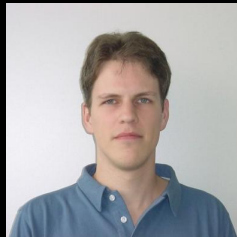


Gamification: An Interactive Session

Dr. [Alexandru Iosup](#),
Otto Visser, Dr. Ana Lucia Varbanescu,
Tim Hegeman, and Jesse Donkervliet



@AIosup

The “Leaking Faucet”



- Major technical university in the Netherlands
- “P-in-een” of an important BSc track
- Completion “in time” of the BSc
- (What do students think about it?)

<40%

<50%

ELSEVIER



Exercise: The Blame Game

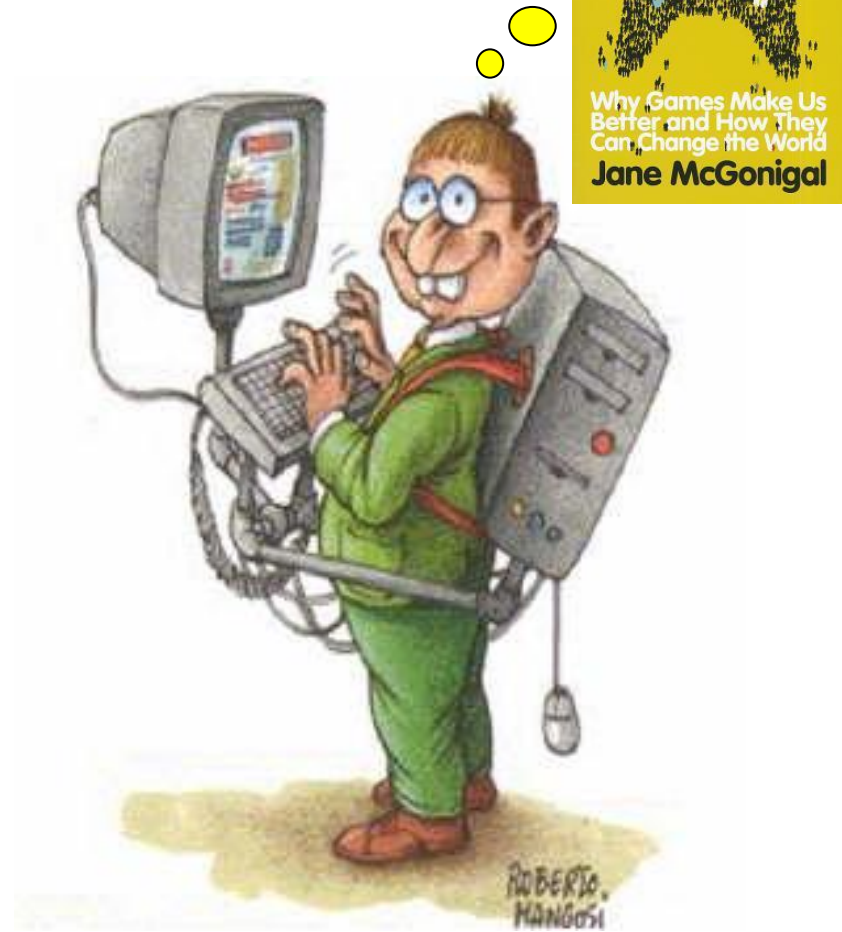
- Team work, first 2 minutes
 1. Form team of 2-3 persons
 2. Think about own experience
 3. Convince your team before proposing an answer
- Open discussion, next 2 minutes
 - Tell everyone the answer

Q: **Who is responsible** for the **current yield** of higher education?

Voting on best answer

We're In This Together (My Answer)

- New generation of students
- New types of students, especially multi-culti
- It's not you, it's me
- New ambition of our faculty, but cannot select students



<https://quotablequoteunquote.files.wordpress.com/2008/08/walkingcomputergeek.jpg>

We're In This Together (My Answer)

- New generation of students



- New types of students

The main challenges for the future?

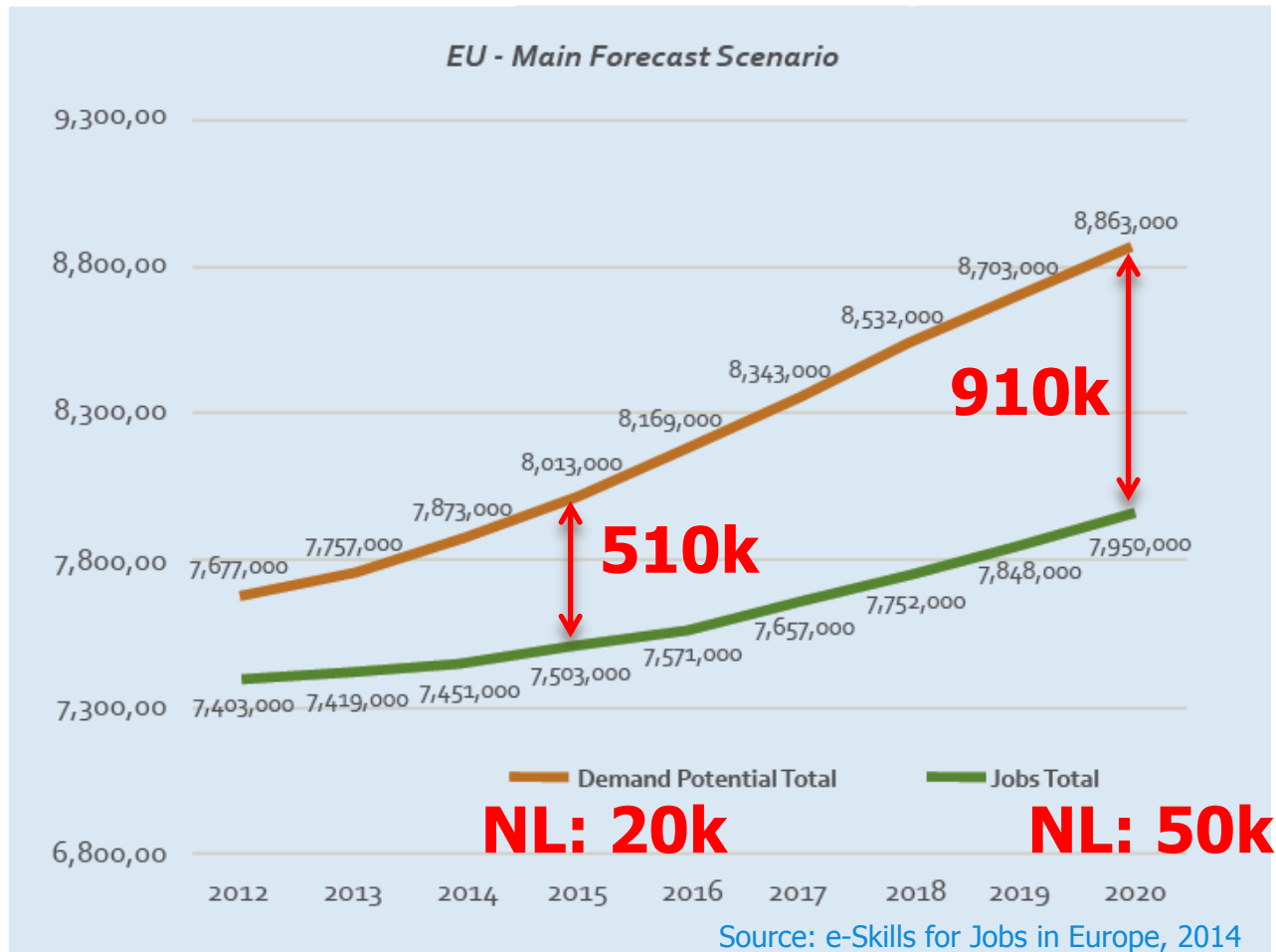
**Every student counts!
Every student is different!**

- New ambition of our faculty,
but cannot select students

<https://quotablequoteunquote.files.wordpress.com/2008/08/walkingcomputergeek.jpg>



Let's Extrapolate to Europe: The Workforce Gap in ICT



Source: e-Skills for Jobs in Europe, 2014

Let's Extrapolate to Europe: The Workforce Gap in ICT

EU - Main Forecast Scenario

9,300,00

The main challenges for the future?

Every student counts!
Every student is different!



NL: 20k

NL: 50k

Source: e-Skills for Jobs in Europe, 2014

Let's Extrapolate to Europe: The Workforce Gap in ICT

EU - Main Forecast Scenario

9,300,00

The main challenges for the future?

**Every student counts!
Every student is different!**

Rhetorical Q:

Which teaching technique can help?

7,300,00

6,800,00

2012 2013 2014 2015 2016 2017 2018 2019 2020

Source: e-Skills for Jobs in Europe, 2014

Agenda for Today or Gamification. Because Every Student Counts!

Time
Units

1. Introduction, with high-level goal and low-level objectives 1
2. An intuition behind gamification 1
- ⇒ 3. A practical framework for gamification in higher education (getting your courses gamified) 5½
 - ⇒ 1. Learning Objectives to content (refresher on higher-education basics) ½
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 - ⇒ 3. Designing the gamified experience, focus on MDA* framework ½
 - ⇒ 4. Designing the gamified experience, focus on dynamics and mechanics ½
 - ⇒ 5. Designing the gamified experience, focus on assessment 1
 - ⇒ 6. Playtesting for fun and motivation, and against common pitfalls 1
 - ⇒ 7. Operating a gamified course 1
- ⇒ 4. Wrap-up ½

* Mechanics, Dynamics, Aesthetics

What is Gamification?

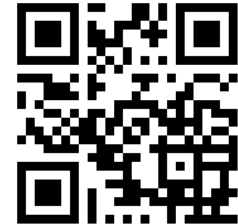
A: Game Thinking + Techniques

Q: What is **gamification**?

A: The use of thinking and techniques designed for gaming in non-gaming settings, e.g., in education.



<http://goo.gl/v97zSW>



What is the intuition behind gamification?



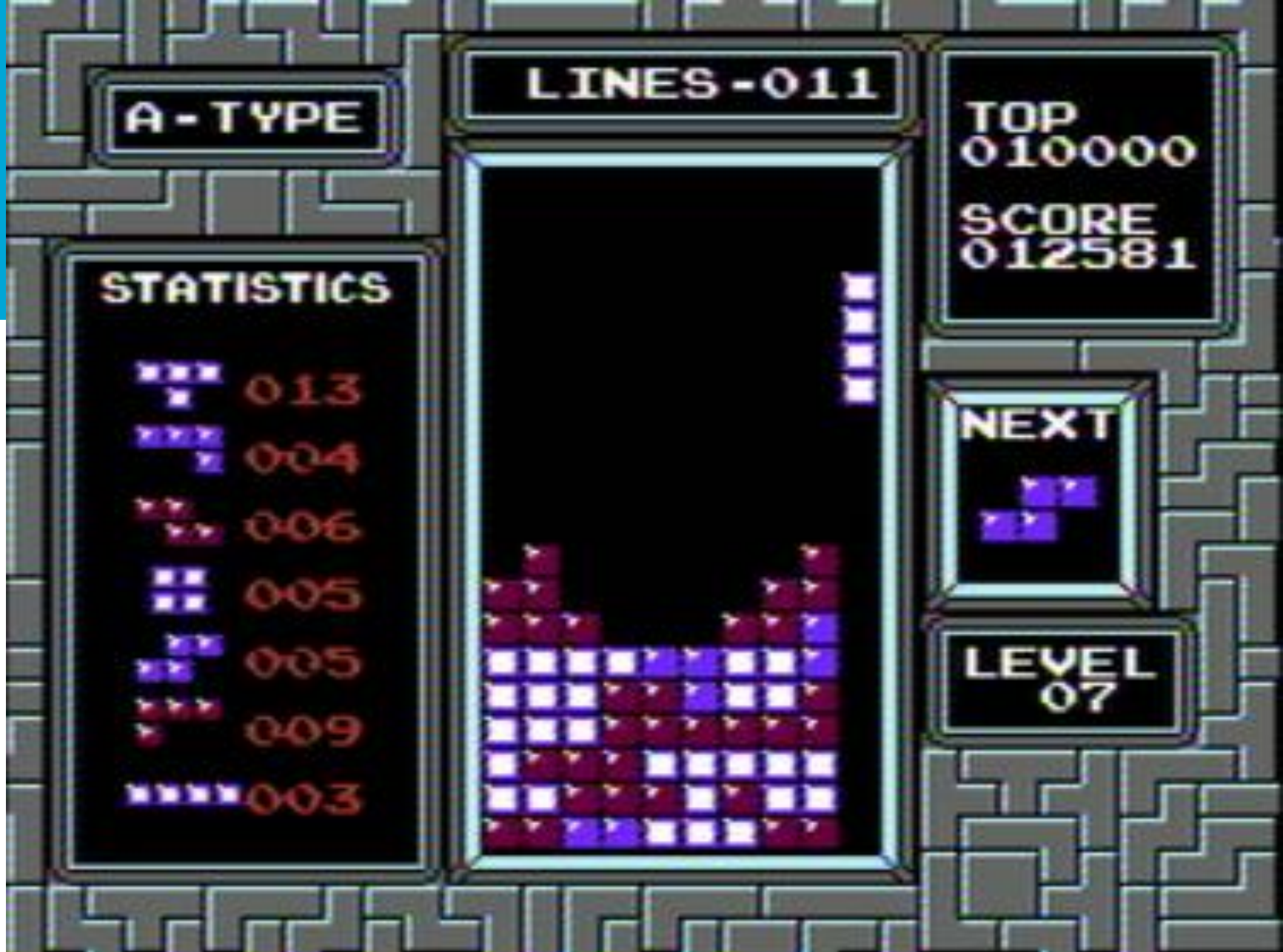
How can gamification be used?

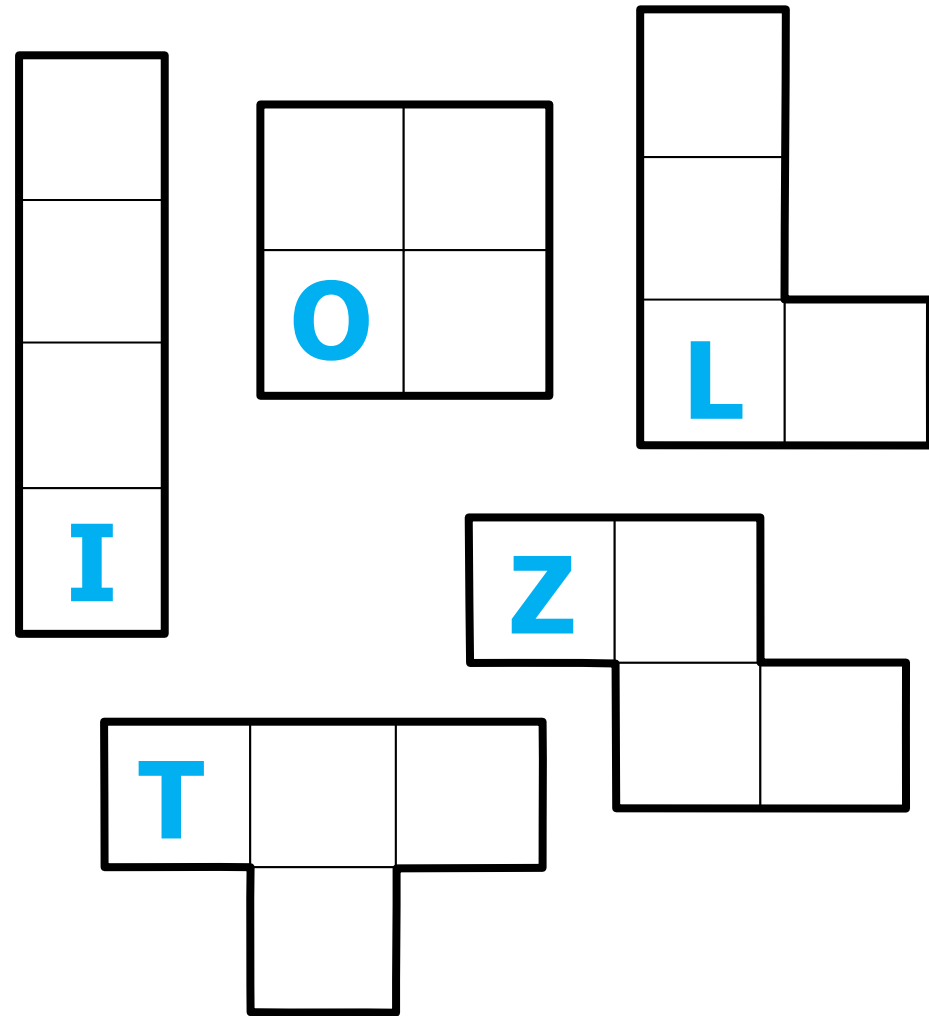
<http://goo.gl/ILSNeB>



Do You Know This Person?

