
GSGS'20
5TH GAMIFICATION & SERIOUS GAME SYMPOSIUM
September – November 2020 | Online edition | www.gsgs.ch
HEALTH
CULTURE
ENVIRONMENT
TRANSPORT
URBANISM
LEARNING
EDUCATION
TRAINING

## GSGS'20 EXECUTIVE COMMITTEE

**Carrino, Stefano**
HE-Arc | Posters chair

**Gobron, Stéphane**
HE-Arc | General chair & Proceedings chair

**Rekik, Yassin**
hepia | Organisation & Programme chair

**Reutenauer, Olivier**
Digital Kingdom | Communication & Publicity chair

**Rossetti, Samuel**
Contreforme | Demo chair

**Savicic, Gordan**
HEAD Genève | HSLU Luzern | Award design chair

**Truchot-Cardot, Dominique**
HES-SO | La Source

## GSGS'20 ADMINIS-TRATIVE COMMITTEE

**Dervaux Duquenne, Agnès**
HE-Arc | Archive & Documentation

**Montserrat, Gutierrez**
HE-Arc | English proof reading

**Oulevay, Noémie**
Contreforme | Proceeding editorial design

**Senn, Julien**
HE-Arc | in charge of Administration

## CONTACTS

**julien.senn@he-arc.ch**
**stephane.gobron@he-arc.ch**

## WEBSITE

**www.gsgs.ch**

## GSGS'20 SCIENTIFIC COMMITTEE

**Alvarez, Julian**
R&D researcher in ludic-pedagogy | Immersive Factory | France

**Ascolese, Antonio**
digital project Manager | i-maginary | Italy

**Bauer, René**
Head of Master Program Game Design | Game Lab | Zurich University of Arts | ZHDK | Zürich

**Boulic, Ronan**
CG & VR specialist | head of the Immersive Interaction Group (IIG) | EPFL | Lausanne

**Bustamante, Vera**
Occupational health | CHUV | Lausanne

**Cardin, Sylvain**
Virtual reality project manager | MindMaze | Lausanne

**Carrino, Francesco**
Lecturer and PostDoc Researcher | HEIA-FR | HES-SO | Fribourg

**Carrino, Stefano**
Serious game expert | CS Dept | HE-Arc | HES-SO | Fribourg & Neuchâtel

**Charrotton, Yannick**
CTO Lambda Health System | LHS S.A. | Yverdon-les-Bains

**Correia De Oliveira, Domingos**
Emergency expert | Health domain | HE-Arc | HES-SO | Neuchâtel

**Didier, John**
Head of Teaching and Research Unit Didactics of Art and Technology | HEP-VD | Lausanne

**Fisher, Frédéric**
Head of the Academie de Meuron school of visual arts | Academie de Meuron | Neuchâtel

**Gobron, Stéphane**
Head of the Image Processing & Computer Graphics group | HE-Arc | HES-SO | Neuchâtel

**Gordan, Savicic**
Professor and design expert | HEAD | Geneva | HSLU | Luzern | CAOCAO Studio

**Hans, Loïc**
CEO Entrée de Jeux | société coopérative | Entrée de Jeux | La Chaux-de-Fonds

**Herbelin, Bruno**
Center for Neuroprosthetics Deputy Director | EPFL | Lausanne

**Iannaccone, Antonio**
Full professor | Institute of psychology and education | UniNE | Neuchâtel

**Kahlina, Dragica**
Lecturer for Digital Ideation | HSLU – Informatik | Rotkreuz

**Kocher, Mela**
Research associate | senior researcher | Department of Interaction/Game Design | Zurich University of the Arts | Zurich

**Kokoszka, Valérie**
Lecturer in philosophy | Center for Medical Ethics | Catholic University of Lille | France

**Kunz, Beat**
Founder | Game Designer & Software Engineer bei Fusion-Robot | fusion-robot.ch | Zurich

**Kuppe, Martin**
Director R&D | chief executive and co-founder | Method in the Madness | France

**Lauria, Michel**
Head of the Robotics Laboratory | hepia | HES-SO | Geneva

**Le Callennec, Benoit**
Expert in animation | HE-Arc | hes-so | Neuchâtel

**Lemaire, Vincent**
Founder – CEO at Be!rescuer | BLS – AED instructor | Be!rescuer | Vaulruz

**Macedo, Ana Paula**
Dean of the School of Nursing | University of Minho | Portugal

**Marklund, Björn Berg**
Senior lecturer | University of Skövde | Sweden

**Marquis, Ludivine**
Conservative dept Archeology | NMB Nouveau Musée Bienne | Bienne

**Mathieu, Alexia**
Head of Master Media Design | HEAD | HES-SO | Geneva

**Monti, Massimo**
Head of partnerships and industrial valorisation | HE-Arc | HES-SO | Neuchâtel

**Mugellini, Elena**
Head of Technology for Human Well-being Institute | HEIA-FR | HES-SO | Fribourg

**Ouerhani, Nabil**
Head of the Interaction Technologies group | HE-Arc | HES-SO | Neuchâtel

**Quinche, Florence**
Expert in the field of Pedagogy applied to Video Game | HEP-VD | Lausanne

**Rekik, Yassin**
Expert in augmented and virtual reality | hepia | HES-SO | Geneva

**Reutenauer, Olivier**
Project manager | Digital Kingdom | Vevey

**Rossel, Jean-Bernard**
CTO | Talk-to-me | Neuchâtel

**Rossetti, Samuel**
Expert art & graphics | Contreforme | Neuchâtel

**Salamin, Patrick**
Sr Software Engineer | Logitech | Lausanne

**Sanchez, Eric**
Professor | serious games expert | Laboratoire d'innovation pédagogique | UniFR | Fribourg

**Scarano, Vittorio**
Coordinator of ROUTE-TO-PA | H2020 | Dept of computer science | University of Salerno | Italy

**Schaffter, Nicolas**
Project manager | interface science & société | UNIL | Lausanne

**Schwab, Philomena**
Project manager | Stray Fawn Studio | Zürich

**Sibilio, Maurizio**
Dr., Full Professor | Department of Human | Philosophical, and Training Sciences | University of Salerno | Italy

**Solari, Fabio**
PhD, associate professor | Dept. of Informatics | Bioengineering, Robotics and Systems Engineering | University of Genoa | Italy

**Tabin, Jean-Pierre**
Social science expert | EESP | HES-SO | Lausanne

**Taly, Antoine**
Researcher in the Theoretical Biochemistry Lab | CNRS | France

**Thibault, Mattia**
Postdoctoral researcher | Tampere University | Finland

**Thys, Frédéric**
Chief doctor of the emergency department | Grand Hopital de Charleroi | Belgium

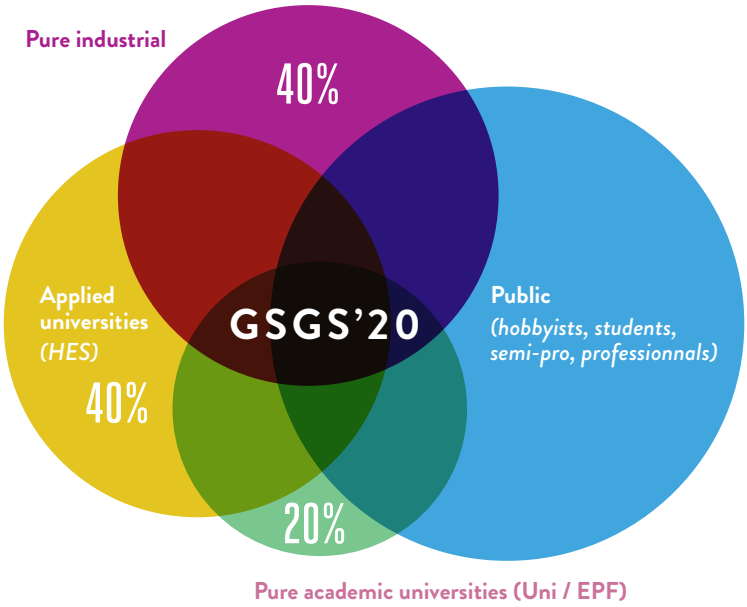
**Truchot-Cardot, Dominique**
MD / PO | Head of Source Innovation Lab | Institut et Haute École de la Santé La Source | HES-SO | Lausanne

**Wenk, Nicolas**
Immersive virtual reality and Serious Games based motor learning and neurorehabilitation | PhD Student | ARTORG Center | Universität Bern | Bern

**Widmer, Antoine**
Augmented reality expert | Gestion | HEVS | HES-SO | Sierre

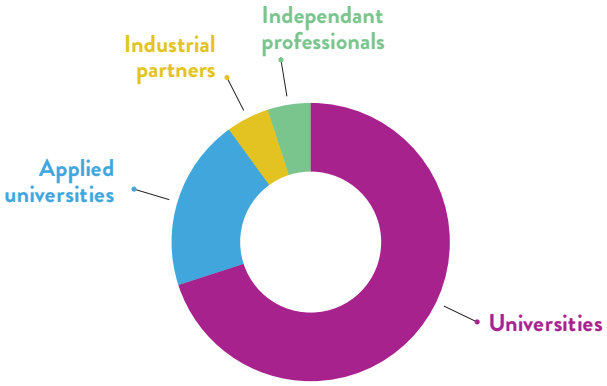
## GSGS'20: AN INTER-PROFESSIONAL OPPORTUNITY FOR THE SWISS INDUSTRY

The GSGS'20 conference aims to be a bridge between industrial needs and original academic answers in the domain of Gamification and Serious Gaming. It highlights the playful perspective to tackle technical, training, ecological, management and communication challenges. Bringing together the strengths of academy and industry, this event provides an exchange and networking platform through the intervention of national and international actors.

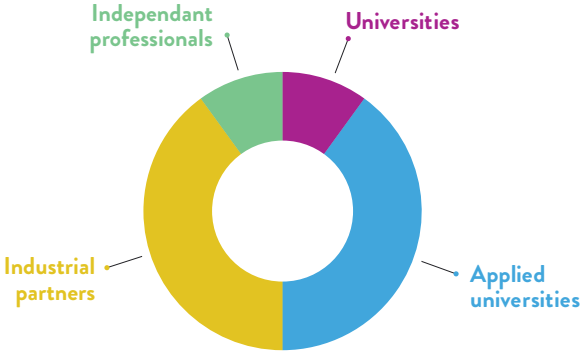



*Four categories of people interacting to rise innovation.*

WHAT CAN BE EXPECTED AT...




