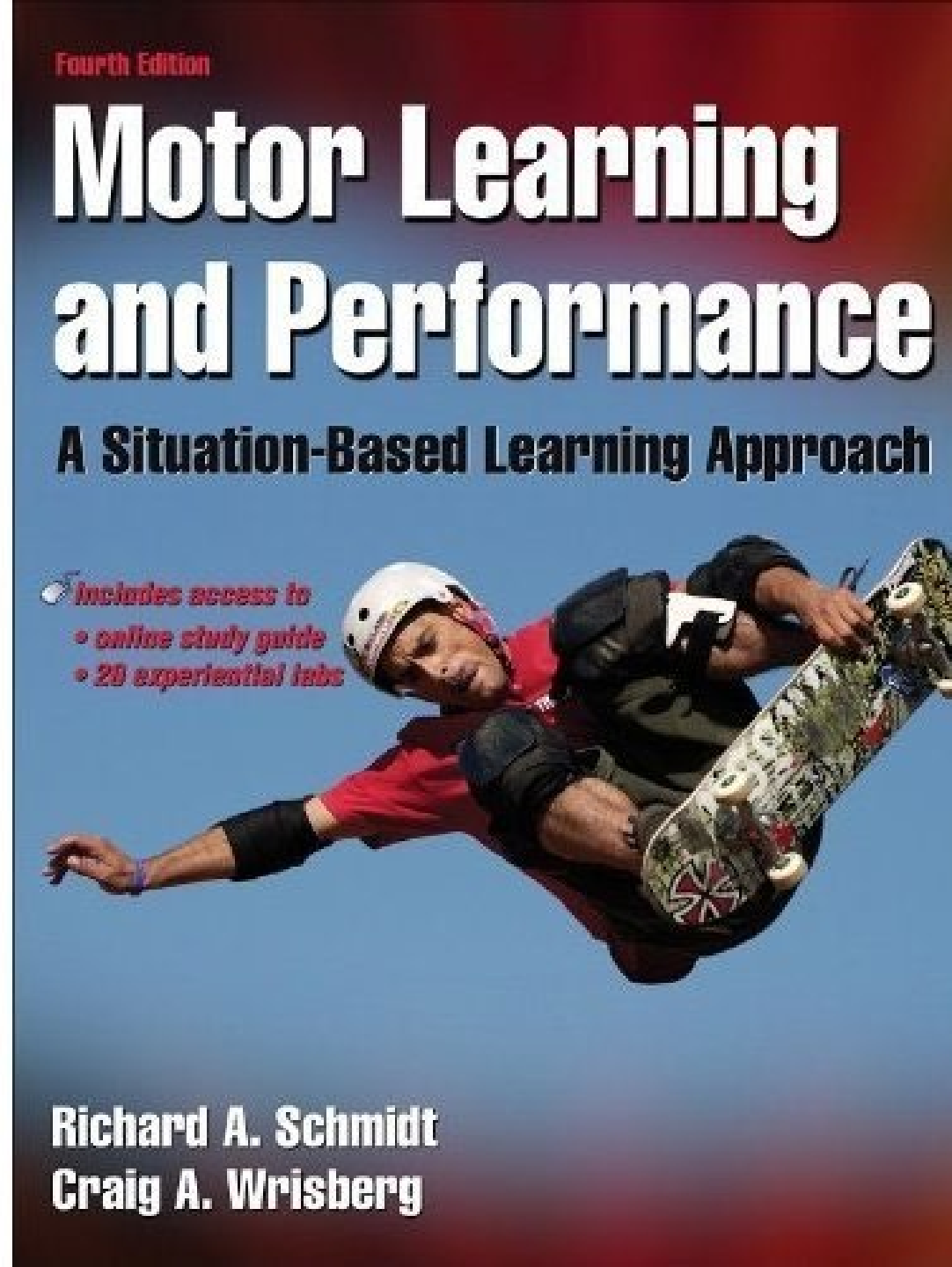
CRC Press
Taylor & Francis Group

Books

Books

Books

Fourth Edition

Motor Learning and Performance

A Situation-Based Learning Approach

Includes access to
- online study guide
- 20 experiential labs

Richard A. Schmidt

Craig A. Wrisberg

Papers & talks

- High-quality conferences and journals: CHI PLAY, CHI, UIST, SIGGRAPH, Proceedings of the ACM on HCI, ACM Transactions on Graphics