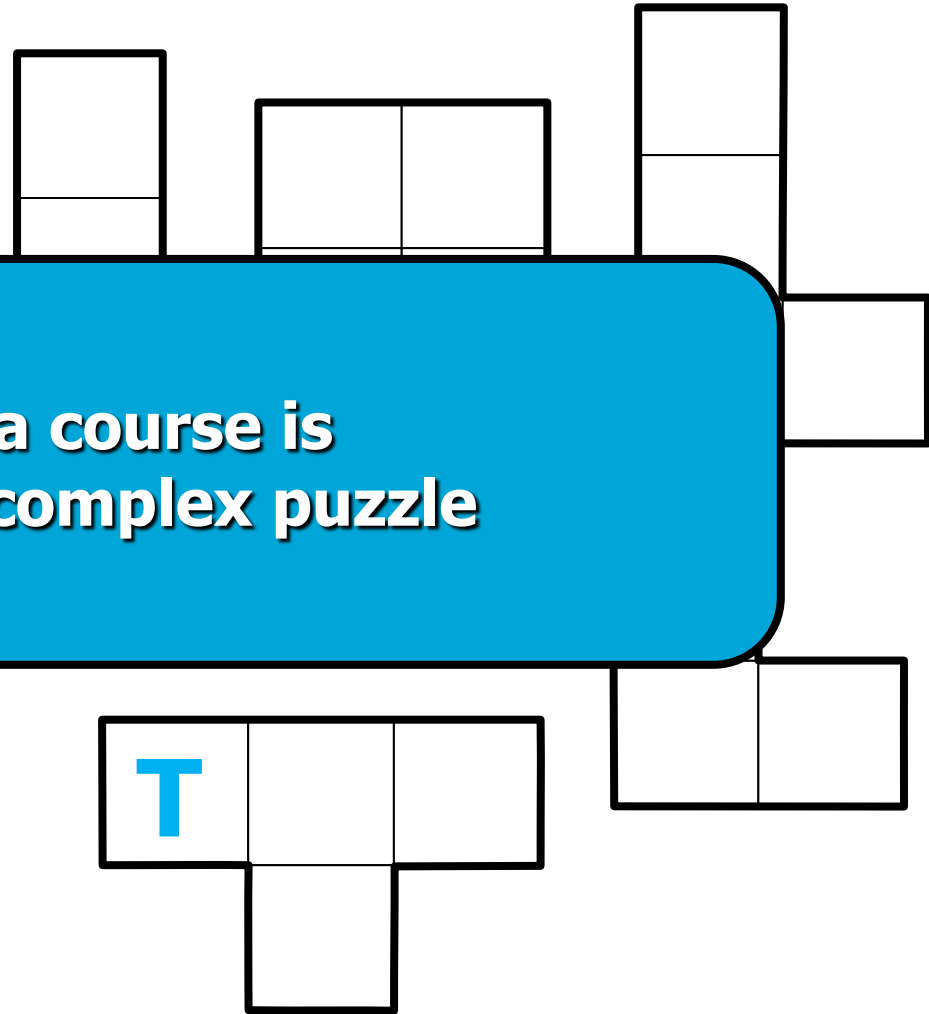
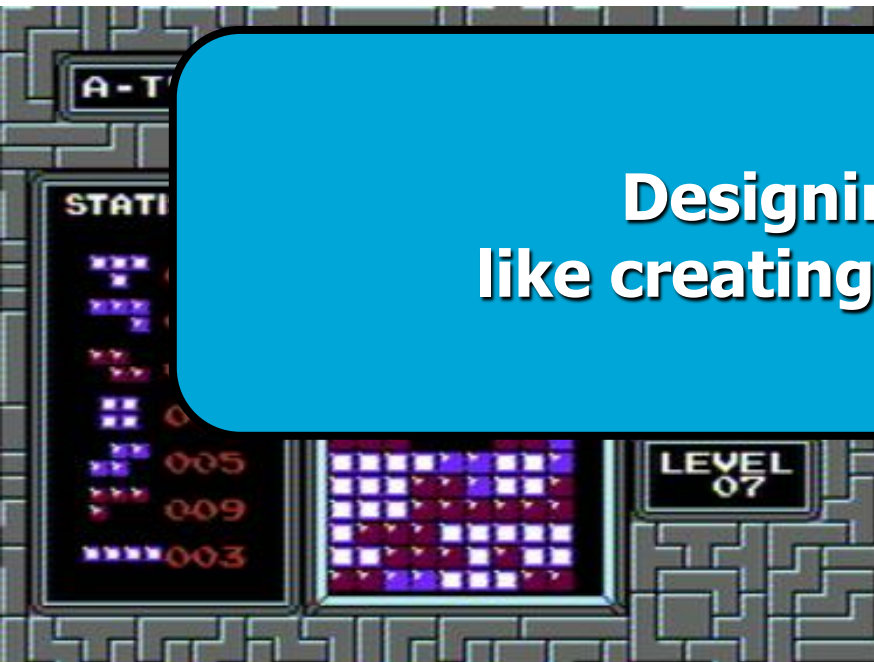




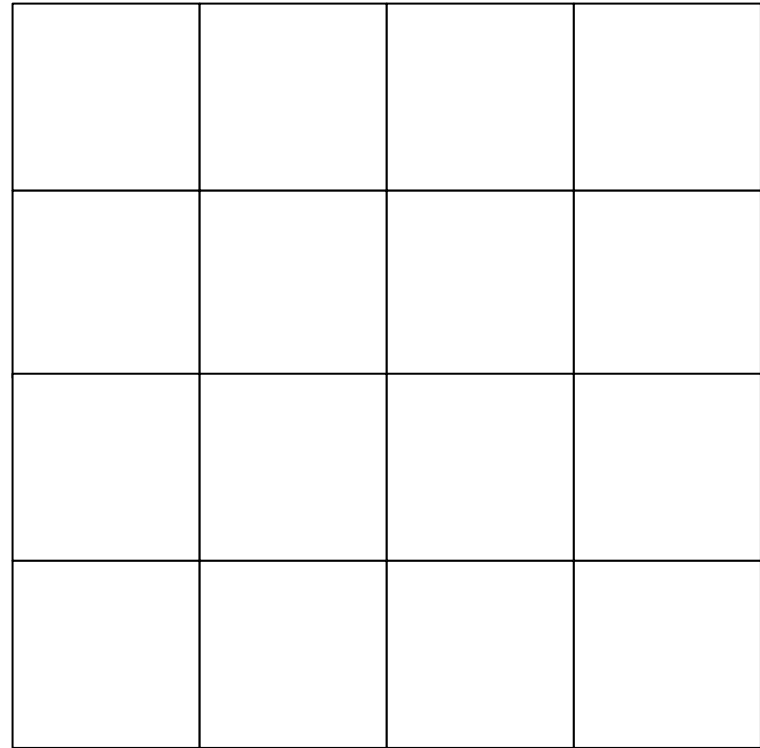
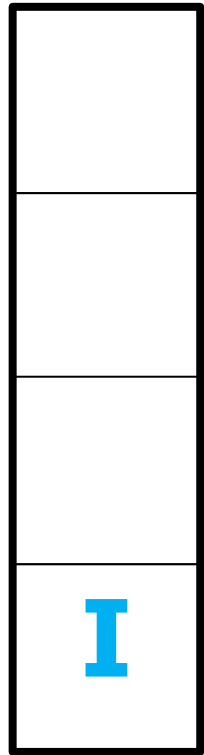




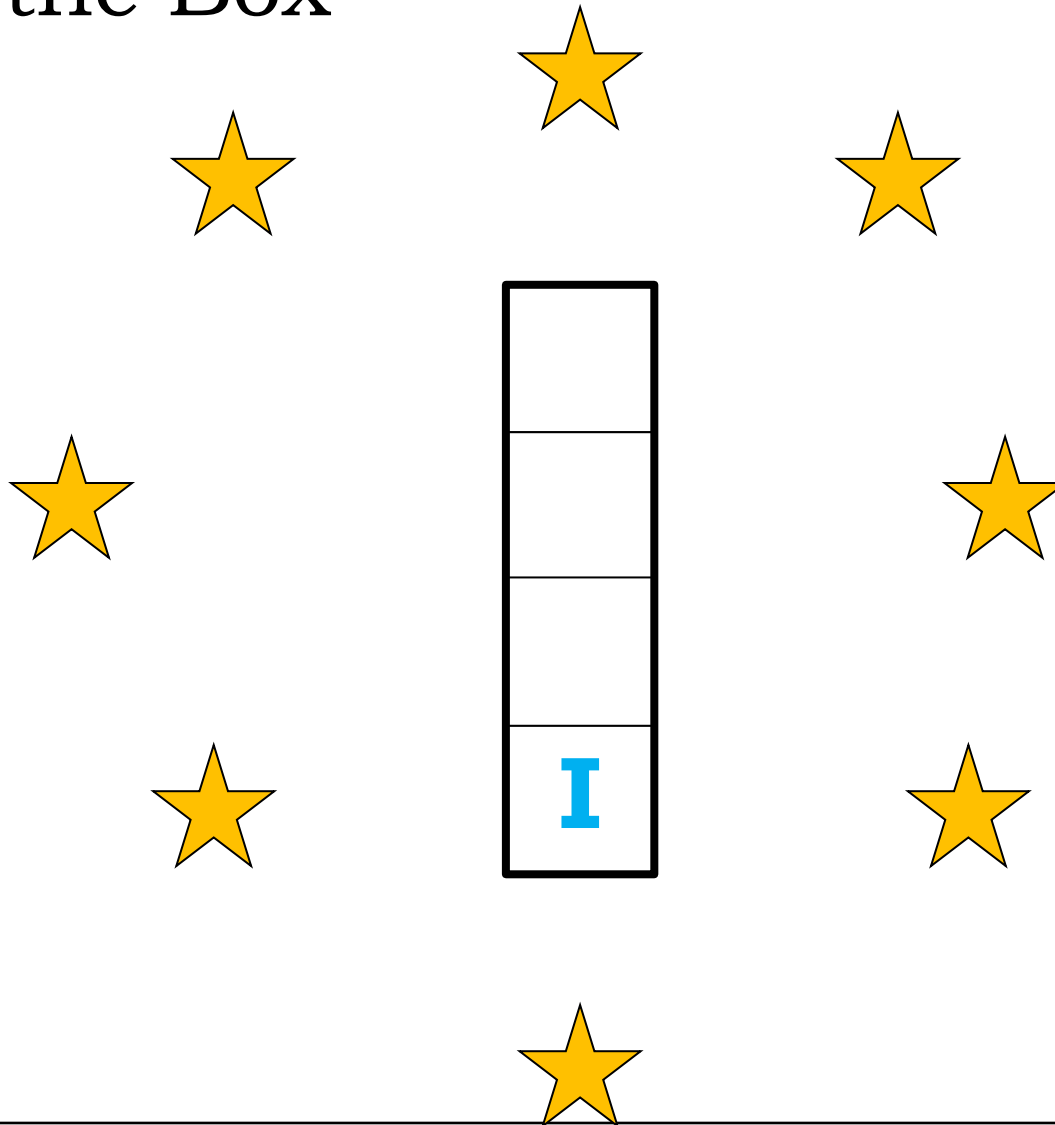
**Designing a course is
like creating a complex puzzle**