...A CLASSICAL CONFERENCE




...GSSG'20

PAPERS

## THURSDAY 24 SEPTEMBER EDUCATION & LEARNING

16:00–16:07 **1 Analysis of the 20 most played educational games in an intelligent learning platform for children**
Natalia Lara Nieto-Márquez | Universidad Camilo José Cela, Smile and Learn Digital Creations | Spain
Discover >

16:10–16:17 **2 Don't be boring: The case of a gamified Google Classroom**
Izabella Jedel | Insert Coin | Sweden
Discover >

16:20–16:27 **3 Playful learning and information literacy: the changes of an academic library**
Fantin Reichler | UNINE | Switzerland
Discover >

16:30–16:37 **4 Assessment and Personalization in Learning Games**
Michael Kickmeier-Rust | Pädagogische Hochshcule St. Gallen | Switzerland
Discover >

16:45–17:30 Round table - Gamified learning needs competition, fun and social interactions. Right? But is it effective?

## THURSDAY 1 OCTOBER HEALTH STAFF-ORIENTED

16:00–16:07 **5 Object hunt for speech therapy**
Stéphane Gobron | HE-Arc | Switzerland
Discover >

16:10–16:17 **6 Creation of a serious game exploring decision making by triage nurses in a stressful environment**
Fiorentino Assunta | La Source | Switzerland
Discover >

16:20–16:27 **7 "END OF LIFE", a serious game to develop skills for healthcare professionals**
Sylvia Gonzalez | HE-Arc | Switzerland
Discover >

16:30–17:15 Round table - Simulation is the key in healthcare oriented games. Right? But are actual games really meeting the challenge of human emotions?

## THURSDAY 8 OCTOBER PERSONAL & PROFESSIONAL TRAINING

16:00–16:07 **8 iManuVisu: A visualization and gamification system for mechanical maintenance manual**
Maria Sisto | HE-Arc | Switzerland
Discover >

16:10–16:17 **9 Making a digital manual of a manufacturing operation more fun thanks to augmented reality**
Axel Collet | HEPIA | Switzerland
Discover >

16:20–16:27 **10 Engaging guitar learners with artificial intelligence and gamification**
Stefano Carrino | HE-ARC | Switzerland
Discover >

16:30–17:15 Round table - Simulations can prevent risks. Right? But should those simulations really be games or playful if lives or high costs are at risk?

DEMOS

## THURSDAY 15 OCTOBER

### EDUCATION & LEARNING

16:00–16:07 **A Analysis of the 20 most played educational games in an intelligent learning platform for children**
Natalia Lara Nieto-Márquez | Universidad Camilo José Cela, Smile and Learn Digital Creations | Spain
Discover >

16:10–16:17 **B Don't be boring: The case of a gamified Google Classroom**
Izabella Jedel | Insert Coin | Sweden
Discover >

### SKILLS DEVELOPMENT

16:20–16:27 **C STRATEGIOUS**
Xavier Wilain | XW_SeriousGames | Switzerland
Discover >

16:30–16:37 **D Ambassador Pre-Crisis Decision-making**
Ashish Amresh | Arizona State University | USA
Discover >

16:40–17:00 Questions

## THURSDAY 22 OCTOBER

### PERSONAL & PROFESSIONAL TRAINING

16:00–16:07 **E Inside the cockpit of the semi-autonomous cars of tomorrow**
Quentin Meteier | HEIA-FR | Switzerland
Discover >

16:10–16:17 **F To Bee or Not to Bee: Prototyping a VR training Game for Beekeepers**
Richard Wetzel | HSLU | Switzerland
Discover >

### CULTURE & URBANISM

16:20–16:27 **G Les Barons – an urban treasure hunt through La Chaux-de-Fonds' watchmaking heritage**
Loïc Hans | Entrée de Jeux | Switzerland
Discover >

16:30–16:37 **H Saint Ursanne Circuit Secret**
Maria Sisto | HE-Arc | Switzerland
Discover >

16:40–17:00 Questions

## THURSDAY 29 OCTOBER CULTURE & URBANISM

16:00–16:07 **11** Playing with Local Heritage: co-designing game-stories for youth
Lissa Holloway-Attaway | University of Skövde | Sweden **Discover >**

16:10–16:17 **12** Les Barons – an urban treasure hunt through La Chaux-de-Fonds' watchmaking heritage
Loïc Hans | Entrée de Jeux | Switzerland **Discover >**

16:20–16:27 **13** Jurassic Tampere & urban toyification
Mattia Thibault | Tampere University | Finland **Discover >**

16:30–16:37 **14** Interactive Rhythm Making System using Tablet and Large Scale Display
Atsushi Yamaji | Osaka Electro-Communication University | Japan **Discover >**

16:45–17:30 Round table - Games are highly engaging and immersive. Good games with a good story really are. Right? But are they engaging you in the gaming experience or in the matter you are gamifying?

## THURSDAY 5 NOVEMBER TRANSPORT AND ENVIRONMENT

16:00–16:07 **15** The effect of reclining horizontal plane on VR sickness
Nana Tian | EPFL | Switzerland **Discover >**

16:10–16:17 **16** Inside the cockpit of the semi-autonomous cars of tomorrow
Quentin Meteier | HEIA-FR | Switzerland **Discover >**

16:20–16:27 **17** To Bee or Not to Bee: Prototyping a VR training Game for Beekeepers
Richard Wetzel | HSLU | Switzerland **Discover >**

16:30–16:37 **18** BombusCar: Gamification Design of a Carpooling-Based Freight Transport
Francesco Carrino | HEIA-FR | Switzerland **Discover >**

16:45–17:30 Round table - Reckless, cautious, or somewhere in between, we all behave differently while playing games. Right? So can they really train us, with the same result, for real life?

# DEMO & POSTER SESSIONS SUMMARY

## THURSDAY 15 OCTOBER

84

### ANALYSIS OF THE 20 MOST PLAYED EDUCATIONAL GAMES

Natalia Lara Nieto-Márquez | Universidad Camilo José Cela, Smile and Learn Digital Creations, Madrid, Spain

Discover >

85


### DON'T BE BORING, THE CASE OF A GAMIFIED GOOGLE CLASSROOM

Jedel Izabella | Insert Coin, Göteborg, Sweden

Discover >

86


### STRATEGIOUS

Xavier Wilain | XW_SeriousGames, Bex, Switzerland

Discover >

87

### AMBASSADOR PRE-CRISIS DECISION-MAKING

Ashish Amresh | Arizona State University, Tempe, USA

Discover >

## THURSDAY 22 OCTOBER

88

### INSIDE THE COCKPIT OF THE SEMI-AUTONOMOUS CARS OF TOMORROW

Quentin Meteier | HumanTech Institute, HEIA-FR, HES-SO, Fribourg, Switzerland

Discover >

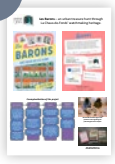
89

### TO BEE OR NOT TO BEE

Richard Wetzel | Immersive Realities Research Group, School of Information Technology, HSLU, Lucerne, Switzerland

Discover >

90



### LES BARONS – AN URBAN TREASURE HUNT THROUGH LA CHAUX-DE-FONDS' WATCHMAKING HERITAGE

Hans Loïc | Entrée de Jeux, La Chaux-de-Fonds, Switzerland

Discover >

91

### SAINT URSANNE CIRCUIT SECRET

Maria Sisto | Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

Discover >

# SPEECH & SHORT PAPERS

# ROUNDTABLE

**Julien Schekter**
Responsable de la communication
DFJC (Département de la formation, de la jeunesse et de la culture)
État de Vaud, Lausanne, Suisse

**THURSDAY 24 SEPTEMBER** EDUCATION & LEARNING

16:45 – 17:30 Gamified learning needs competition, fun and social interactions. Right? But is it effective?

**THURSDAY 1 OCTOBER** HEALTH STAFF-ORIENTED

16:30 – 17:15 Simulation is the key in healthcare oriented games. Right? But are actual games really meeting the challenge of human emotions?

**THURSDAY 8 OCTOBER** PERSONAL & PROFESSIONAL TRAINING

16:30 – 17:15 Simulations can prevent risks. Right? But should those simulations really be games or playful if lives or high costs are at risk?

**THURSDAY 29 OCTOBER** CULTURE & URBANISM

16:45 – 17:30 Games are highly engaging and immersive. Good games with a good story really are. Right? But are they engaging you in the gaming experience or in the matter you are gamifying?

**THURSDAY 5 NOVEMBER** TRANSPORT AND ENVIRONMENT

16:45 – 17:30 Reckless, cautious, or somewhere in between, we all behave differently while playing games. Right? So can they really train us, with the same result, for real life?

# SESSION EDUCATION & LEARNING

**THURSDAY 24 SEPTEMBER**
16:00–17:30


NATALIA LARA NIETO-MÁRQUEZ


IZABELLA JEDEL


FANTIN REICHLER


MICHAEL KICKMEIER-RUST

# 1 THE 20 MOST PLAYED EDUCATIONAL GAMES ANALYSED IN AN INTELLIGENT LEARNING PLATFORM FOR CHILDREN

**Nieto-Márquez Natalia Lara**
Universidad Camilo José Cela, Smile and Learn Digital Creations, Madrid, Spain
*Contact: nlaranim@gmail.com*