- Also good: Designing Interactive Systems (DIS), Foundations of Digital Games (FDG), Digra

- GDC talks can be good, but they are not peer-reviewed before presenting, and the quality and reliability of what is said varies a lot

- https://arxiv.org/: Used a lot in technical areas, but might not yet be peer-reviewed and trustworthy

- https://osf.io/preprints/psyarxiv/: Like arxiv but for psychology

How to find? (Demo)

The best research search engine: https://scholar.google.com/

ACM SIGCHI conferences (CHI, CHI PLAY, UIST). 2020 onwards, this includes talk videos: https://programs.sigchi.org/

      Useful: filter by awards

GDC YouTube channel: https://www.youtube.com/@Gdconf

Main types of research

- Confirmatory
    - Answers research questions through testing and confirming research hypotheses
    - Example hypothesis: New drug makes patients recover faster
    - Example hypothesis: Novel user interface decreases task completion time
    - Example hypothesis: Novel game mechanic increases enjoyment
    - Needs enough data for reliable statistical analysis
- Exploratory: What interesting hypotheses or questions might there be? Often precedes confirmatory research, e.g., exploratory in-depth interviews with a small sample of participants followed by confirmatory questionnaire study with a large sample
- Descriptive: How do people experience or play/use games and interactive technology? What processes do game developers and designers use?
- Technical / constructive / problem solving: Inventing solutions to problems. Usually combined with confirmatory or at least exploratory investigation of whether and how the solution works

INTERACTIONS

Search 🔍

f t 📡 BLOG

DIGITAL EDITION:

To appreciate the special editorial and graphical connections in the November-December issue, the editors-in-chief and contributors recommend viewing the content via *Interactions'* Digital Edition on a full-size screen in "Page View."

View This Article

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▶ FULL-TEXT (PDF)

▶ IN DIGITAL EDITION

▶ COMMENTS

Reader Tools

📄 PRINT
◻◻◻ TEXT SIZE

➕ SHARE f ⟩ ✉ ...

FEATURES

XXIII.3 May + June 2016
Page: 38
Digital Citation

RESEARCH CONTRIBUTIONS IN HUMAN-COMPUTER INTERACTION

Authors:

Jacob Wobbrock, Julie Kientz

All scholarly fields strive to contribute new knowledge. In the field of human-computer interaction (HCI), this new knowledge increasingly comes in rich forms like videos and demos, but the archival research paper remains the most widely used and accepted capture and delivery mechanism for research knowledge. The knowledge contribution made by a research paper—or more precisely, made by the work a research paper describes—is any research paper's central feature. For example, a theoretical physics paper may contribute a new mathematical model for the behavior of light near black holes. A civil engineering paper may contribute a new method for…

1. Empirical
2. Artifact
3. Methodological
4. Theoretical
5. Dataset
6. Survey
7. Opinion/essay

Questions for evaluating a paper (or a thesis)

1. Research goal, problem, and/or question?

2. Research gap: What is missing in previous knowledge (knowledge gap) or solutions to the problem?

3. Intended results and contribution? (Preferably based on established contribution types)

4. Methods/approach?
   - What data, observations, or other evidence are provided for the claimed results and contribution, and what method/approach is used to obtain those?

5. Significance? Why should anyone care, why does your work matter?
   - What makes the question interesting?
   - Why does the problem need to be solved?
   - What impact does the work have?
   - What value does the contribution provide over previous work?

Exercise: Identify the contribution types and the answers to the 5 questions in papers and theses

- Instructions, materials, and report template: https://urly.fi/30Hk

Discussion

- Any papers that provided particularly clear answers to the questions?
- Any common patterns you noticed?
- Any other insights on reading or writing theses/papers?