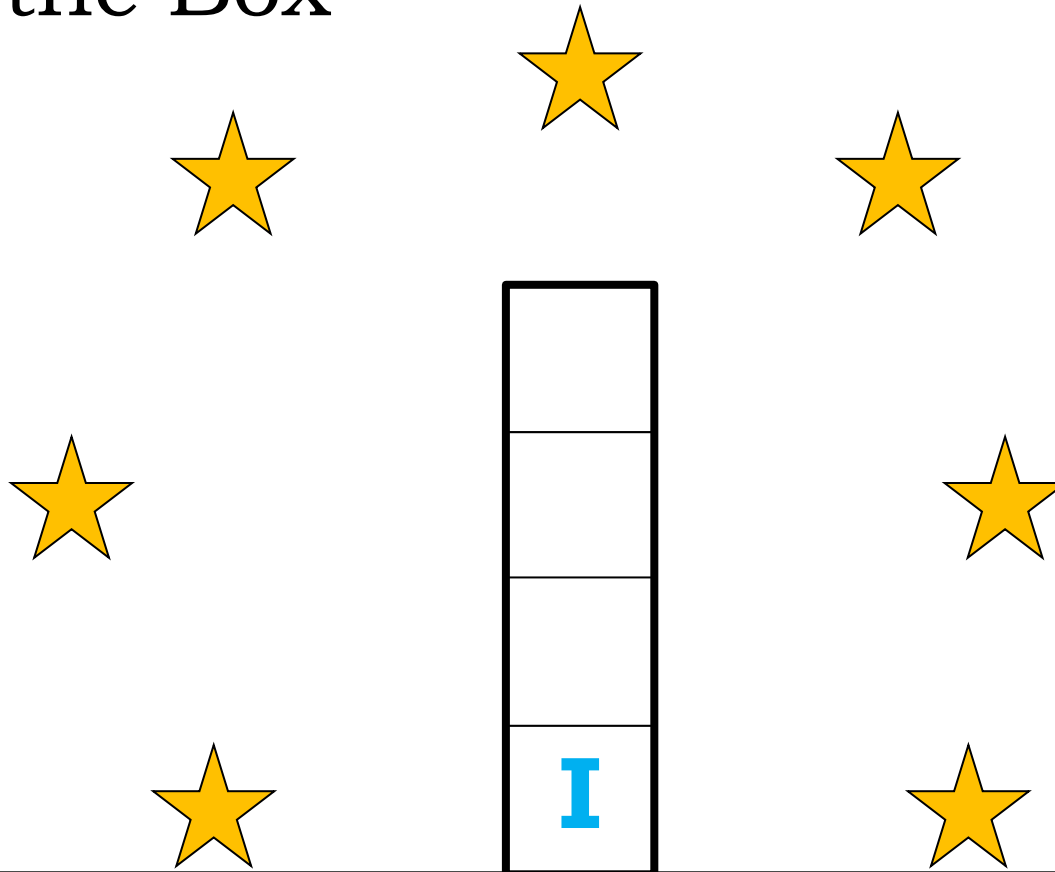
I in the Box



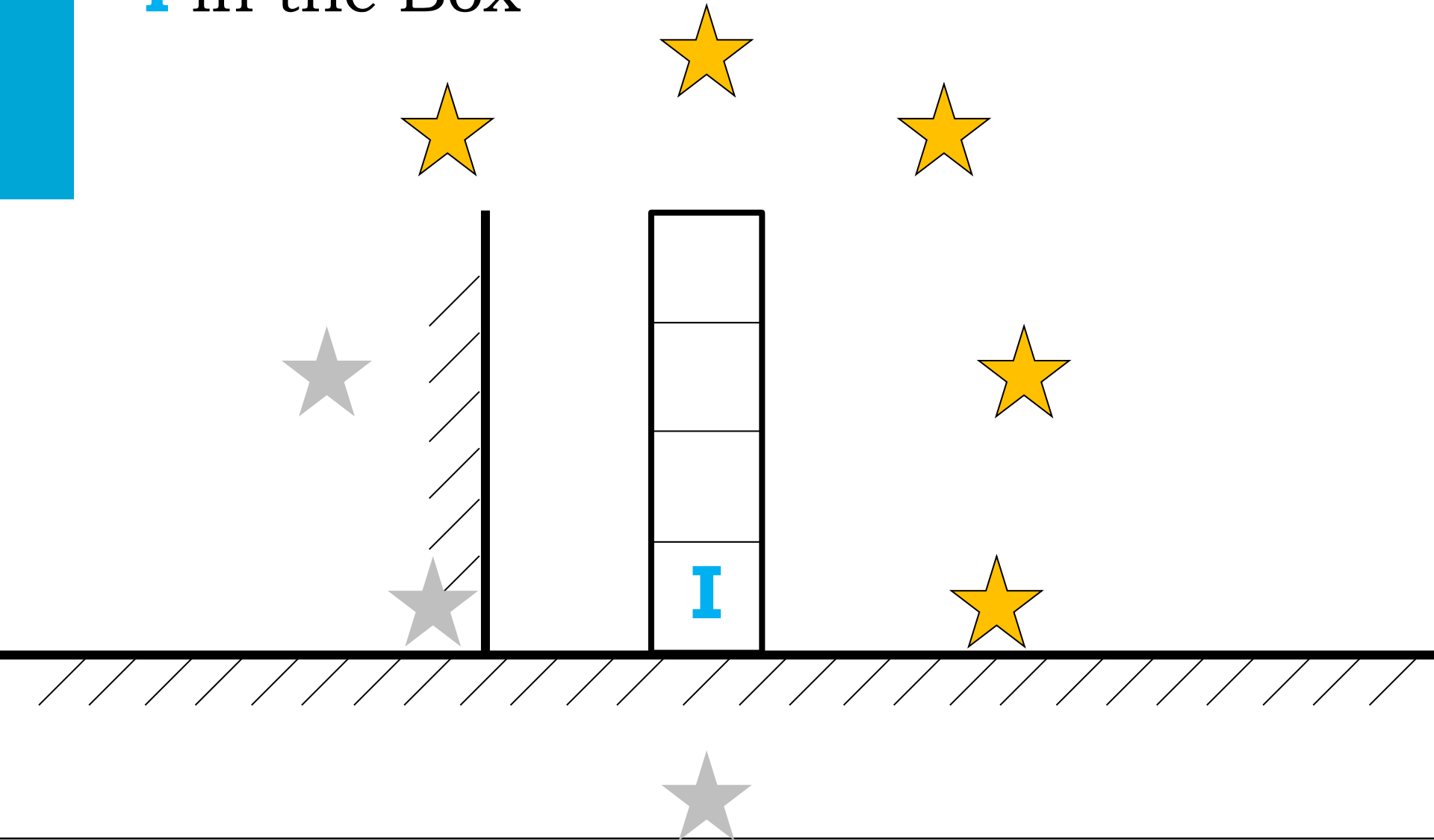
I in the Box



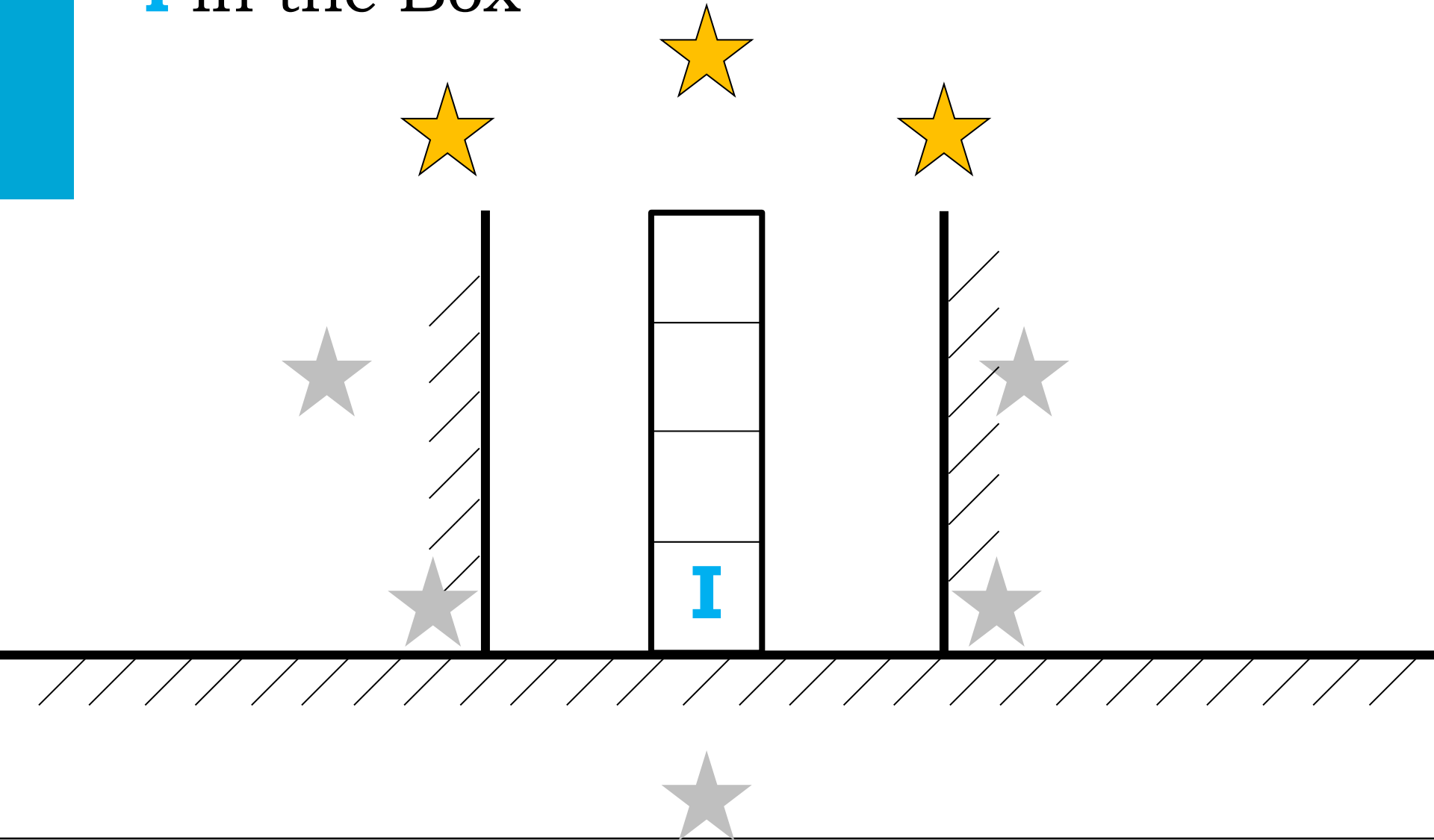
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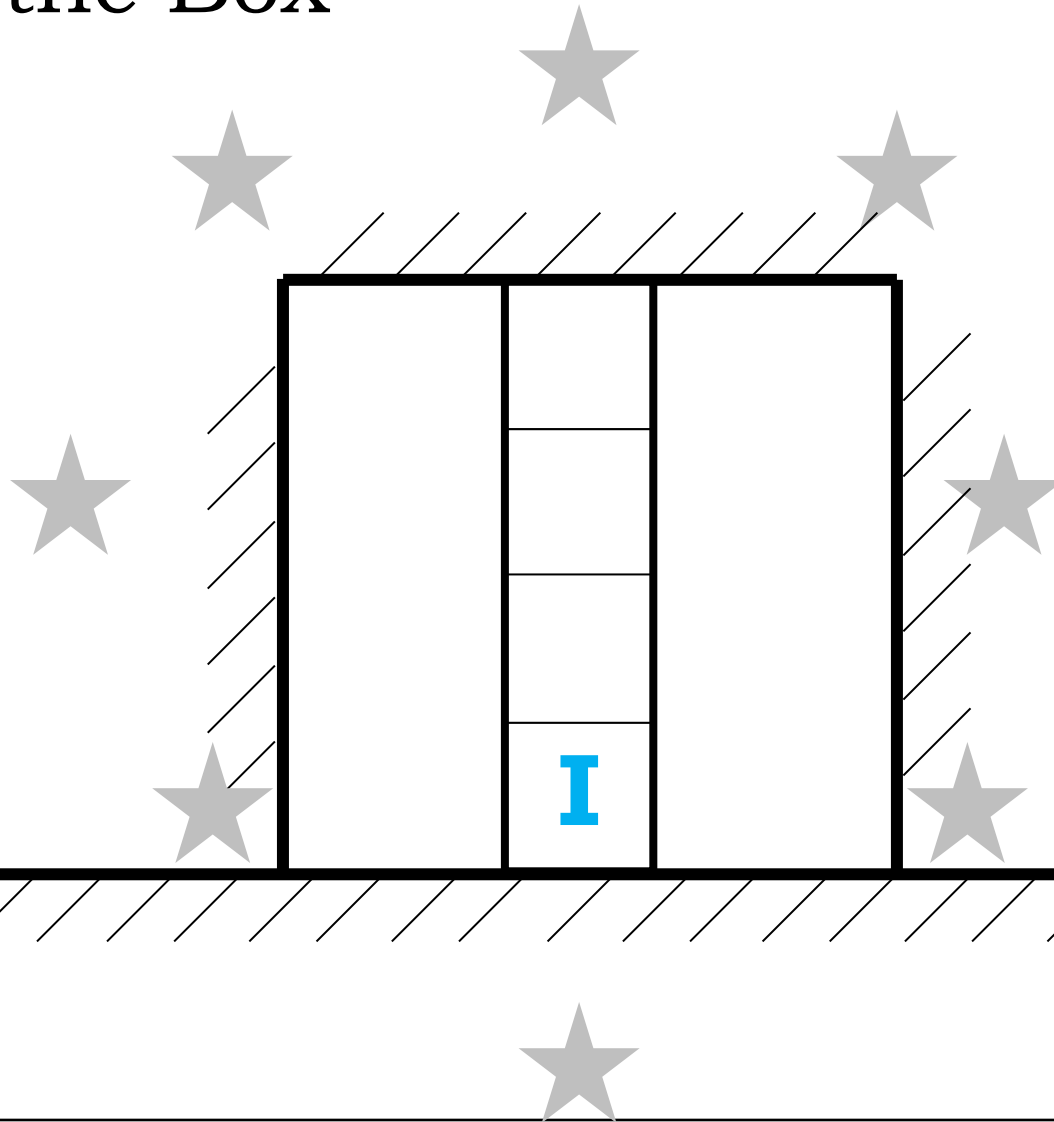
I in the Box