## ABSTRACT

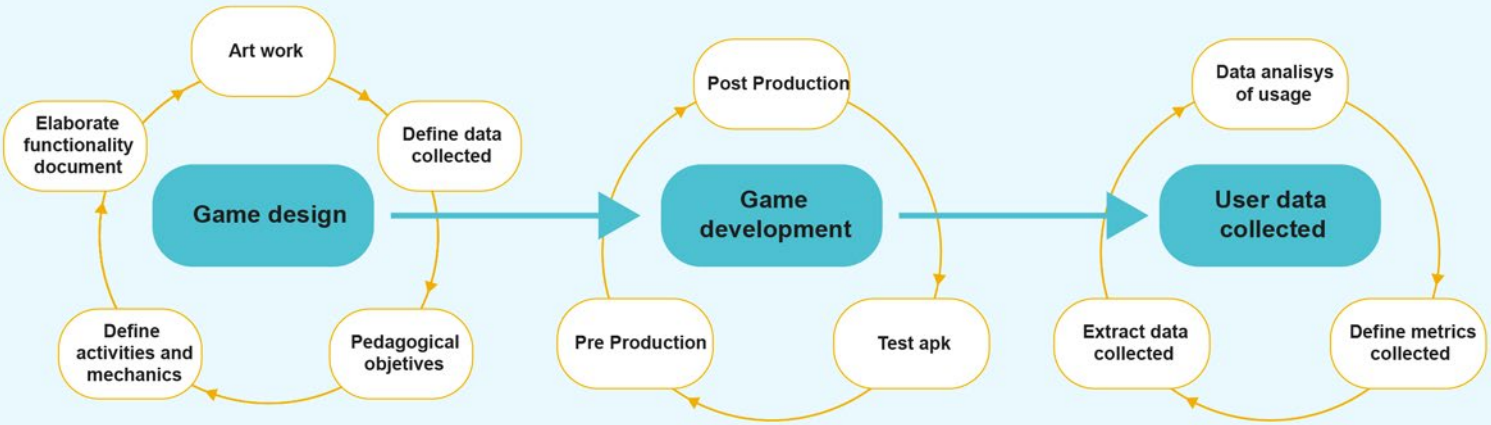
The use of serious games keeps growing as well as the number of companies that develop this kind of content. As there are lots of created serious games, it is important for education experts to know how these games can help students to learn. In addition, it would be helpful to know in what way serious games are more useful to motivate students to learn and help them to develop their skills. The present study introduces an analysis from the pedagogical approach, regarding 20 popular games in the educational learning platform, "Smile and Learn". First, we use frameworks to check if pedagogical objectives are followed. Secondly, we evaluate whether games are useful in developing student skills. The objectives of the games must establish connections between learning and game mechanics, as indicated in the LM-GM (learning mechanics-game mechanics) framework.

This study enables establishing new directions and ways to develop learning games for children. In the top 20 most played games in the platform, we must point out that interactive and social parts are the main common features. In order to provide future instructions for game development, it is recommended to develop more management simulation games to support learning, even though difficulties will arise while developing them.

## KEYWORDS

Serious games; game-based learning; educational technology; game design; children; human computer interaction; user experience research.





## CONTEXT

"Smile and Learn" is an intelligent platform in the educational technology that develops digital material such as videos, games, quizzes and tales for children aged 3-12 years. These activities are arranged into "Worlds" following the principles of Gardner's theory of multiple intelligences: "science", "spatial", "logic", "emotions", "arts", "literary", "multiplayer" and an additional world, named after the user and where he can build virtual cities. This user's world is linked to the platform's reward system where children can spend the tokens ("smilies" or "gems") they earned while performing tasks in the platform activities. "Smile and Learn" is multi-device and available for different operating systems (Windows, Android and iOS) and its activity contents have been translated in five languages (Spanish, English, French, Italian and Portuguese). As a result, these games can be used by teachers in their lessons under several teaching methods **[1]**. Moreover, as most of the activities were drawn from international curricular contents based on global elementary education standards or cognitive skills acquisition, they can help students perform better in their grades **[2, 3]**.

The image above shows a game design outline and development process as well as a collection of user data analysis.

## TARGETED ISSUES

At first, some of the implementation limitations of digital material in schools can be the lack of funds or devices as well as challenges that teachers need to face to use this material to support their lessons **[1]**. In some cases, these issues arise because teachers need more training, but sometimes they are due to a lack of information or because the games do not follow a structure or pedagogical goals that help teachers evaluate their students **[3]**. In order to give an answer to the second issue, we proposed this study that provides information on the most engaging games for children at school. This analysis also wants to connect learning and pedagogical objectives with the use of games in class as a support teaching material.



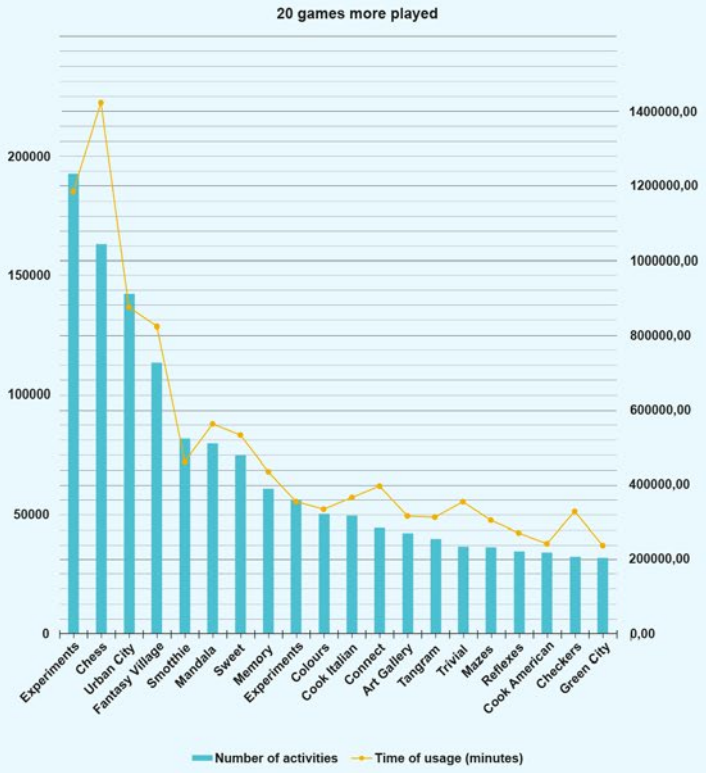
Secondly, no concrete framework has been defined to design and develop games with educational purposes. The literature review shows some examples of frameworks to define and do game evaluation **[E.G. 2,3,4]**: most of them come close to giving practical answers to the game designing problematics, however, the day-to-day company operations are not always taken into account, given the large number of professional profiles involved.

*This study enables establishing new directions and ways to develop learning games for children*

## PROPOSED SOLUTION

This study main goal is to determine which activities are the most played and give their main characteristics. This study assesses the top 20 educational games most used by children aged 3-12 years. The data collection on most used games consists of the activity number and time of use in minutes. The period of use goes from July, 1, 2019 to January, 1, 2020.

This base could help in the field of game design and frameworks to know more about games and learning mechanics (GM-LM) specialised in educational activities of several areas of knowledge **[3,4]**. By analyzing the "Smile and Learn" platform and the use of its frameworks, we have established a basis to start using the latter in game design company models. Thereby, we can look into the game design to see whether the most played games follow a structure or belong to a concrete game category or genre. Thanks to this analysis, it is expected to provide guidelines to make those games more engaging for children. Additionally, the game evaluation and description could help teachers implement them in their lessons and guide them including the pedagogical objectives and evaluating student progress **[2,3]**.






## RELEVANT INNOVATION

Based on this study new directions and ways to develop games for children learning can be established. Meanwhile, rewards featured in the platform, that work as a link between different Worlds activities, can be used by teachers to assess students. Another way to use games is to promote intrinsic motivation by goal-achieving tasks in the platform, as digital material as games are used within the scope of other teaching methods. This will give teachers the chance to implement games freely in their lessons.

Another point is how to link framework theory or guidelines designing with company practices. Also, this area combines multidisciplinary areas with different ways of communication and skills that need to be joined. To put into practice and evaluate whether pedagogical objectives are followed or games are useful in developing student skills, a connection has been established between learning and game mechanics as indicated in the LM-GM framework.

## PROJECT OUTCOMES AND RESULTS

In the image above, we show the number of activities and usage time regarding the 20 most played games. The average duration per activity in minutes is: Experiments, 6.15; Chess, 9.12; Urban City, 6.12; Fantasy Village, 7.26; Smoothie, 6.04; Mandala, 7.06; Sweets, 7.11; Memory, 7.15; Fashion, 6.29; Colours, 7.05; Italian Cuisine, 7.37; Connect, 9.28; Art Gallery, 7.49; Tangram, 8.20; Trivial, 10.06; Mazes, 8.36; Reflexes, 8.21; US Cuisine, 7.06; Checkers, 10.14; Green City, 7.40.

What stands out is the use of games in the Science, Spatial, Logic, Emotions, Artistic, Literary, Multiplayer and the user's worlds where they can build cities (e.g. Urban City or Fantasy Village). Following genre categorizing according to Baptista et al. [2], these 20 games can be classified as:

- puzzles, where we can find traditional games like chess, trivial, connect, checkers, ...
- mix of puzzles and quizzes, games as experiments, all cooking games and Arts games.
- management simulation, where we can find games as Green City, Fantasy Village, Urban City.

If we use the LM-GM framework [4] for all 20 games, we can observe that the most used Game Mechanics (GM) are: guidance, tokens, resource management, action points, movement, assessment and rewards. If we relate GM to LM, we find that the most used are: feedback, plan, experimentation, repetition, simulation, assessment, motivation. Pedagogical goals featured in thinking skills are retention, comprehension, application, analysis and evaluation.

## CONCLUSION

In the top 20 most played games in the platform, we must point out that interactive and social parts are the main common features. Most of these games can be played against the machine, in pairs or groups. According to Baptista et al. [2], these 20 games may help to boost performance operating skills, decision making, problem solving, technical skills, organisation, among others.

## PERSPECTIVES AND NEEDS

- Combination of different genres, mechanics and social interactions may have a high impact in learning and skills acquisition.
- It is necessary to define how game evaluation can be done and keep doing research related to the assessment of the learning process through games in order to help teachers.
- Training and guides for teachers are needed.
- Figure out and implement more ways of evaluating different games. For example, "escape rooms" that just can be played once.

## ACKNOWLEDGMENTS

This research is funded by Community of Madrid 'Industrial PhD grants', under project number IND2017/SOC-7874.

Special mention to Dr. Alejandro Baldominos, Dr. Alejandro Cardeña and Iphigeneia Mariou for their help and collaboration in the project.



## REFERENCES

[1] Choppin, J.; Borys, Z. *Trends in the design, development, and use of digital curriculum materials.* ZDM Mathematics Education 2017, 49, 663–674.

[2] Baptista, R.; Coelho, A.; de Carvalho, C. V. *Relationship between game categories and skills development: Contributions for serious game design.* In ECGBL 9th, 2015.

[3] Belloti, F.; Ott, M.; Arbab, S.; Berta, R.; De Freitas, S.; Kiili, K.; De Gloria, A. *Designing serious games for education: from pedagogical principles to game mechanism.* In ECGBL5th 2011, 26-34.