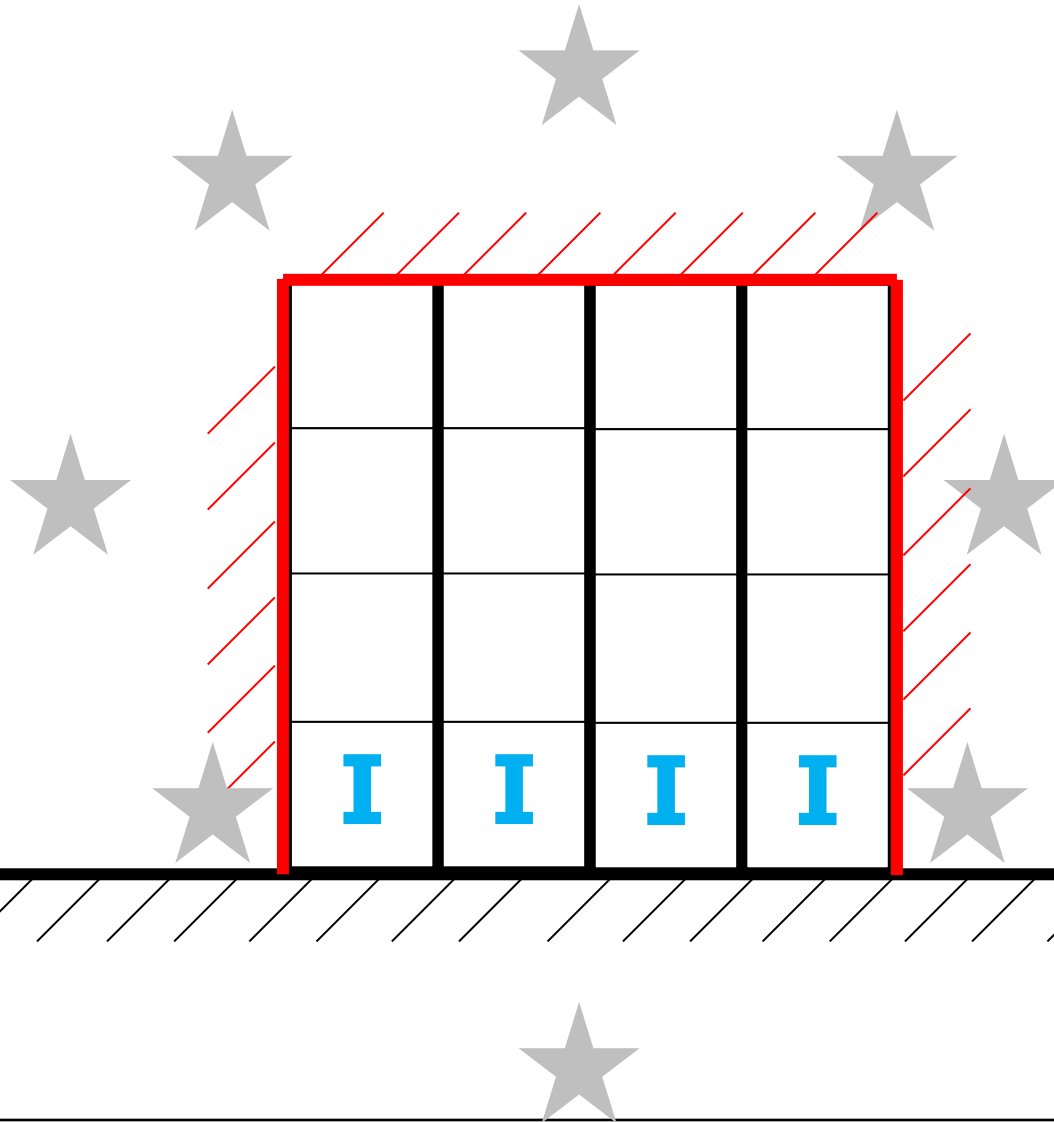


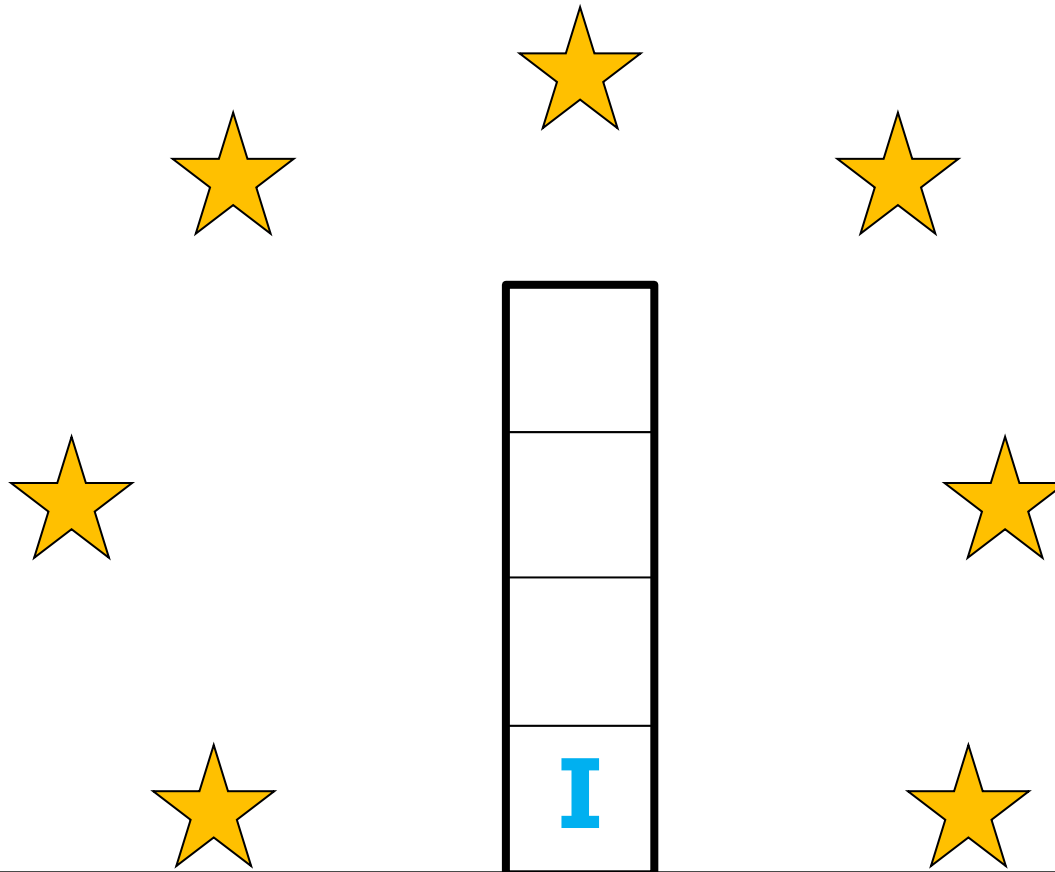
I in the Box



I in the Box



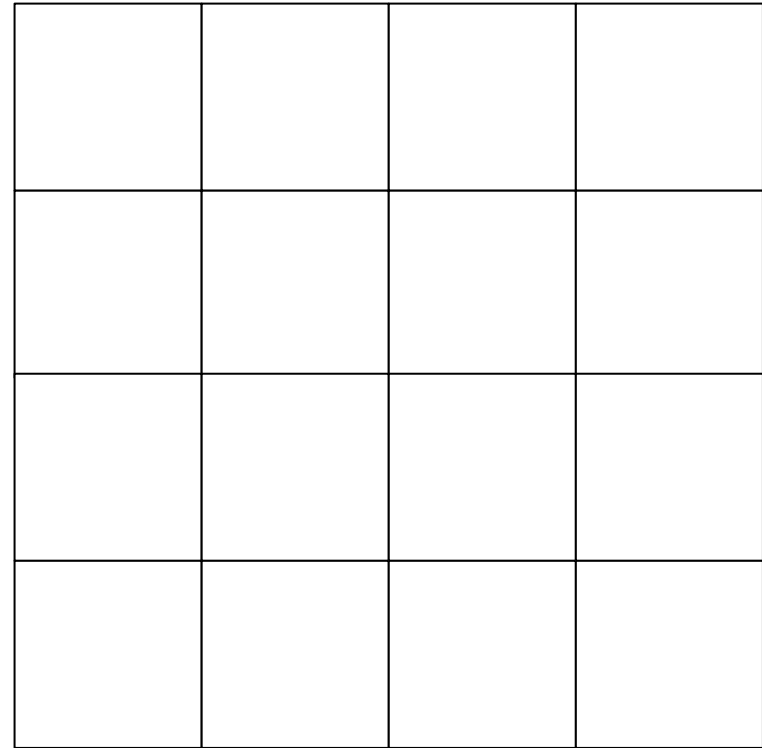
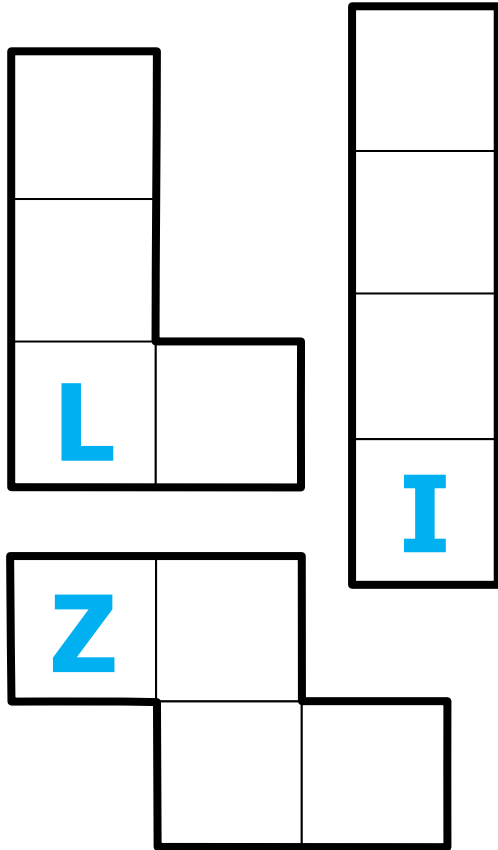






Content Unlocked!

2 x



Agenda for Today or Gamification. Because Every Student Counts!

Time
Units

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* Mechanics, Dynamics, Aesthetics

A Framework for Gamification in Higher Education

1. Decide on Learning Objectives and related content.
2. Describe the perfect student.
3. Design the gamified experience*.
4. Playtest your design and check for fun!
5. Operate your gamified course.

* Mechanics, Dynamics, Aesthetics



A Framework for Gamification in Higher Education

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* Mechanics, Dynamics, Aesthetics

Course Design, In 5 Easy Steps...

- Team work, first 2 minutes
 1. Form team of 2-3 persons
 2. Think about own experience
 3. Convince your team before proposing an answer
- Open discussion, next 1 minute
 - Tell everyone the answer

Q: **How do you design a course** in higher education? (What do you show to your Director of Education?)

Voting on best answer



Decide on Learning Objectives etc. (or, the basics of education)

1. Goals

- High-level descriptions, e.g., “EDU601 Modern Education Techniques”

2. Outcomes

- Low-level descriptions
- Measurable verb + Limitations + Performance

3. Teaching method(s)

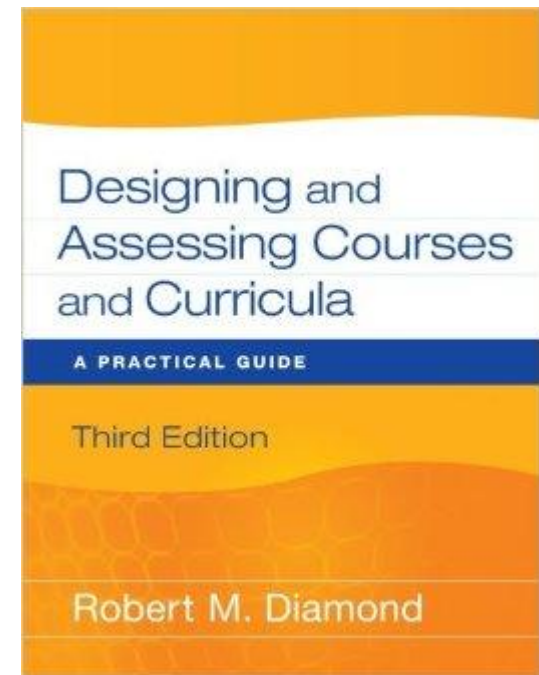
- Teaching facts, concepts, procedures, systems
- Lectures [, flipped classroom?], Lab, etc.
- [Learning learning? Teaching teachers?]

4. Assessment method(s)

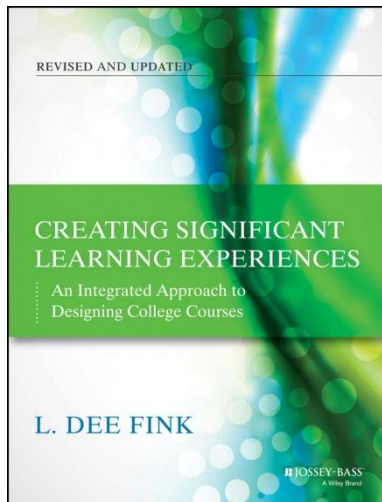
- Of students. Of the course itself.
- [Of the teaching methods?]

5. Operation of the course

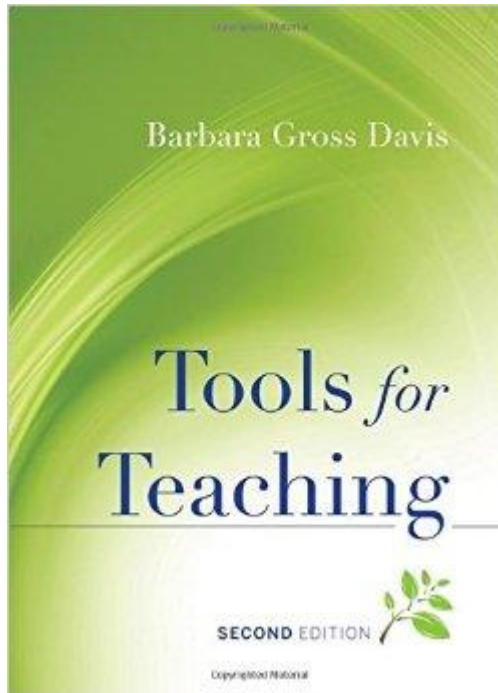
- Team, including SAs, co-teacher, etc.



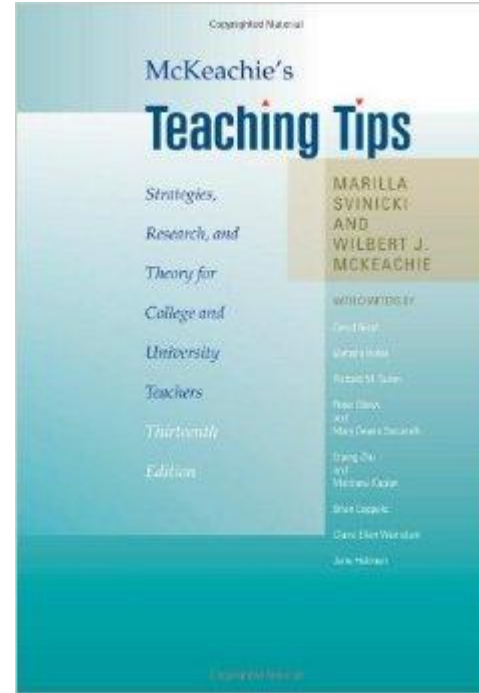
Have You Read These?



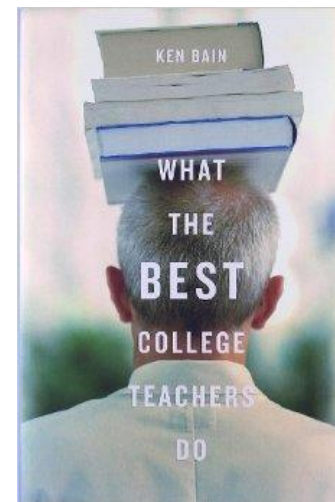
Learning how to learn
Significant learning



Group work
Assessment



Planning, team
Grading



From the
trenches...

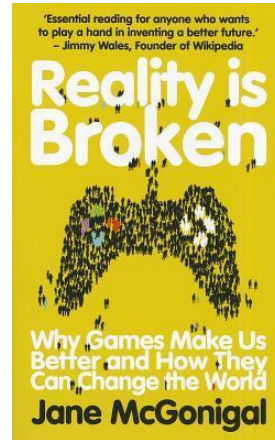
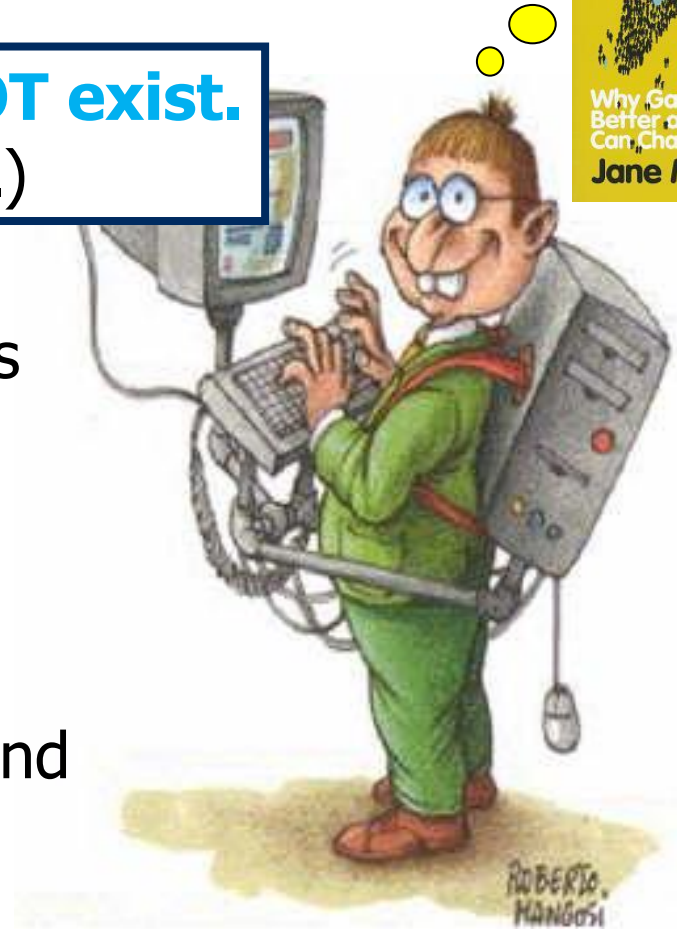
A Framework for Gamification in Higher Education

1. Decide on Learning Objectives and related content.
2. Describe the perfect student.
3. Design the gamified experience.
4. Playtest your design and check for fun!
5. Operate your gamified course.

What's Wrong With the Perfect Student?

The perfect student does NOT exist.
(And yet we are all here.)