[4] Arnab, S.: Lim, T.; Carvalho, M.B.; Belloti, F.; De Freitas, S.; Louchart, S.; ... & De Gloria, A. *Mapping learning and game mechanics for serious games analysis.* British Journal of Educational Technology, 2015, 46, 391-411.

# 2 DON'T BE BORING: THE CASE OF A GAMIFIED GOOGLE CLASSROOM

**Jedel Izabella[1], Gillberg David[2], Palmquist Adam[3]**
**1:** The University of Gothenburg, Göteborg, Sweden
**2:** Insert Coin, Göteborg, Sweden
**3:** University of Skövde, Skövde, Sweden

*Contact: izabellajedel@hotmail.com*

## ABSTRACT

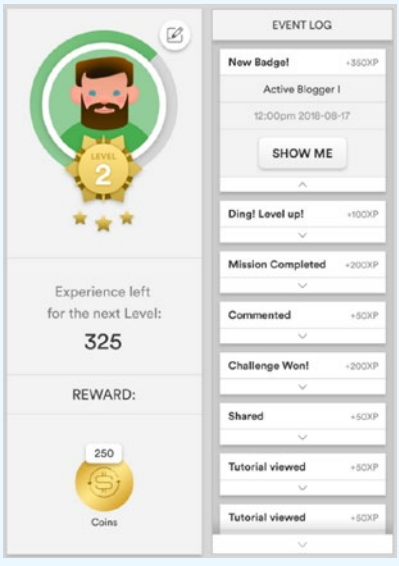
Gamification has shown varied effects on student performance. In this study we examine the implementation of an agnostic gamification platform, Gamify the World ENgin (GWEN), in Google Classroom (hereafter GC) and focus on the scalability indication as well as gamification's influence on the students and teachers perception of the course and their interaction with it. The results show an overall positive view of gamification and offer guidance to further implementations.

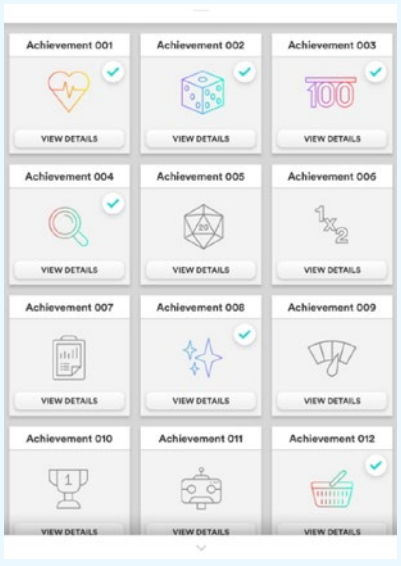
## KEYWORDS

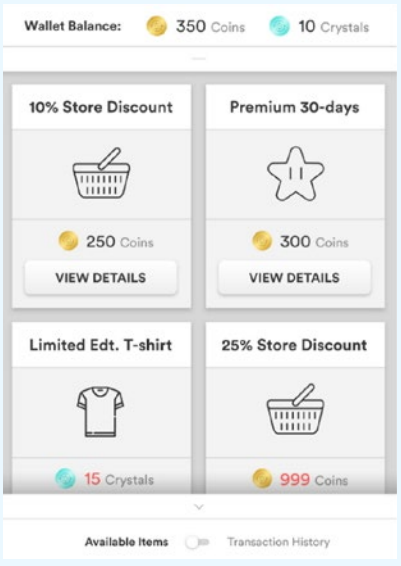
Gamification; Learning management system; Upper secondary school;
Google classroom; Levels; Achievements; Missions; Student motivation; Blended learning.



**Gamification System Suggestion**
Levels, Achivements & Shop Module



## CONTEXT

Completed upper-secondary education is a primary structural indicator of education objectives (established by the EU member states) [1] success. Individuals with no upper-secondary education face difficulties in the European labour market [1]. In Sweden adolescents with an upper- secondary education have a 75% employment rate while those with only a secondary education have a 28% rate [2]. This number is prognosed to change negatively due to an upcoming regression in the European economy [3].

This case study is a part of the Swedish Innovation agency Vinnova GARFIEID project which concerns the digital gamification of a mathematics course at Bräckegymnasiet, a municipal upper secondary school with a practical orientation in Gothenburg. The school focuses on students' later employment in the construction industry.

GWEN implemented game mechanics in the school's existing Learning Management System (LMS), in close collaboration with plugin developers at Insert Coin. The aim was to increase student engagement and completion rates without lowering the knowledge requirements.

Reviews from gamification applied to education have shown varied results, with different studies indicating either positive, negative or inconclusive effects [4]. To get a more nuanced understanding of applied gamification and its long-term effects a user-centric qualitative approach was applied to assess the implementation.

## TARGETED ISSUES



Apart from the practical subjects the students at Bräckegymnasiet also have to study core subjects such as Swedish, English and mathematics as mandated by the Swedish Education Act [5]. For this study we chose a course in Mathematics, in part due to the school students' historically varying results when it comes to theoretical subjects.

At an introductory workshop, four different student groups were defined, all with different but related challenges:

*The system will react automatically to the user-activity and give each student an individual sense of progression*

**Group 1: High achievers**
Tends to be dragged down by a culture that sees mathematics as an unnecessary evil.

Loses speed and are not challenged enough, this unless the teachers find the time to focus on them. Often prefers to study at home.

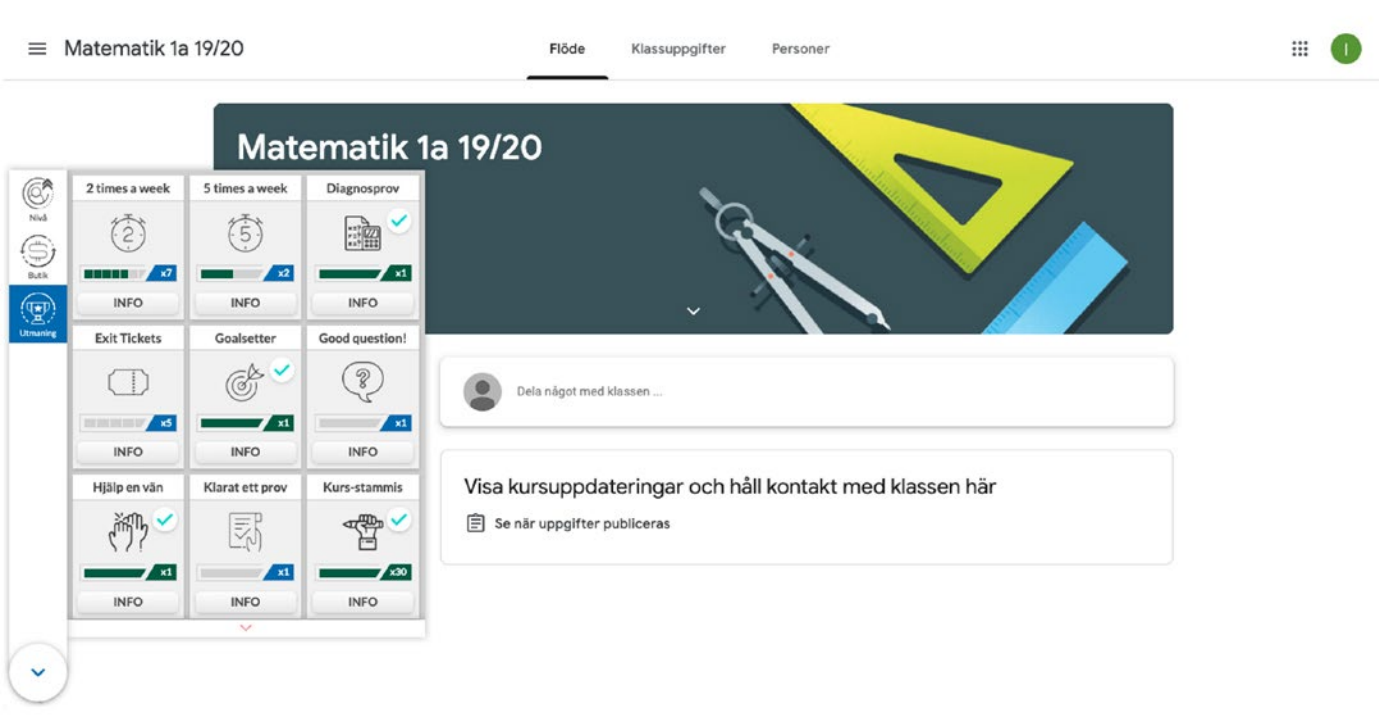
**Group 2: Competent but unmotivated**
Will often finish early in class and then tends to disturb the other students.

Needs more challenges. Hard to be motivated by the teachers.

**Group 3: Not fully competent and unmotivated**
Have not "fully earned" their previous grades. The knowledge level required to pass their previous courses does not match what is needed on this level.

Needs to get a fresh start. Hard to motivate unless they feel that they can succeed at the course start.

**Group 4: Not fully competent but motivated**
Hard to identify. They are often classified as group 3 members, but are actually easy to motivate if discovered in time.






## PROPOSED SOLUTION

GWEN is built around two main concepts:

Modules: Standalone but communicate with each other when deployed together. Contain the main logic and each module represents one or more game mechanic(s) such as badges, quest and levels.

Behaviours: Predefined user actions that the system will react to.

Together with the teachers, four modules were chosen:

Level: Gives instant feedback to all Behaviours by giving experience points (xp) to the student and increasing his/her level at predefined steps. Level-ups are rewarded with virtual coins.

Mission: Dynamically generates missions with objectives from the previously defined Behaviours. Completed missions are rewarded with xp in the Level module. Due to limitations in how the teachers used GC this module was not included in the final implementation.

Achievement: Similar to missions, but predefined and described more elaborately. Some achievements have multiple levels of increasing magnitude. A completed achievement will be rewarded with xp in the Level module.

Shop: The items in the shop are bought with virtual coins and consist of half points for the final exam. The idea was that once the student had earned enough virtual coins to buy the exam points, they would have acquired sufficient knowledge to pass the exam without the extra points gained

Based on teacher feedback and GC limitations, a set of behaviours, focusing on activity (not results), were defined. The main categories were: Quizzes, Attendance, and Teacher feedback.