- Achieves all course objectives
- Explores new directions
- Socializes with students around
- Excels in all tests, early



<https://quotablequoteunquote.files.wordpress.com/2008/08/walkingcomputergeek.jpg>

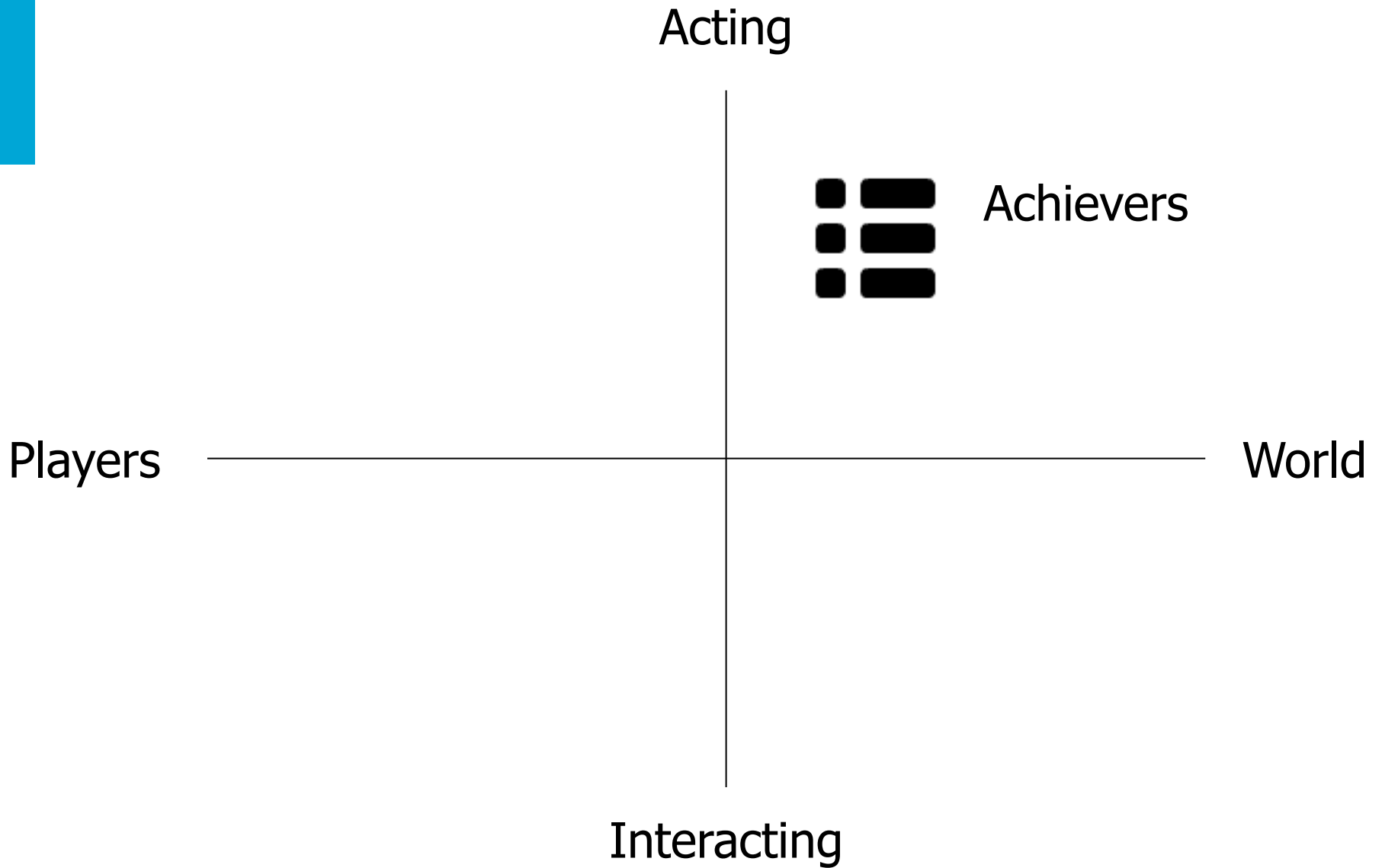
Acting

Players

World

Interacting





Acting



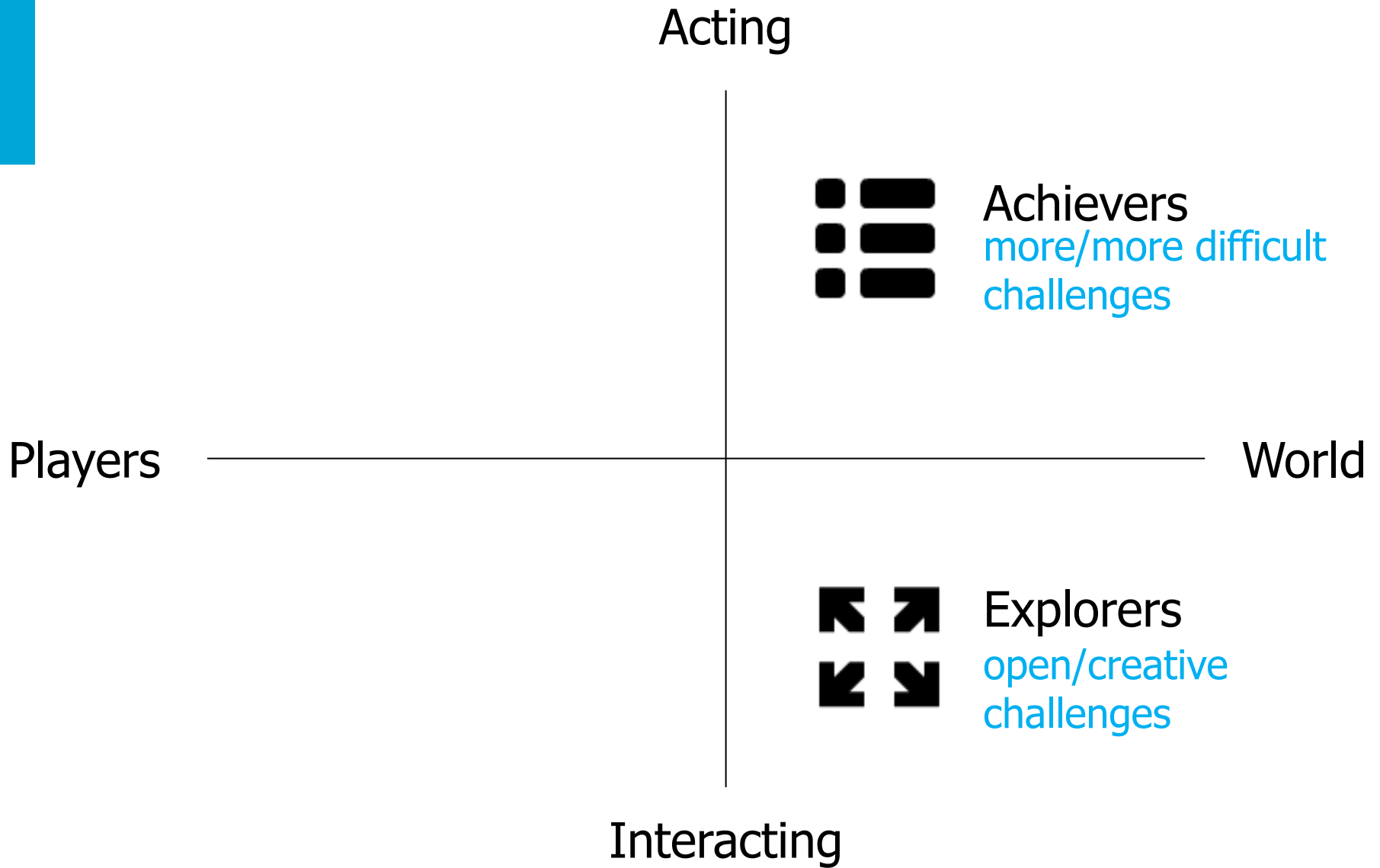
Achievers
more/more difficult
challenges

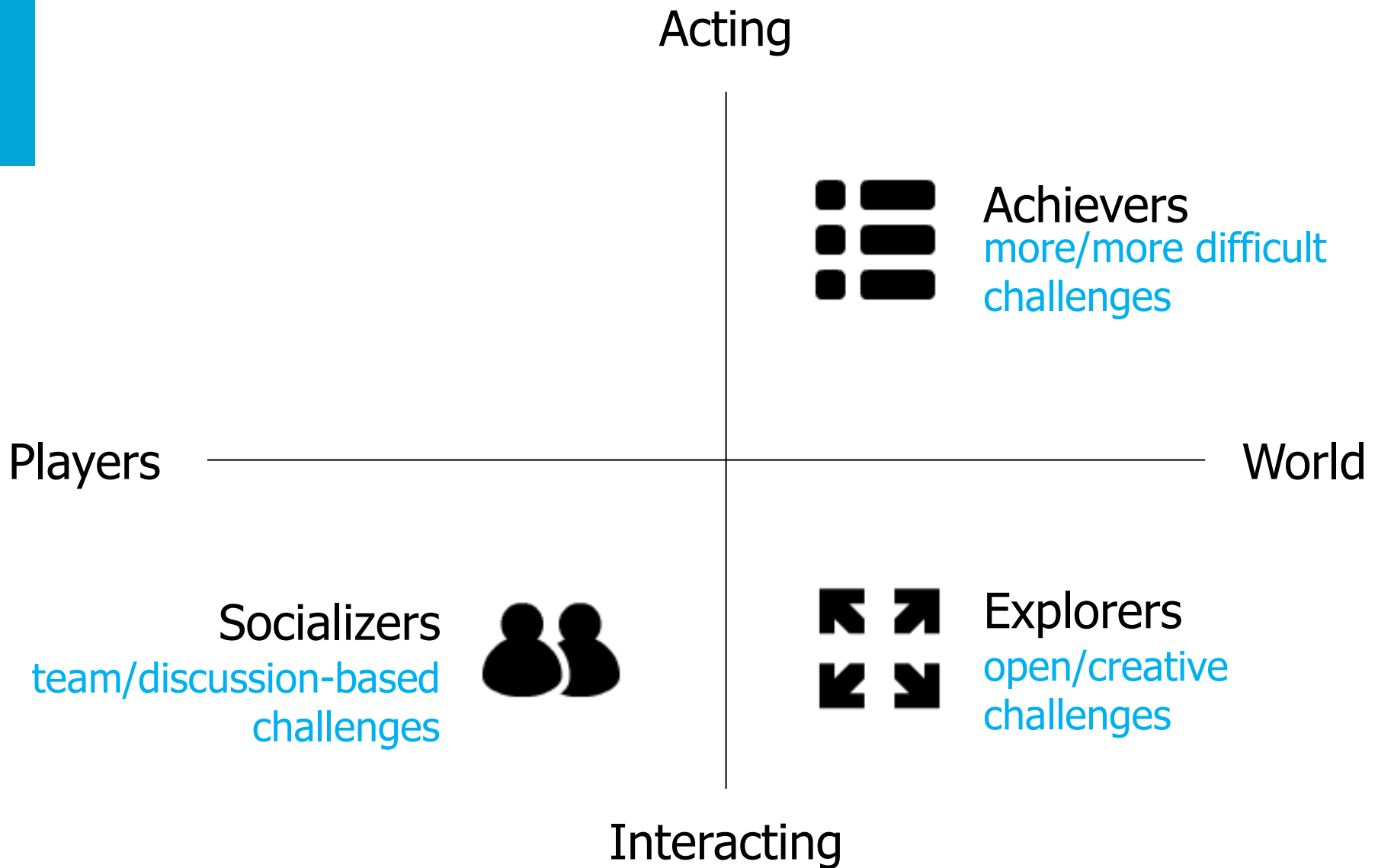
Players

World

Interacting







Acting

Winners
competitive/single-winner
challenges



Achievers
more/more difficult
challenges

Players

World

Socializers
team/discussion-based
challenges

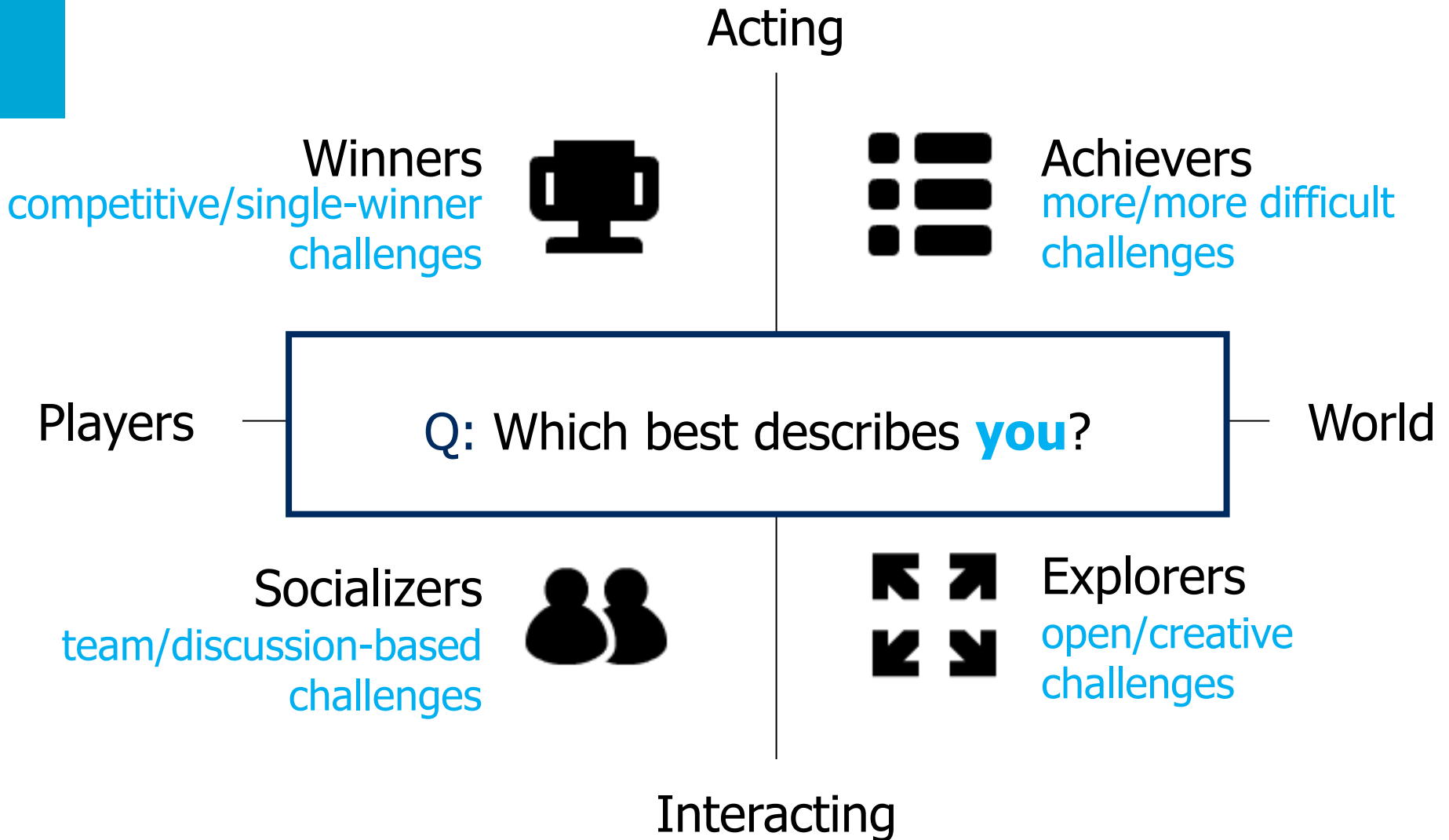


Explorers
open/creative
challenges

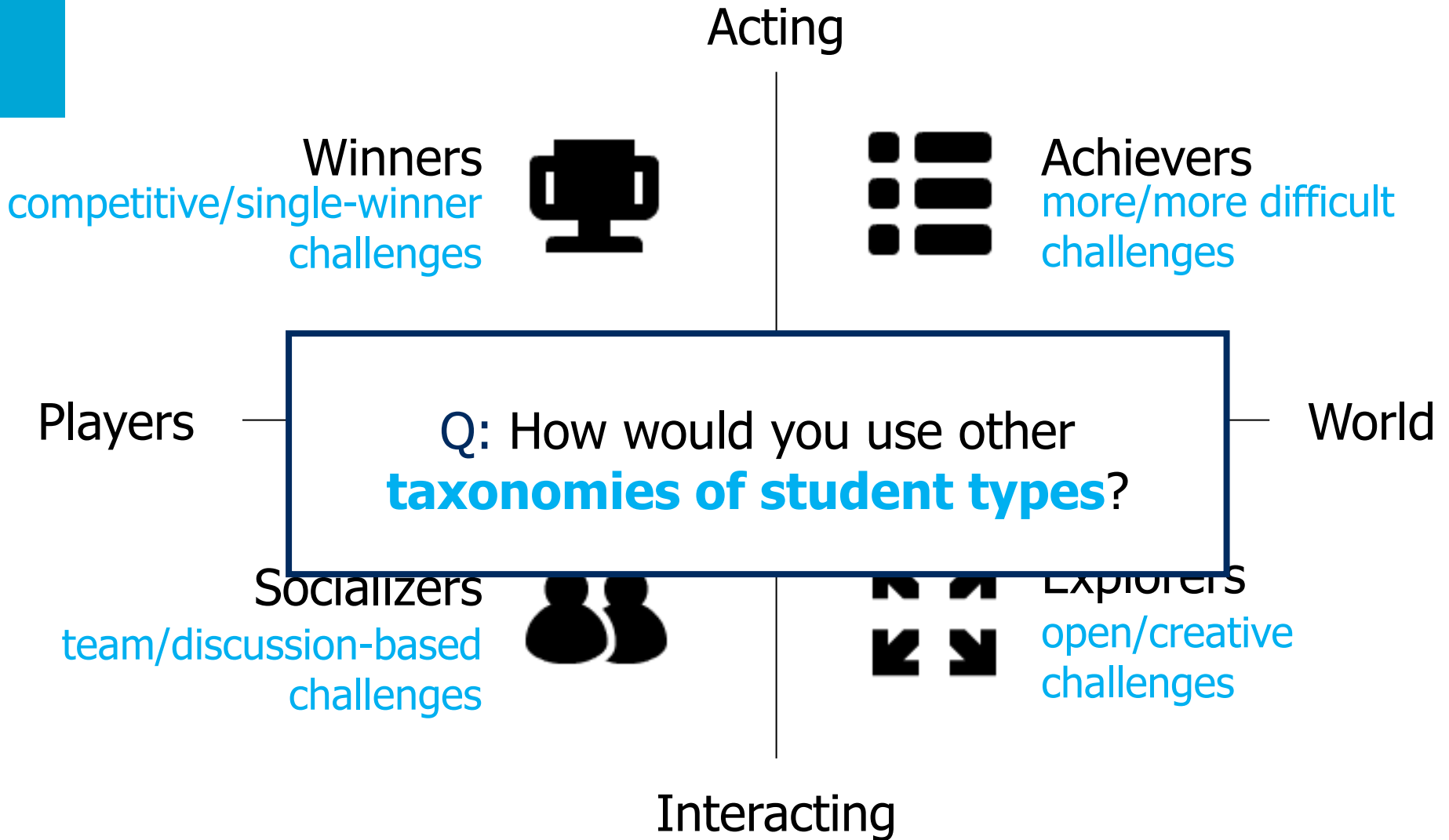
Interacting



Exercise: The “Who Are You?” Game



Exercise: The “Who Are You?” Game



A Framework for Gamification in Higher Education

1. Decide on Learning Objectives and related content.
2. Describe the perfect student.
3. Design the gamified experience.
4. Playtest your design and check for fun!
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Gamification Is NOT Only:

- Playing a game in the classroom



- Points
- Badges
- Leaderboards



PBL = The BLT sandwich



A Framework for Gamification in Higher Education

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3. Design the gamified experience.
 - Focus on the Mechanics-Dynamics-Aesthetics Framework
 - Focus on Mechanics and Dynamics
 - Focus on Assessment
4. Playtest your design and check for fun!
5. Operate your gamified course.

Q: What's in a game?

A: **Over 250,000,000 active players**

Social Gaming =

100,000k+ players who benefit from social engagement



Gamification scales in practice

1. Mechanics

Explore, do, learn, socialize, compete +

2. Dynamics

Player progress and interaction, ...

+

3. Game Content*

puzzles, challenges, extra-projects, culture

* Art class pending.

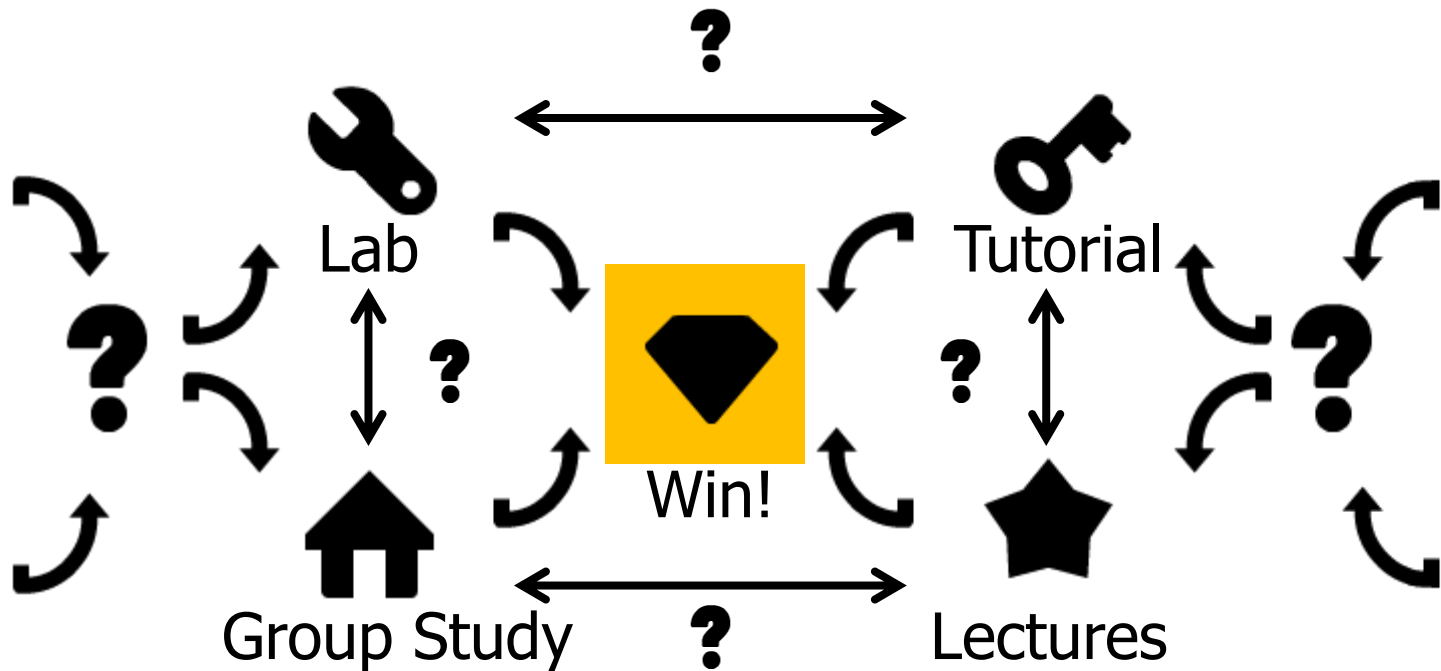


Gamification Mechanics & Dynamics in Our Courses

- **Too many to list here**
 - Scoring system is but one element
 - Badges? Only for B.Sc., some “random” * [Manga cum laude](#)
- **Onboarding** (mechanics)
 - Entry quiz
 - Story every lecture
- **Social Learning** (dynamics)
 - In-class teams, competing casually
 - Self-study as team effort, competing
 - Involve Winners and Achievers in class
 - Involve Winners and Explorers in self-study
- **Different player types → different MDA**
 - Ladders, ranking, end-lecture quiz: mostly for Winners
 - Content unlocking (dynamics): Explorers and Achievers

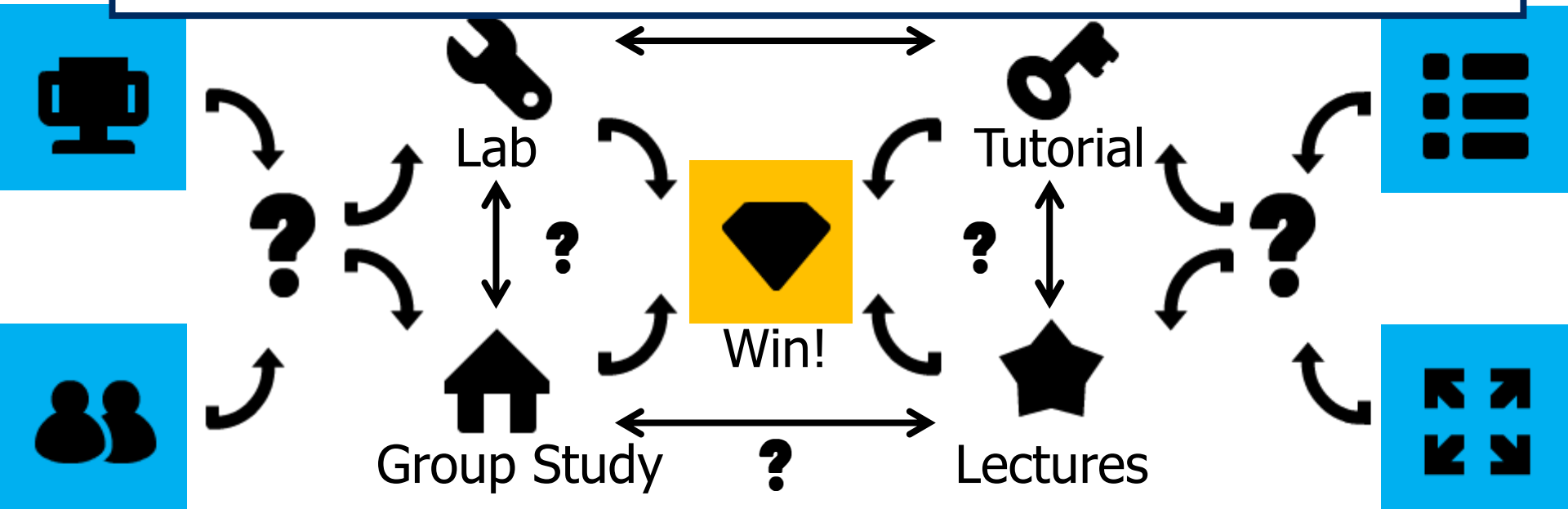


Designing a course is like creating a complex puzzle



The Learning Graph

Q: How to build the **learning graph** for **your course**?



Q: How to build the **learning graph** for **your course**?

A: From the Course Schedule

weeknr.	36	37	38	39	40	41	42	43	44	45
weektype	C	C	C	C	CT	C	C	CW	CWT	T
onderwijsweek	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10
maandag	Open. acad.jr	9	16	23	30	7	14	21	28	4
dinsdag	3	10	17	24	1	8	15	22	29	5
woensdag	4	11	18	25	2	9	16	23	30	6
donderdag	5	12	19	26	3	10	17	24	31	7
vrijdag	6	13	20	27	4	11	18	25	1	8
zaterdag	7/09	14/09	21/09	28/09	5/10	12/10	19/10	26/10	2/11	9/11
zondag	8/09	15/09	22/09	29/09	6/10	13/10	20/10	27/10	3/11	10/11



Q: How to build the **learning graph** for **your course**?

A: From the Course Schedule

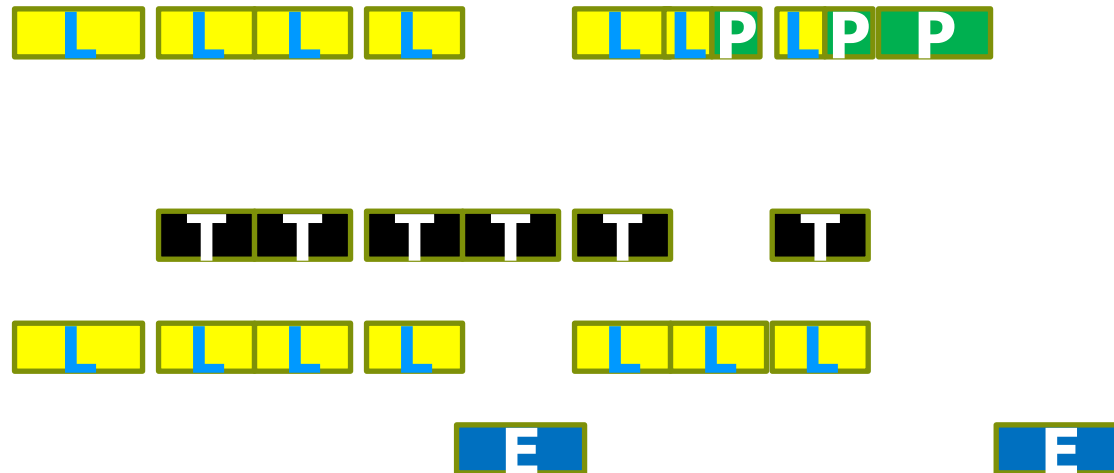
weeknr.	36	37	38	39	40	41	42	43	44	45
weektype	C	C	C	C	CT	C	C	CW	CWT	T
onderwijsweek	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10
maandag	Open.	9	16	23	30	7	14	21	28	4
dinsdag	3	10	17	24	1	8	15	22	29	5
woensdag	4	11	18	25	2	9	16	23	30	6
donderdag	5	12	19	26	3	10	17	24	31	7
vrijdag	6	13	20	27	4	11	18	25	1	8
zaterdag	7/09	14/09	21/09	28/09	5/10	12/10	19/10	26/10	2/11	9/11
zondag	8/09	15/09	22/09	29/09	6/10	13/10	20/10	27/10	3/11	10/11



Q: How to build the **learning graph** for **your course**?

From the Course Schedule

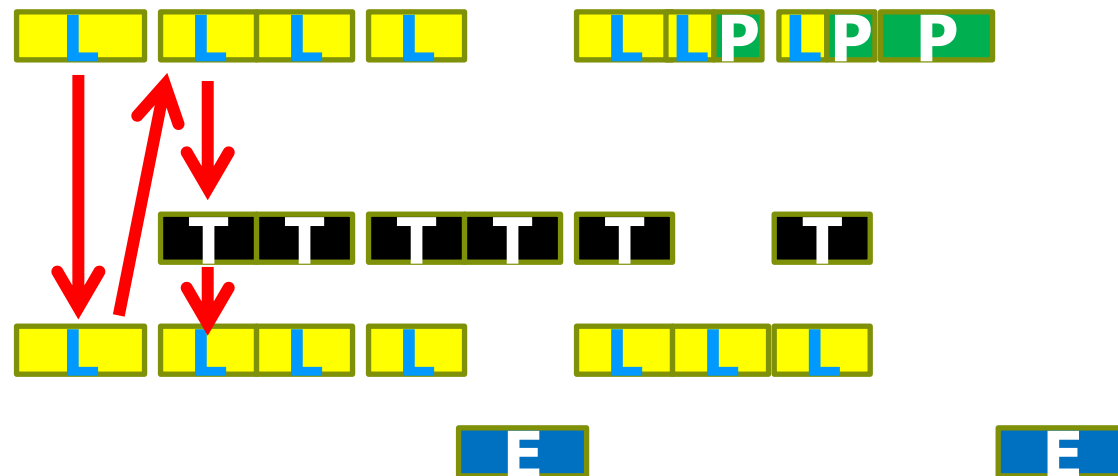
1. Extract activities from the Course Schedule



Q: How to build the **learning graph** for **your course**?