## RELEVANT INNOVATION

GWEN is not built specifically for GC or even LMS's in general. Instead, it is built to be agnostic and can be integrated into any digital platform. Examples of existing variations include an employee onboarding app, a fitness coaching app, an e-sports community and a companion app to a blood pressure monitoring tool.

In this case, gamification of GC has been accomplished through a plugin that can detect student activity in GC and send messages to GWEN's backend. The reactions to the messages are presented through a widget that is added on top of the GC pages, giving the students immediate feedback as well as indications of what is possible and encouraged to do within the course.

The GWEN-implementations are in general front heavy, in the sense that most of the design and administration is performed at the project outset. When everything is in place, the system automates all the gamification. In this way the teacher will not be burdened by additional tasks due to the gamification. The system will react automatically to the user-activity and give each student an individual sense of progression. Having a fully automated gamification system also gives the GWEN GC-implementation the potential to be truly scalable. As long as the course setup is created within the gamification design bounds, an existing gamification can be reused by any number of teachers. This will both lower the cost per student and increase the non-monetary gains from the gamification effort.

## PROJECT OUTCOMES & RESULTS

The result is based on three interview sessions with students (n=12), and one session with teachers (n=3). Gamification was perceived as positive in all interviews. The students positive view emerged more over time and extrinsic motivation was the main motivation (i.e. collecting points for the exam). The students also appreciated the competitive and cooperative nature of gamification, being provided context, repetition and feedback to better organize and understand progress, and gaining higher focus, effort, learning, confidence and result. Negative aspects mentioned included exploits in the system, need for more system information and a higher challenge level. The students also wanted more options in the store, a leaderboard, the option to buy more exam points but of lesser value, and making it clearer when a new level had been reached. On a general level, the students did not experience stress and therefore did not see gamification as affecting their stress levels. Teachers perceived gamification as an alternative way for students to learn, with potentially positive outcomes and positive initial effects. They also mentioned that gamification had led to higher initial workload in the planning phase and that there was a lack of implementation information. Finally, both students and teachers mentioned the need for variation and appreciation for the blended learning environment.



## CONCLUSION

From the results it can be concluded that gamification was appreciated by students and teachers. Looking forward, gamification could enable students to be more active in their learning. Clear guidelines and sufficient communication needs to be provided to both the students in further implementations, and in the long run, the system should enable higher adaptation to individual and successive progress.

## PERSPECTIVES & NEEDS

The agnostic platform enables the gamification elements to be modified and applied to other schools and educational contexts. From the case study learnings the next implementation will include better communication with the teachers and guidelines for teachers to improve their communication with students. On a long-term perspective, the AI application to individualize the learning process for each student would also be of interest.

## ACKNOWLEDGEMENTS

The authors would like to thank the teachers and leaders at Göteborgs stad and the team at Bräckegymnasiet and Insert Coin. The study was partly supported by the Swedish innovation agency, Vinnova grant number 2018-02953.

## REFERENCES

[1] Eurostat: *Early leavers from education and training* https://ec.europa.eu/eurostat/statistics-explained/index.php/Early_leavers_from_education_and_training Reviewed 2020-01-29

[2] Skolverket (2016) RAPPORT 441 *Arbetslivet efter skolan: Arbetsledares bedömning av unga medarbetares kompetens och inom vilka branscher unga arbetar*

[3] Swedish Ministry of Finance *Konjunkturläget* Oktober 2019

[4] Dichev, C., & Dicheva, D. (2017). *Gamifying education: what is known, what is believed and what remains uncertain: a critical review. International journal of educational technology in higher education,* 14(1), 9.

[5] The National Agency for Education in Sweden https://www.skolverket.se/download/18.6bfaca41169863e6a653b46/1553956926501/pdf685.pdf

# 3 PLAYFUL LEARNING AND INFORMATION LITERACY: THE CHANGES OF AN ACADEMIC LIBRARY

**Reichler Fantin**
Bibliothèque - Faculté des Lettres et Sciences Humaines, UNINE, Neuchâtel, Switzerland
*Contact: fantin.reichler@unine.ch*

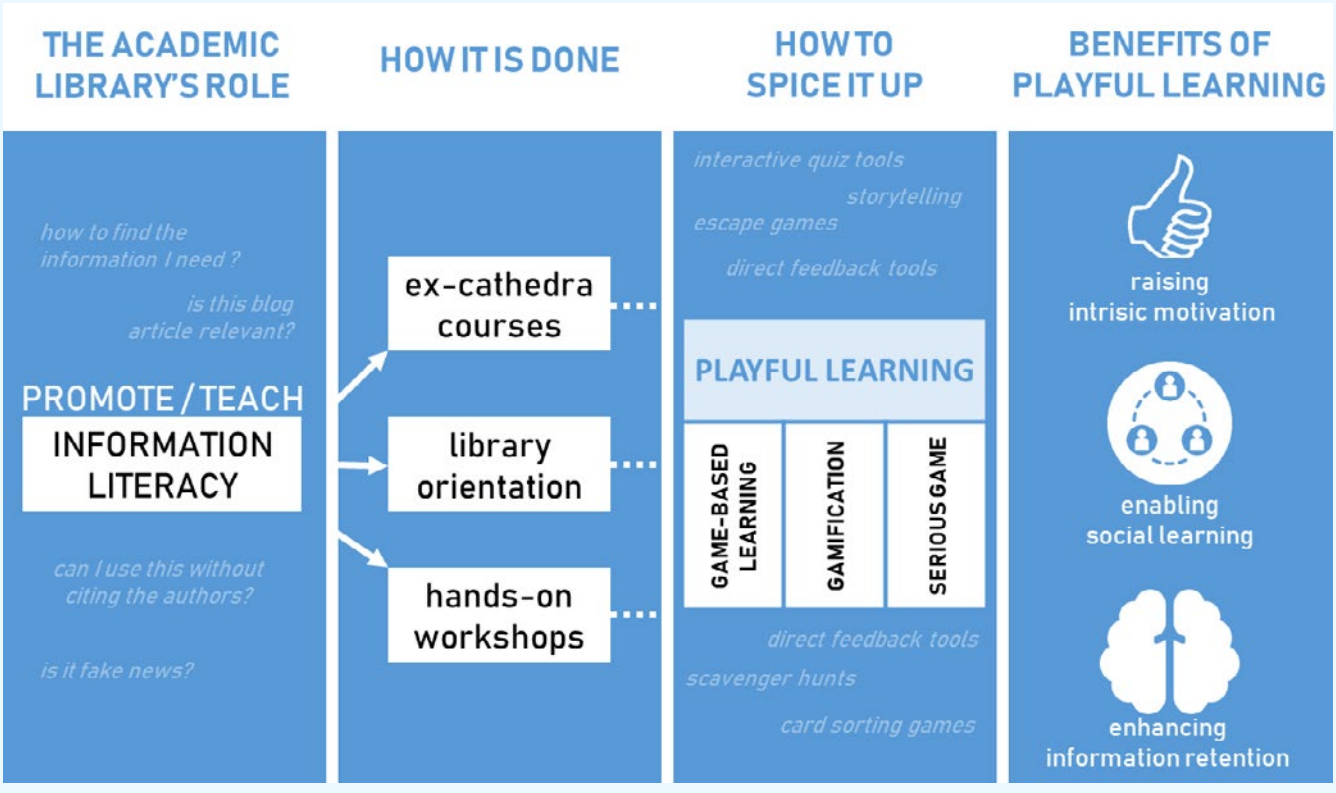
## ABSTRACT

At the Université de Neuchâtel (UniNE), one of the Faculty of Arts & Humanities Library's (FAHL) roles is to teach their students about information literacy (IL), which takes many forms and reaches a large audience, from first-year students to researchers. The librarians in charge of IL promotion noticed several problems, such as poor information retention or lack of intrinsic motivation among their users. The FAHL considers to integrate playful learning in its services to address this issue: classic instructions and library orientation are redesigned, and a broader playful learning framework is taking shape.

## KEYWORDS

Gamification, game-based learning, serious game, academic library, library instruction, library orientation, information literacy, playful learning.





## CONTEXT

In an information society, people need to harness key competences and behaviors that are grouped under the "information literacy" label. In academia, the library traditionally handles the promotion and instruction of such skills in order to support and empower students (Stalder et al., 2011) from their first semester to their master graduation. The same situation touches the FAHL of the UniNE. The library is indeed the central hub for IL promotion, and it offers several services addressed to different types of users, which include:

- A 2-hour mandatory introduction course to documentary research taught to every first-year student (approximately 350 people);
- A non-mandatory library orientation visit for first-year students happening during the UniNE "Welcome Day";
- 2-hour discipline-specific advanced courses on documentary research for third-year bachelor students or first-year master students.

## TARGETED ISSUES

Regarding the introduction course, the FAHL is pleased to have such an opportunity to reach so many users at once, but there is an important drawback. This instruction happens too early in the students' curriculum. At that moment, they are barely confronted to situations where they would need to use IL skills, which makes it difficult to raise intrinsic motivation and, in a longer perspective, information retention.



It also seems that the library orientation does not manage to convey all the valuable information the users would eventually need on the long term. The tour format may be too conventional.

More generally, the FAHL wants to portray a dynamic image and show users that they can count on its expertise, services and support regarding IL matters.

## PROPOSED SOLUTION

In 2019, FAHL started considering the integration of playful learning – gamification, game-based learning and serious games elements – in its services: the blend of motivational triggers, active learning and social learning it offers is particularly effective to develop IL among users **[3]**. Significant efforts were made in this direction: a bachelor thesis from the HEG Genève's Information Studies faculty was conducted at the FAHL **[1]**, and a documentary information specialist with a gamification and serious game design background was hired the same year.

*Playful learning is an emerging subject in library science in Switzerland*

The bachelor thesis brought several scenarios forward, including the creation of a toolbox containing IL related playful activities, and the basis of a scavenger hunt/escape game. The first one was set up – with approximately 15 activities – and implemented in the introduction and advanced instructions given in the fall of 2019. The latter replaced the original library orientation by a scavenger hunt with heavy storytelling elements.

## RELEVANT INNOVATION

Innovation happens while using playful learning elements in FAHL's instructions and library orientation. Playful learning is an emerging subject in library science in Switzerland: several actions were taken, and a community of practice grows slowly. This experience represents the first construction step of a broader framework for the FAHL, where playful learning will be introduced in as many IL support instances as possible. There is a willingness, concrete incentives and a certain freedom to create, develop, test and implement new gamification, game-based learning and serious games projects.