From the Course Schedule

2. Add dependencies between activities

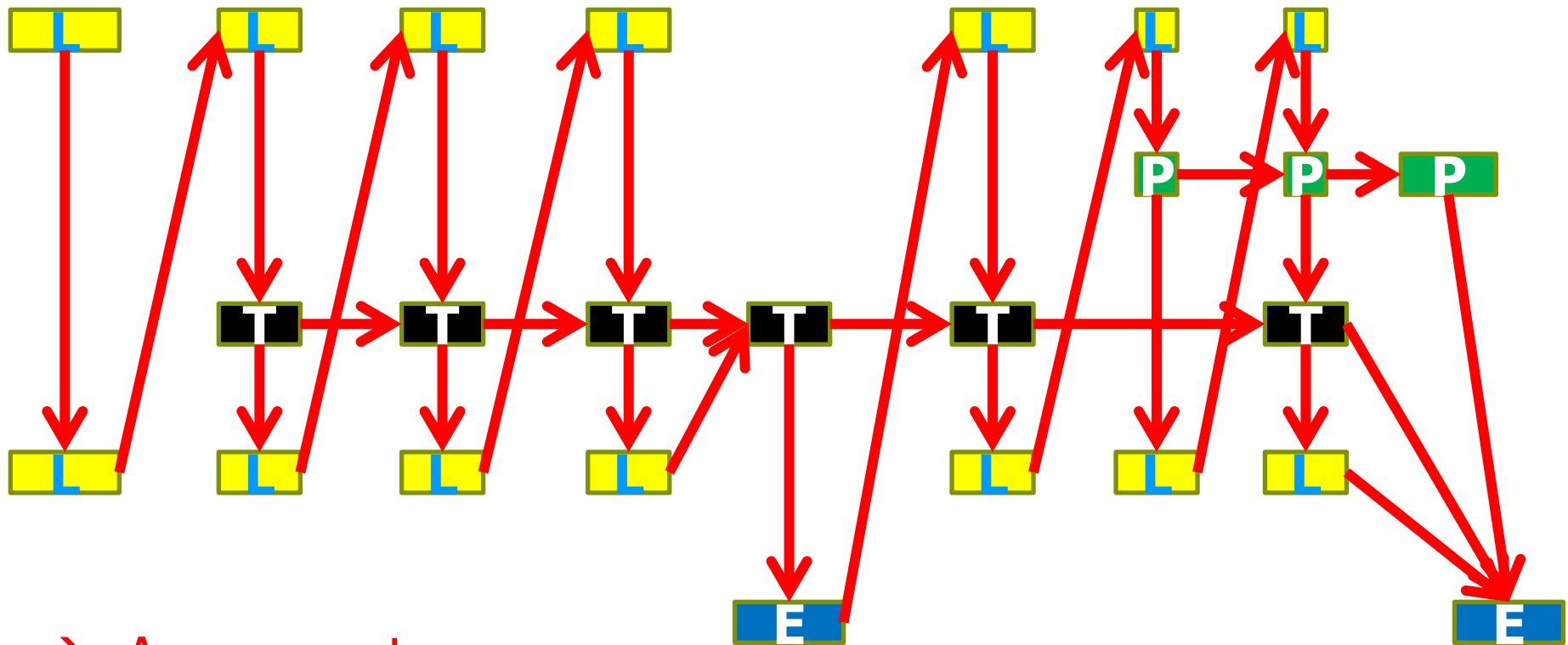


→ Assessment

Q: How to build the **learning graph** for **your course**?

From the Course Schedule

2. Add dependencies between activities (continued)



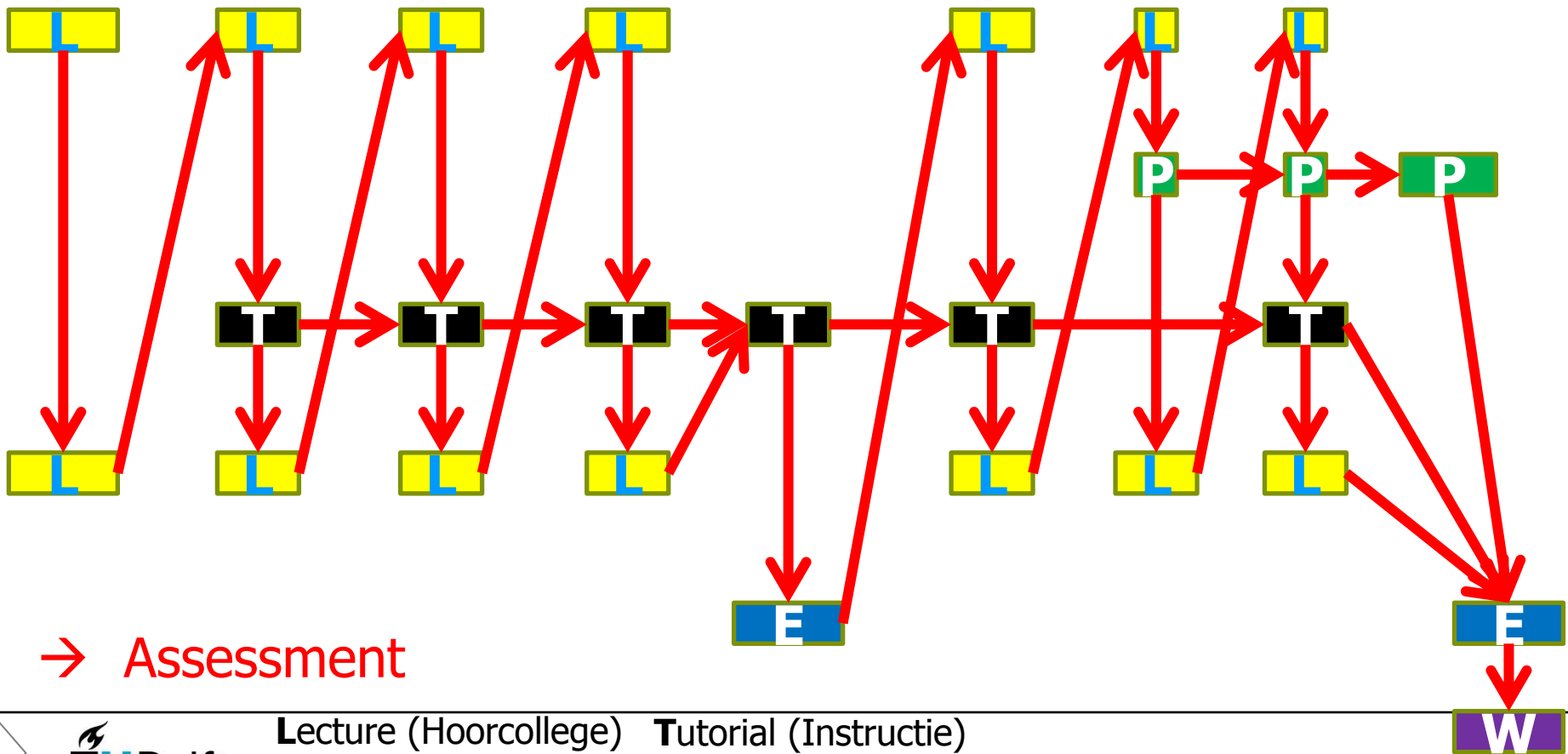
→ Assessment



Q: How to build the learning graph for **your course**?

From the Course Schedule

3. Add important states, such as **Winning**



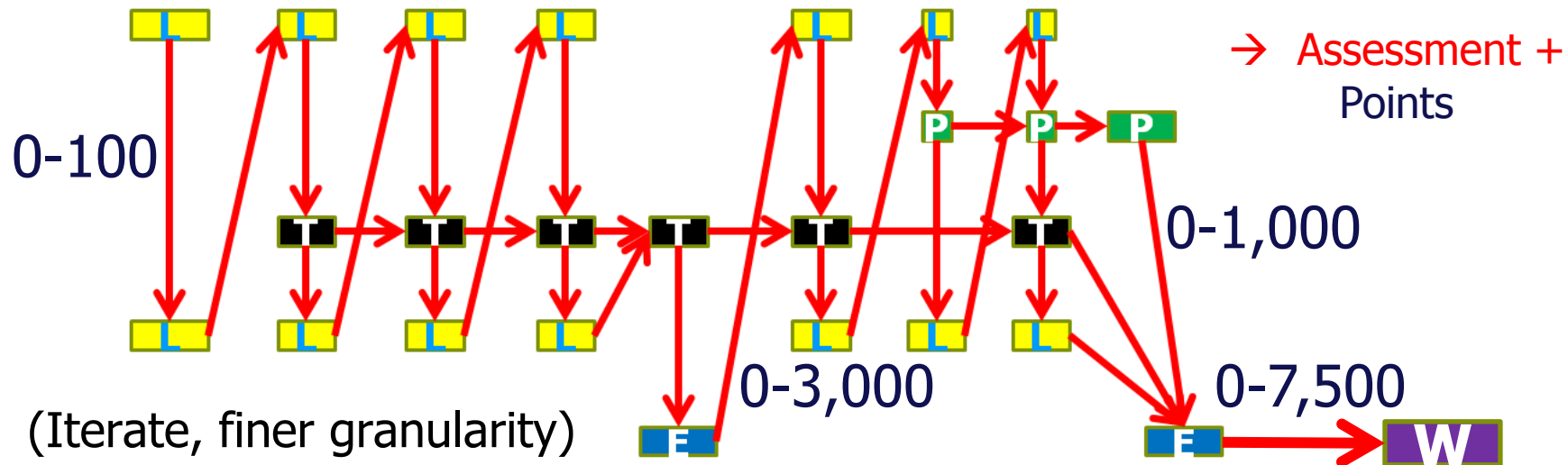
→ Assessment



Q: How to build the **learning graph** for **your course**?

From the Course Schedule

1. Extract activities from the Course Schedule
2. Add dependencies between activities
3. Add important states, such as Winning
4. Annotate edges (points, etc.)
5. Identify paths of advancement on the resulting graph



Q: How to build the **learning graph** for **your course**?

From the Course Schedule

Q: How to add to the **learning graph**
self-study (homework) activities?

Q: How to add to the **learning graph**
an **entry quiz**?

→ Assessment

E

E

W



A Framework for Gamification in Higher Education

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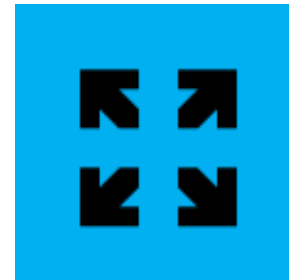
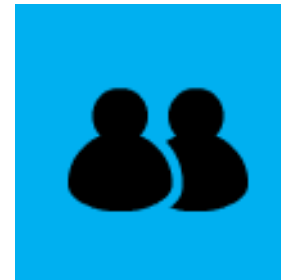
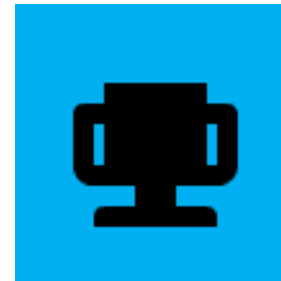
Assessment That Motivates!

10,000 points for a 10


+50 for good activity

+1,000 for most challenging activity

Badges, unlocked content



Our Diverse Scoring System

1. Course Points	2. Access Tokens	3. Brownie Points
10,000 for straight 10	Start with 1	
+1,000 team self-study		
+1,000 lab bonus #2	Bonus Lab assignments	I will bake brownies for <u>you!</u> (but not force you to eat them)
+500 lab bonus #1	Advanced topics (GPUs, clouds)	
+300 correct exam Q	Discuss w Lecturer	
+50 activity in Lab/Lecture/Tutorial	Propose Exam Qs	
+25 correct end-lecture quiz		
+500 entry quiz	Rec. letter	

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Wrap-up w bonus:
Content/Aesthetics

Challenging and Diverse Content to Activate Diverse Students

Learning Objectives

BSc-CO, 6EC (168h)	MSc-CC, 5EC (140h)
Digital Logic and Data Representation	Overview of cloud computing
Computer Architecture and Organization	Scheduling and Resource Management
Interfacing and I/O Strategies	Data Centers and Energy Efficiency
Memory Architecture	Multi-tenancy concepts, incl. virtualization
Functional Organization	Cloud programming models
Multiprocessing	Case studies
Performance Enhancements	Guest lecturer
Directions in Computing	



Industry state-of-the-art



Topics touch today's research



Social relevance



A Framework for Gamification in Higher Education

1. Decide on Learning Objectives and related content.
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Playtesting Your Own Course!

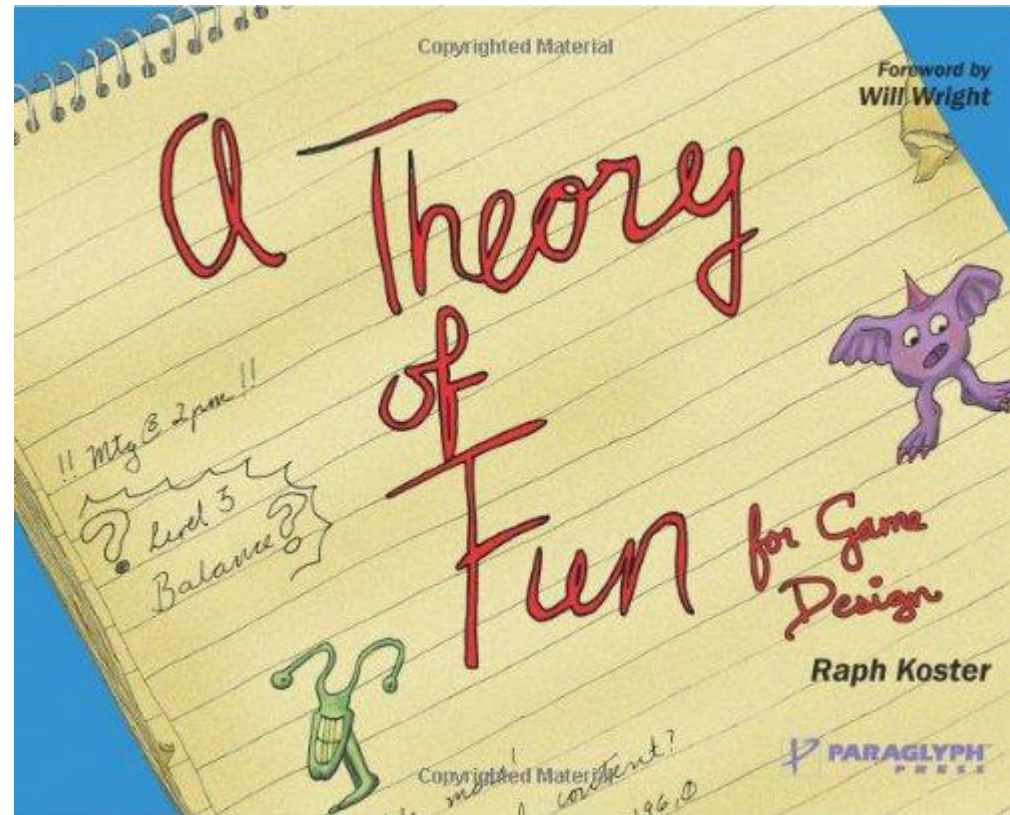
(Get others to role-play being your students)

1. Fine-tune fun
2. Are you increasing student motivation?
3. Balance the different paths of advancement



1. What Leads to Fun?

- Surprise
- Recognition
- Belonging
- Fantasising
- Just playing
- ...



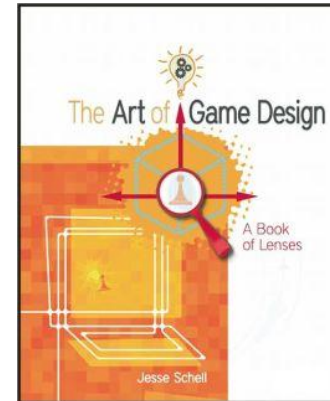
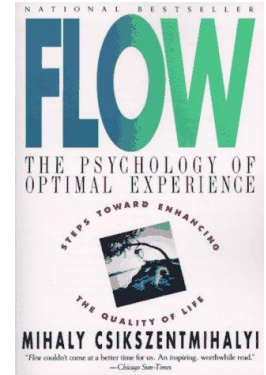
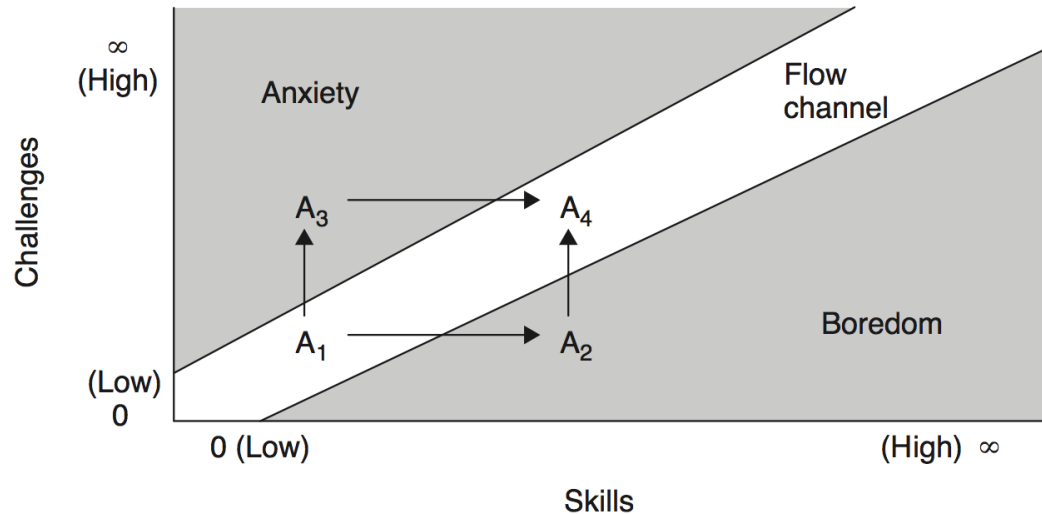
2. What Leads To Motivation?

- Extrinsic Motivation
 - Fun!
 - Rewards, achievements, badges
 - Passing the course
 - Top of the ranking
 - ...
- Intrinsic Motivation
 - Fun!
 - **Mastery** of subject, **your way**
 - **Be you! Access** and, later, **Autonomy**
 - Higher **purpose, your way**
 - (also **Maslow's Hierarchy of Needs**)
- But ... one trigger may be extrinsic for some, and intrinsic for others



3. Balance Leads to Flow

- Flow = mind state of being focused exclusively on one activity (“being in the zone”, “the flow channel”)



- Balance between challenge increase and skill growth

A Framework for Gamification in Higher Education

1. Decide on Learning Objectives and related content.
2. Describe the perfect student.
3. Design the gamified experience.
4. Playtest your design and check for fun!
5. Operate your gamified course.

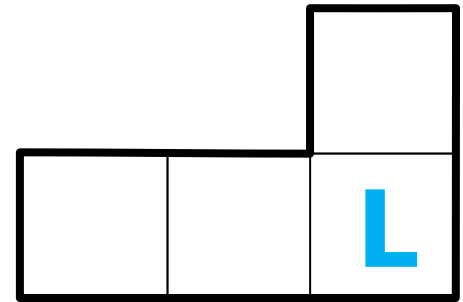
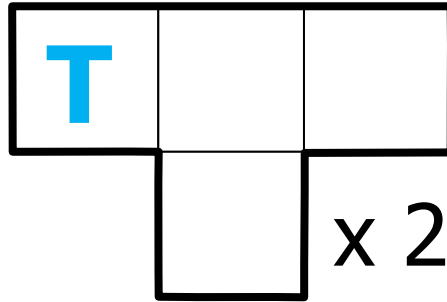
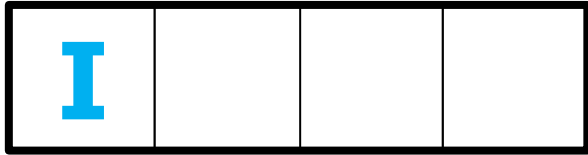
>10+ Operational Years Since 2007

- B.Sc. Courses
 - TI140x Computer Organization (5+ years)
- M.Sc. Courses
 - IN4392 Cloud Computing (3 years, co-teaching)
 - IN4391 Distributed Computing Systems (2 years)
- **Main lesson: manage course dynamics**
- **We are building a Living Lab, we are here to help you!**

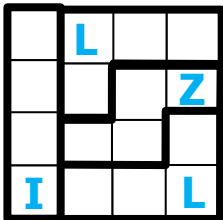
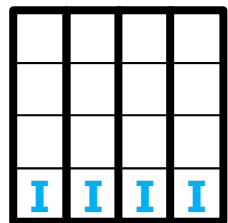
Experience Operating Our Courses

- **Overview, overview, overview!**
- **Learning graph overview**
- **Public overview (student's view)**
 - Updates often & complete
- **Private overview (your & your team's view)**
 - Statistics: how many and which students are lagging behind?

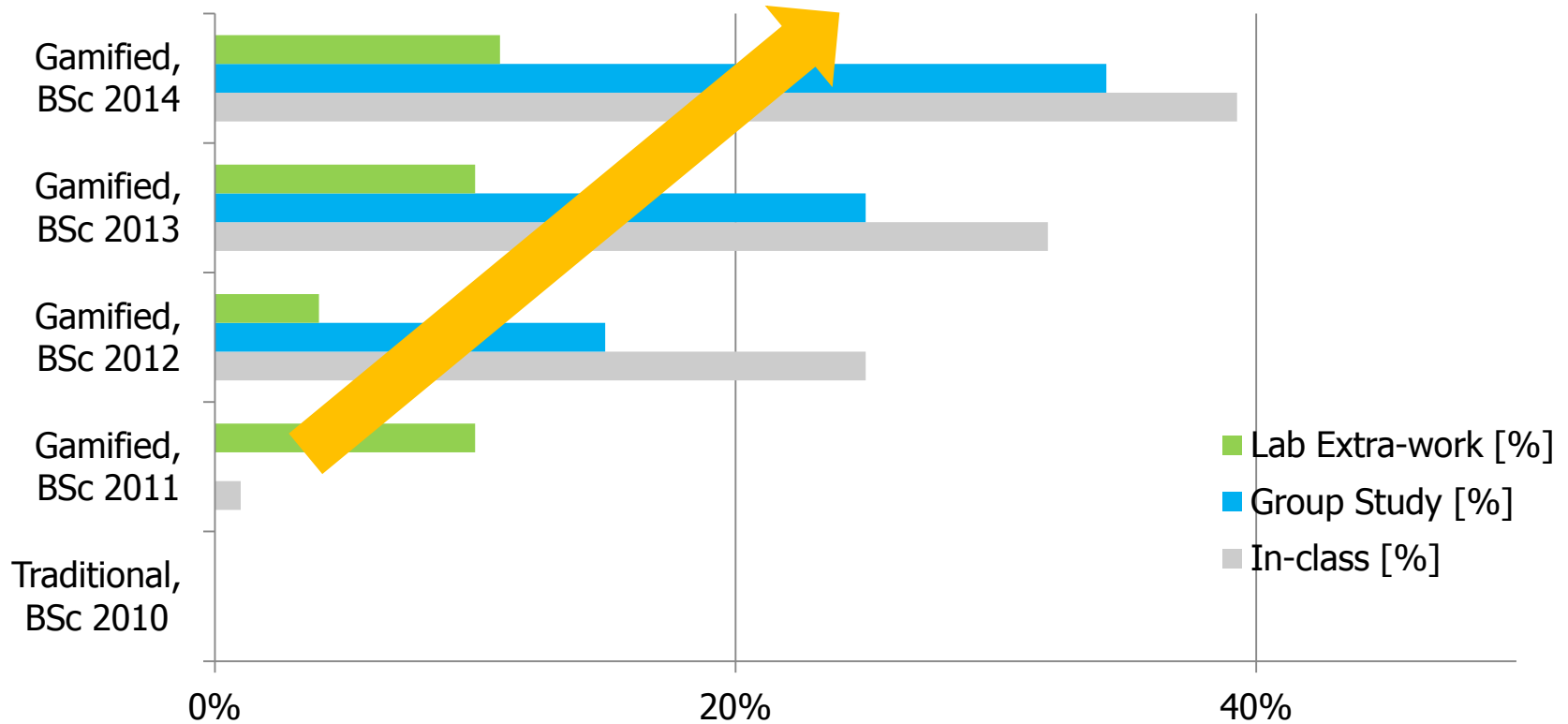




Does gamification work?



Gamification works!



Extra work due to gamification, relative to traditional [% all students]



What Happens When A Student Does Not Like the Course Topic?

“ I want to thank you for showing that even though I'm not that good at written exams, I still can excel at other points in my study. I'd love to have a copy of my badge, as physical reminder of a course that made me eager to learn about things. Even when some of those things will never really have my interest.

This course, and the way it was given, learned me a few things about what motivates me, and only for that reason it was totally worth getting up for every lecture.

”

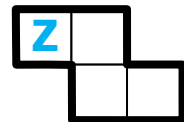
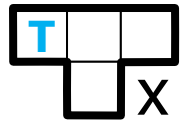
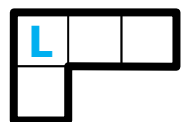
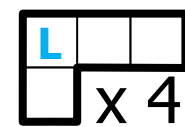
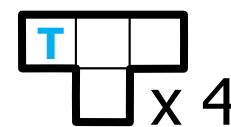
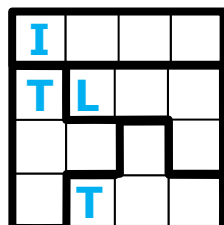
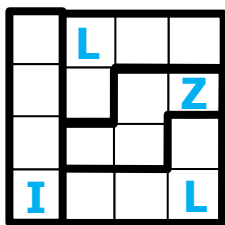
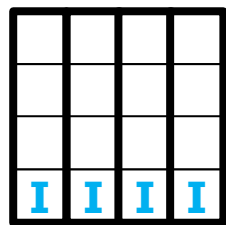
Agenda for Today or Gamification. Because Every Student Counts!

Time
Units

1. Introduction, with high-level goal and low-level objectives 1
2. An intuition behind gamification 1
- ⇒ 3. A practical framework for gamification in higher education (getting your courses gamified) 5½
 - ⇒ 1. Learning Objectives to content (refresher on higher-education basics) ½
 - ⇒ 2. Understanding student types 1
 - ⇒ 3. Designing the gamified experience, focus on MDA* framework ½
 - ⇒ 4. Designing the gamified experience, focus on dynamics and mechanics ½
 - ⇒ 5. Designing the gamified experience, focus on assessment 1
 - ⇒ 6. Playtesting for fun and motivation, and against common pitfalls 1
 - ⇒ 7. Operating a gamified course 1
- ⇒ 4. Wrap-up ½

* Mechanics, Dynamics, Aesthetics

Designing a course is
like creating a complex puzzle



**Gamification as
concept & intuition, mechanics & dynamics, ...**

Gamification works!



Lumaxart Trophy Winner

A Framework for Gamification in Higher Education

1. Decide on Learning Objectives and related content.
2. Describe the perfect student.
3. Design the gamified experience.
 - Focus on the Mechanics-Dynamics-Aesthetics Framework
 - Focus on Mechanics and Dynamics
 - Focus on Assessment
4. Playtest your design and check for fun!
5. Operate your gamified course.

Thanks from our team.



Alexandru Iosup

Gamification
Researcher &
Professor



Otto Visser

Gamification
Engineer &
Professor



Ana Lucia
Varbanescu

Gamification
Professor



Tim Hegeman

Gamification
SA



Jesse Donkervliet

Gamification
SA



Marc de Kool

Gamification
Supporter &
Part-Time Actor



www.pds.ewi.tudelft.nl

Does Gamification Work for **Me**?



Q: But, Alexandru, surely not every course can use **gamification**!? I mean, there is no technique for **my** concept / activity / entire course...

A: Wonderful Advances in Gaming, Last 10 Years: diverse **individual** challenges

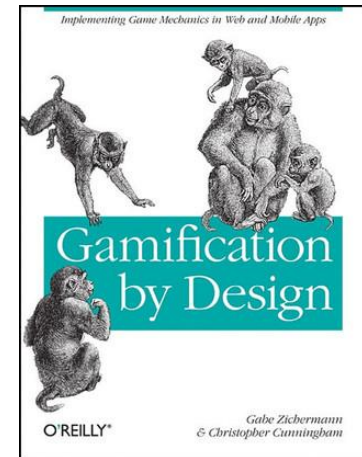


A: Wonderful Advances in Gaming, Last 10 Years: diverse **social** challenges



Gamification Mechanics & Dynamics

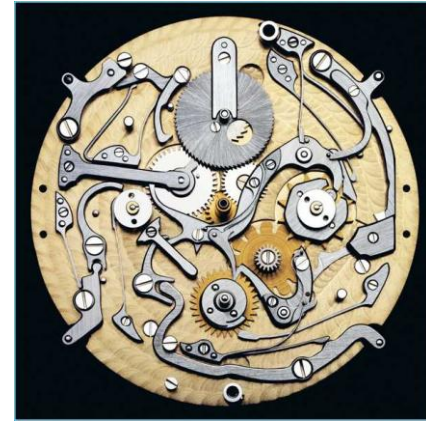
- Mechanics = how the system turns inputs into outputs
 - Mechanics are applied directly, by the system (course staff), without further interaction from students.
- Points
- Badges
- Leaderboards
- Game states, such as winning, losing, cheating, etc.
- Challenges for each player type
- Rules, tutorials, guidelines, helpers, checklists
- Feedback
- Unlocked content
- ... so many more



Gamification Mechanics & Dynamics

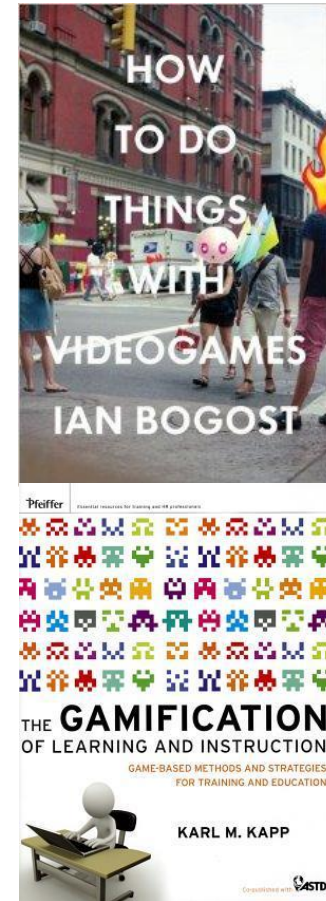
- Dynamics = how the players and the system interact
 - **Progress / Learning graph**, with challenges as **nodes**, tested progress as **edges**, points etc. as **properties of edges**
- **Individual dynamics** (so, regardless of what others do)
 - Students can spend their points for some reward
 - Students get access to more advanced content
- **Group dynamics** (so, regardless of what students outside the group do)
 - Peer-reviews are discussed with the group, can result in bonuses/exclusions
- **Cohort dynamics**
 - Top-20% participate in extra lectures
 - Best group wins cookies
 - Bonus for best student/group of the day

http://www.kunstbuch-shop.de/images/guido-mocafico-movement-03_462.jpg



Possible Games for Teaching Facts, Concepts, Procedures, and Systems

What?	How? Common teaching elements
Facts	<p>Story w terms, acronyms, and jargon</p> <p>Taxonomies and Venn diagrams</p> <p>Games of repetition, recognition, matching</p>
Concepts	<p>Story w metaphors</p> <p>Boundary examples</p> <p>Games to experience, classify, compare sort</p>
Procedures (Rules)	<p>Top-to-bottom view, story w Why? What?</p> <p>Role-playing (Mechanics + feedback)</p>
Systems	<p>Tutorials to experience under guidance</p> <p>Using all the other elements for complete XP</p>



It's The People

- **You**

- Time management

- **Co-teacher**

- Verify and reflect on your ideas and adaptations

- **Student assistants**

- What are they going to do? How many? How to co-involve in design?

- **Students**

- How many? Is this cohort the same as last year?
- Have they seen a gamified course before?

Tools: Missing?

- BlackBoard?
 - Contract ends end of 2015; tender for replacement is started
 - We are involved in testing possible candidates
- Excel?
- FeedbackFruits?
 - Promises basic gamification support for 2015/2016
- Dropbox? → SurfDrive!

There's No Free Lunch!

- Gamification takes time and energy
 - One week to consider gamification elements +
 - One day per lecture for adaptation +
 - Continuous adaptation +
 - Continuous assessment, e.g., end-lecture quiz +
 - Explaining a new system to students +
 - The nitty-gritty details
- Gamification takes personal effort
 - A new system has to conquer inertia
 - A new system has to conquer doubt
- **You are not alone, we are here to help!**



References (Shortlist, brief info)

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