## PROJECT OUTCOMES & RESULTS

Considering that the aforementioned actions constitute a pilot project for further and deeper activities, we did not plan any quantitative evaluation. We lack sufficient hindsight to do so, but some worthy observations were made:

- It would not be relevant to focus on the introduction course assessment results as only 2 out of 4 teaching librarians chose to use playful learning, and the grades were not significantly different from last year results. Qualitative feedback were mostly positive.
- 20 users participated to the scavenger hunt during the "Welcome Day". Most people were intrinsically motivated during the 30-minute experience.
- During advanced documentary research instructions, an IL-oriented serious game designed by Walsh [3] was included in the pedagogical sequence as a formative assessment. A class from 5 to 50 users tested it: reactions and qualitative feedback were genuinely positive.

## CONCLUSION

From the FAHL's perspective, this first stage in the construction of a broad playful learning framework is successful and strongly encouraging for future developments. There is still a lot to explore and experiment in this precise field, but we observed that with a bit of support from a parent institution, great projects can be built with few to no technological resources.

## PERSPECTIVES & NEEDS

The library orientation is likely to be replaced by an escape game. Alternate forms of this playful activity are considered, including "break out games", where users solve puzzles to open a box, not to escape a room [2].

A reflection is currently under way to embed more deeply playful learning in the FAHL, and to establish common practices and guidelines for teaching librarians across the whole university.

## REFERENCES

[1] Hadzi, R. (2019). *Formation d'introduction à la recherche documentaire.* http://doc.rero.ch/record/327846 Stalder, P., Böller, N., Henkel, T., Landwehr-Sigg, S., Piccinini, S., Schubnell, B., & Stuer, B. (2011). Swiss Information Literacy Standards. http://www.informationskompetenz.ch/doc/e-lib/1_e_swiss%20information%20literacy%20standards.pdf

[2] Veach, C. C. (2019). *Breaking out to break through: Re-imagining first-year orieantations. Reference Services Review.* https://doi.org/10.1108/RSR-06-2019-0039

[3] Walsh, A. (2018). *The librarians' book on teaching through games and play. Tallin: Innovative Libraries.*

# 4 ASSESSMENT AND PERSONALIZATION IN LEARNING GAMES

**Kickmeier-Rust Michael**
Pädagogische Hochschule St. Gallen, St. Gallen, Switzerland

*Contact: michael.kickmeier@phsg.ch*

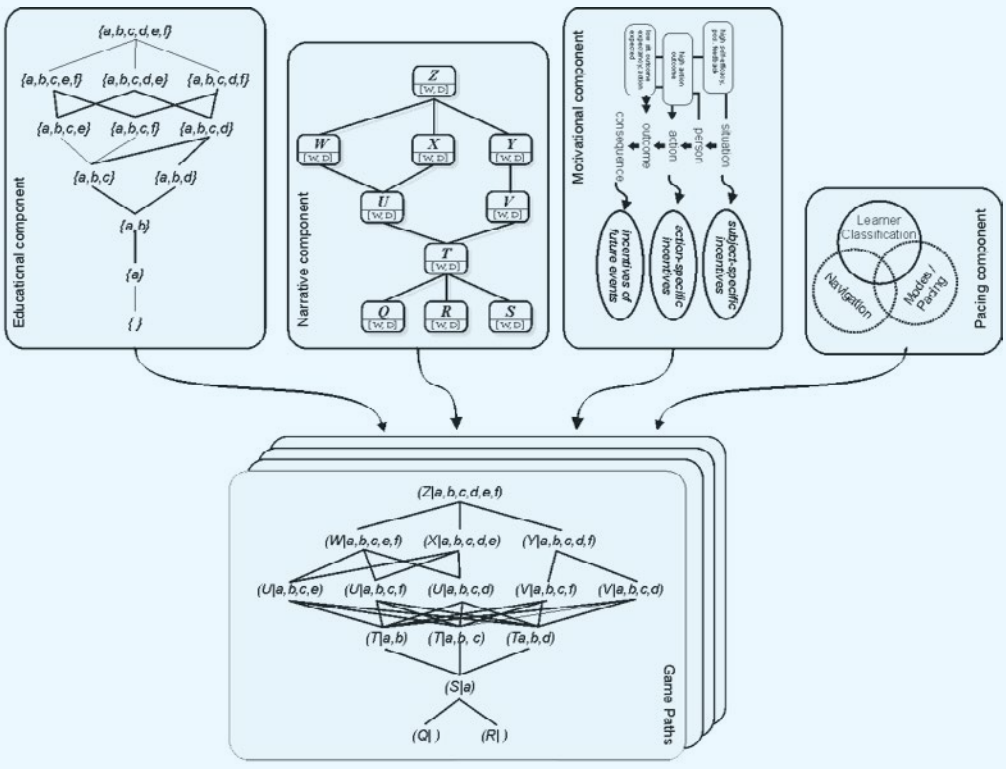
## ABSTRACT

A substantial body of research highlighted that an appropriate personalization of learning experiences is a major success factor for learning games . The experience of flow and immersion is seen as a key advantage of serious games. And it can only be achieved if the game difficulty and learning-related challenges are tailored to a person's abilities. This article introduces Micro Learning Spaces as a psychometrically sound and a practically successful conceptual approach for stealth assessment and a seamless adaptation in serious games.

## KEYWORDS

Psychometrics, Competence Assessment, Item Response Theory, Knowledge Space Theory.





## CONTEXT

Although recent meta-reviews [1] revealed the potential of serious games to facilitate learning, a clear downside of many existing approaches to game-based learning is a lacking accordance with school curricula, context conditions (such as time constraints), and in particular a lack of smart game personalization to support individual learners at best. A key to sound, adaptive individual support is an understanding of the learners' abilities, strength, competence gaps, learning paths, and perhaps emotional/motivational states. This, in turn, means that a strong and valid in-game assessment is of crucial importance. Val Shute and colleagues [4], in their influential work, often argue that assessment and personalization is often too simplified, abstract, and decontextualized to suit the needs of successful individual learning support. To realize a successful approach to in-game learning we need methods and techniques to support the game systems in assessing learning/development progress and abilities (knowledge or skills) in a formative way and to enable the systems to provide the learners with appropriate and tailored support and guidance.

## TARGETED ISSUE

Micro Learning Spaces (MLS) is an extension of Knowledge Space Theory, which is a psychometric, combinatorial approach to technology-enhanced adaptive assessment and tutoring, developed in the 1980s. MLS is based on knowledge structures, which are based on the relationships of atomic skills (e.g., the ability to add two integers). These relationships establish Knowledge Spaces, which can be interpreted as a set of admissible learning paths from holding none of the competences in a domain to possessing all of them. In MLS, these spaces have been combined with Problem Spaces (i.e., a formal representation of problem-solving steps, which typically appear in digital games), interactive storytelling structures, and Formal Concept Analysis, a conceptual approach to data mining. On this basis, that essentially reflects the pedagogical concept of a learning game, the game as such identify the learner's available and lacking skills, possible knowledge gaps and misconceptions or whether a learning is stuck at a certain step in mastering a challenge in the game. In turn, the game can autonomously adapt difficulty levels, educational interventions, or feedback to the concrete needs of a learner. The details of the approach are described by Kickmeier-Rust and colleagues (2012) [3].



## PROPOSED SOLUTION

In the context of the RAGE project (rage-project.eu), which was the flagship project on serious games, in the context of the European Horizon 2020 programme, we developed software assets for CbKST and MLS, that allow game developers easily integrate educational (stealth) assessment, learning analytics, and educational adaptivity in their games. Technically, the assets are based on C# and tailored to the Unity3D platform. On runtime, the game passes logging information to the asset, which then reasons over learning processes, potential knowledge gaps, successful and unsuccessful problem solving steps as well as motivational states, and recommends appropriate and tailored adaptations (e.g., altering the difficulty level), hints, and feedback. The game can subsequently identify appropriate game elements and adapt the concrete gaming experience accordingly.

*The game can subsequently identify appropriate game elements and adapt the concrete gaming experience accordingly*

## RELEVANT INNOVATION

The solution has been exemplified in a variety of digital educational games, one of them the Watercooler game [2]. This game was developed by Nurogames, Germany in the context of the RAGE project. The player is a person




hired by a game studio to help nurture the "team working" between employees at the studio through interpersonal relationships. Engaged as an office assistant, the explicit goal is to contribute to the studio success by improving, enabling, prompting and challenging the attitudes, values, and social skills of the virtual team the players are placed within. The attitudes and values exhibited by a set of virtual characters may be positive or negative and the game ultimately functions as a mirror, which reflects the player's own values and attitudes. The game was designed mainly for students engaged in subjects to which there is a digital skills bias, in which "soft" skills may be regarded as not important by the student, which is often the case for graduates in technical domains. The game provides recognition and space where students are able to develop meta-skills in a game environment where the failure consequences are much reduced, engendering an understanding of, for example, communication, leadership or conflict management and resolution skills. The name "watercooler game" refers to the main game scenario where the virtual employees meet at a central water dispenser in the office, where social interactions occur.

## PROJECT OUTCOMES & RESULTS

The game can be linked to the CbKST-based reasoning and adaptivity assets, which enables an appropriate educational and motivational adaptation. In this particular case, the adaptation includes an evaluation of conflict management skills based on the Thomas-Kilmann-Model (1974). This scale differentiates two dimensions, assertiveness and cooperativeness, and identifies personal conflict modes along these dimensions. The interactive theory-based adaptations of gameplay and interaction formats, including feedback to the player, turned out to be a successful means of reasoning over the interactions between player and virtual characters and tailoring the game to the learner's abilities and attitudes.

## CONCLUSION

Inevitably, the next generation of digital educational games will need to incorporate smart educational features to meet up high expectations to the genre anduse the full potential of digital games for serious purposes, specifically learning. Research from the field of Learning Analytics and Intelligent Tutoring Systems provides conceptual solutions. With the RAGE project, these solutions are (partly) freely available to game developers in form of software assets.

## PERSPECTIVES & NEEDS

Research and technical development in this area will continue. Specifically trending technologies such as machine learning and data mining will further bolsters the educational value and the possibilities of technical educational solutions for serious games. A significant challenge is bringing these technologies into a broad market. It is on game studios to take up available conceptual and technical solutions and to develop mart educational games. Projects such as RAGE attempt to reduce the barriers by offering educational assets (for example for game analytics, avatar systems, emotion detection, and language processing) that can be easily implemented in educational games without requiring substantial scientific expertise. The assets are available through the platform www.gamecomponents.eu.

## REFERENCES


**[1]** *Clark, D.B., Tanner-Smith, E.E., & Killingsworth, S.S. (2016). Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis. Review of Educational Research, 86(1), 79-122.*

**[2]** Hollins, P., Humphreys, S., Sleightholme, G., & Kickmeier-Rust, M. D. (2017). *The Watercooler Game. The 11th European Conference on Games-based Learning (ECGBL)*, October 5 – 6, 2017, Graz, Austria.

**[3]** Kickmeier-Rust, M.D., & Albert, D. (2012). *Educationally adaptive: Balancing serious games. International Journal of Computer Science in Sport, 11(1)*, 15-28.

**[4]** Shute, V., Ke, F., & Wang, L. (2016). *Assessment and Adaptation in Games. In P. Wouters and H. van Oostendorp (Eds.), Techniques to Improve the Effectiveness of Serious Games, Advances in Game-Based Learning.*

# SESSION HEALTH STAFF-ORIENTED

**THURSDAY 1 OCTOBER**
16:00–17:15

STÉPHANE GOBRON

FIORENTINO ASSUNTA

SYLVIA GONZALEZ

# 5 OBJECT HUNT FOR SPEECH THERAPY

**Gobron Stéphane** [1], **Skoruppa Katrin** [2]
1: Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland
2: UNINE, Neuchâtel, Switzerland

*Contact: stephane.gobron@he-arc.ch*

## ABSTRACT

Speech is one of the main ways to communicate in our society, that's why speech-language pathologies, which can affect anybody at any age, can be a real obstacle for a normal everyday life. The problems are well known, and speech-language pathologists specialize in helping the patient overcome their issues expressing themselves orally. The exercises usually provided are mostly very repetitive and can quickly become boring. The transposition of the exercises into a digital platform as a point-and-click object hunt adds a playful dimension to an otherwise uninteresting activity. Furthermore, the addition of a speech-recognition algorithm specialized in speech-impairment allows automatic task evaluation and helps relieve the therapist's work.

## KEYWORDS

Serious game, speech impediment, health.



## CONTEXT

Speech therapy is a related health profession practiced by speech-language pathologists (SLP). The disorders can appear at many stages in life. Their cause can be organic (sensory, motor, neurological disorders or dysfunctions) or psychosocial (developmental difficulties, socio-cultural deficiencies). The intervention field is vast, touching as well adults as children. Many speech therapy group games exist, mainly card games. Still, individual sessions are not as playful, with the most common exercise being the presentation of an image to the patient and asking him to pronounce the word and make a sentence with it. The game sessions have several difficulty levels with irregular words, silent letters or similar pronunciations. The material for these exercises is mainly printed on cards by the therapist. Each patient configuration is done manually, depending on his situation and needs.

## TARGET ISSUE

The issues in the current method are plenty. For the patient, the proposed tasks can quickly become uninteresting and even frustrating, especially for younger children. Repetitiveness and lack of interaction diversity are not very engaging and can even create an aversion towards some exercises. For the therapist, the session preparation is done by hand and can be very long. The results of a session are taken and reported manually in a tedious process, and the results are not analyzed automatically.

## PROPOSED SOLUTION

This project proposes to transpose these exercises in a point-and-click hidden object game. More specifically, the patient must find some specific objects in an image full of objects. Nor only does he have to understand the word but he must also find it in the image and correctly pronounce a given sentence. The quantity of objects in the room, the type and number of objects to be found, is decided by the therapist and saved for later sessions. The score is saved in order for the therapist to see the patient's progress. In the app first version, the pronunciation was evaluated by the therapist; in the second, advanced options for result viewing and reporting have been considered.



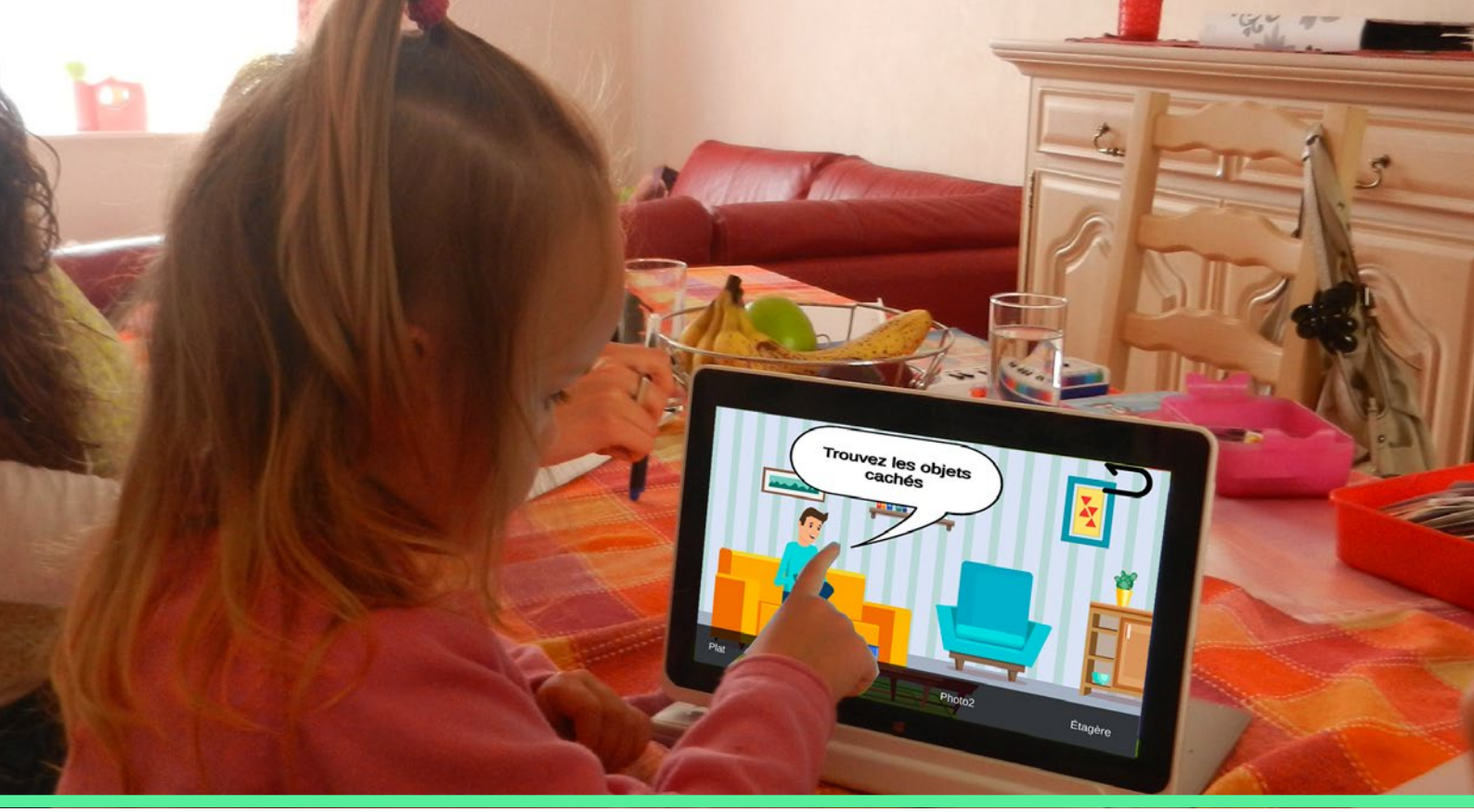
## RELEVANT INNOVATION

The main innovation is a voice recognition algorithm that allows automatic evaluation of the pronunciation with personalized feedback and rewards. This is a real challenge as most of the patients suffer from some speech impediment. The project will use databases of transcribed interactions with speech-impaired patients to train the algorithm for speech recognition. Furthermore, the removal of a systematic human evaluation can help the patient relax, as they feel less judged. The serious game provides a better engagement as well as a better overall feeling about the therapy. The creation of a platform digitalizing the patient results and progress helps the therapist have a better overall view of the situation.

*This project aims to bring assistance to a field that is rarely targeted by technological health innovations*

## PROJECT OUTCOMES & RESULTS

A prototype has been done, including three levels in the same room. The number and type of objects can be configured through an editor interface. The pronunciation validation is temporarily carried out by the therapist, as the speech recognition algorithm is not ready yet. The next step is to add more levels, with more objects and several "styles" of levels (cartoon, photorealistic, futuristic ...). The final step will be to integrate a speech recognition algorithm, tailored to different speech impediments. The final app will be deployed on a computer, with therapist access enabling patient data export into appropriate files.






## CONCLUSION

This project aims to bring assistance to a field that is rarely targeted by technological health innovations. It intends to bring more fun and enjoyable experience to the patient and ease the therapist's work by providing help for repetitive tasks via a partially automated analysis system.

## PERSPECTIVES & NEEDS

The needs for the projects are now the creation of an object database and the creation of more scenarios addressing different real-life problems for patients and therapists. The testing on patients is also a requirement throughout the app development.

## ACKNOWLEDGEMENTS

He-Arc, UniNE

## REFERENCES

[1] Pedroli, Elisa & Padula, Patrizia & Guala, Andrea & Meardi, Maria & Riva, Giuseppe & Albani, Giovanni. (2017). *A Psychometric Tool for a Virtual Reality Rehabilitation Approach for Dyslexia. Computational and Mathematical Methods in Medicine.* 2017. 1-6. 10.1155/2017/7048676.

[2] Rello, Luz & Bayarri, Clara & Otal, Yolanda & Pielot, Martin. (2015). *A Computer-Based Method to Improve the Spelling of Children with Dyslexia. ASSETS14 - Proceedings of the 16th International ACM SIGACC ESS Conference on Computers and Accessibility.* 10.1145/2661334.2661373.

[3] Vanessa Harrar, Jonathan Tammam, Alexis Pérez-Bellido, Anna Pitt, John Stein, Charles Spence, *Multisensory Integration and Attention in Developmental Dyslexia, Current Biology, Volume 24, Issue 5, 2014,* Pages 531-535, ISSN 0960-9822.

# 6 SERIOUS GAME TO EXPLORE DECISION-MAKING BY TRIAGE NURSES IN A STRESSFUL ENVIRONMENT

**Fiorentino Assunta[1], Delmas Philippe[1], Simon Josette[2], Antonini Matteo[1], Jaccard Dominique[3], Hulaas Jarle[3], Hugli Olivier[4], Vuilleumier Séverine[1], Stotzer Guy[1], Kollbrunner Aurélien[1], Gilart de Keranflec'h Charlotte[5]**

1: La Source, School of nursing, HES-SO, Lausanne, Switzerland
2: Geneva University Hospitals, Geneva, Switzerland
3: School of Engineering and Management, HES-SO, Yverdon-les-Bains, Switzerland
4: Lausanne University Hospital, Lausanne, Switzerland
5: University of Health Sciences, HES-SO, Lausanne, Switzerland

*Contact: a.fiorentino@ecolelasource.ch*

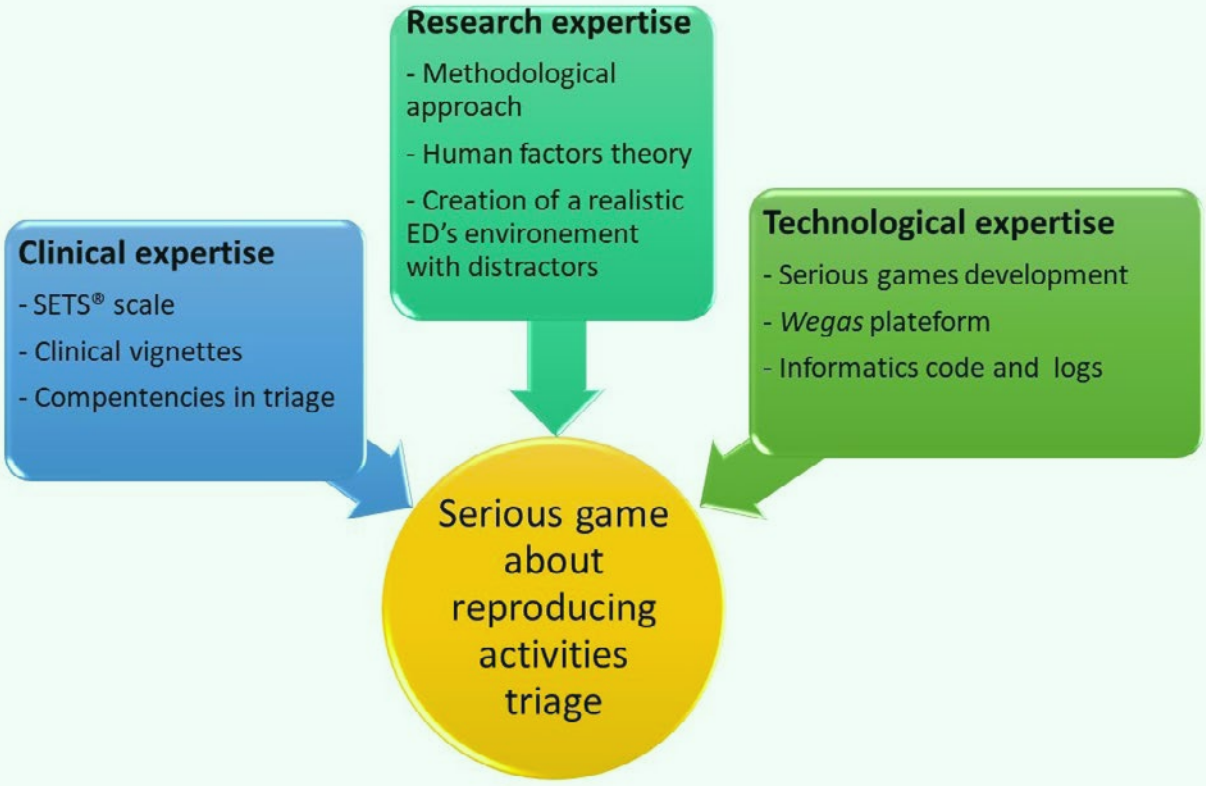
## ABSTRACT

Clinical judgment and decision making are critical components of the nurse function in emergency departments (ED), and more specifically in the field of triage [1]. In order to test the influence of stressors on triage quality, we developed a serious game to reproduce real work conditions in an ED setting. The aim of this first study is to evaluate this serious game feasibility and acceptability. Further research is planned to use the serious game to measure nurses' emotions during triage.

## KEYWORDS

Decision-making, triage, emergency, nurse, serious game.





## CONTEXT

Triage is one of the most important steps in patient admission in emergency departments. Triage decisions have an impact on patients' health and on the use of ED resources and organization [2]. To our knowledge, there is no scientific data on a serious game giving a dynamic approach using 2D patients with clinical written vignettes in an interactive ED environment. Previous research studies on triage evaluation have been conducted with written clinical vignettes, an observational approach or a basic simulator that limits the reproducibility and realism of the triage process [3, 4]. The creation of our serious game was a collaboration between different partners including the School of Engineering and Management (HEIG-VD), La Source (School of nursing), the University of Applied Sciences and Arts Western Switzerland (HES-SO), HESAV-University of Health Sciences the University of Applied Sciences and Arts Western Switzerland (HES-SO) and clinical experts from the Geneva University Hospital and the Lausanne University Hospital, both partners of the Swiss Emergency Triage Scale (SETS®) group (See image above).

## TARGETED ISSUES

Triage activities rely on a complex clinical reasoning process. In 12 hours, a triage nurse assesses the severity of 80 patients, and makes several decisions for each of them. Currently, nurse's training in triage differs in the number of training hours as well as in the training methods, which include direct coaching and vignette-based learning. Serious games are an innovative approach in educational health training. Our serious game revolves around the following main objectives:



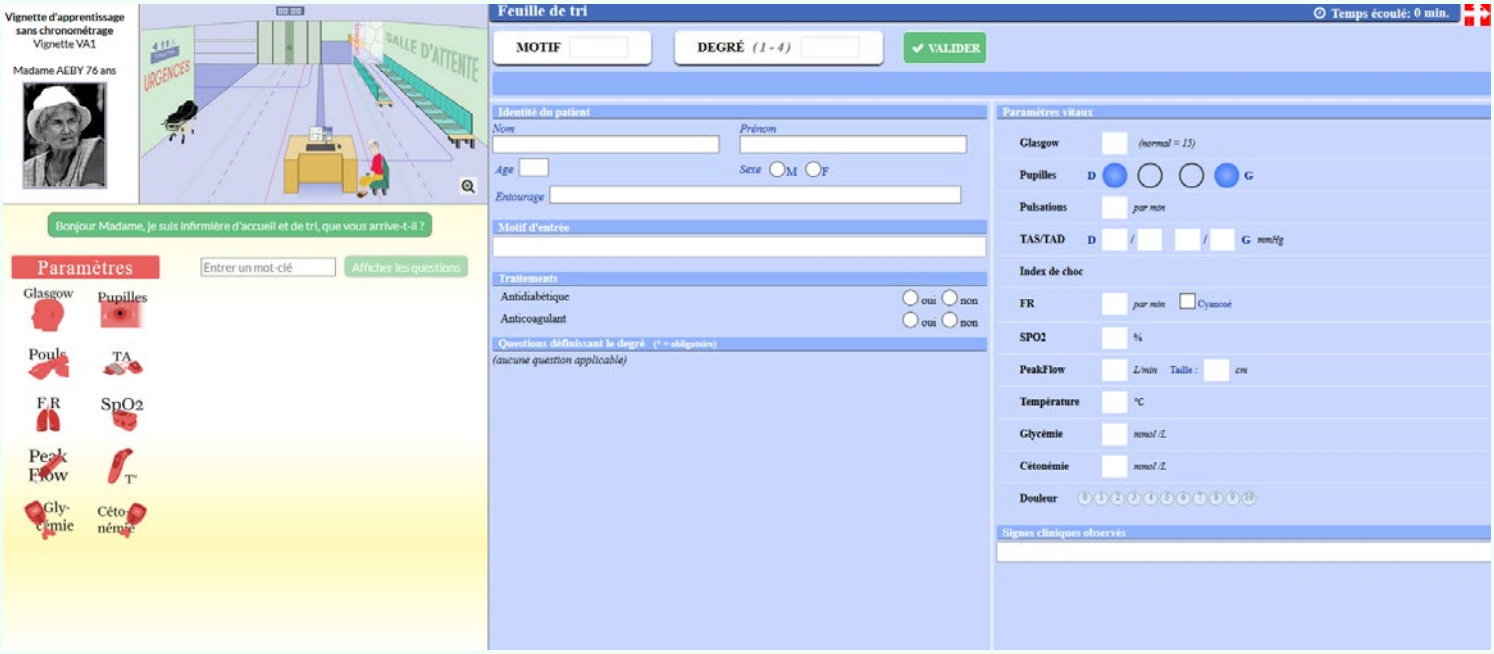
- Analysing decision-making in a realistic triage zone
- Assessing the emergency level degree chosen by the triage nurse on each clinical vignette
- Rating this serious game acceptability in an emergency nurse population

*This serious game offers a realistic immersion, reproducing triage activities*

This work will report the different triage activities that we reproduced in this serious game, like reporting present illness history, collecting vital sign measurements or using SETS® specific criteria. We also describe technical features like sound effects, task interruptions and triage zone design.

## PROPOSED SOLUTION

Triage is a dynamic activity based on patient-nurse interactions. To reproduce this activity, we started from a basic interactive simulator based on simple questions-answers interactions that included 30 clinical vignettes [5, 6]. This was our first prototype. To create a more realistic simulator, we added a dynamic 2D virtual environment replicating an ED waiting room. We created 20 clinical vignettes whose accuracy and consistency were tested by nurse experts. We added 20 2D figures reproducing patient's arrival in emergency by ambulance or wheelchair. We modelized 10 interruption tasks and 10 sound effects representing distractors frequently present in an ED: They were programmed to interfere with specific tasks like anamnesis or vital sign measurement. The serious game records the questions from nurse's anamnesis (See image below), vital sign transcription, the chosen level of emergency and listing of patient complaints according to the SETS®. The serious game is hosted on the Wegas platform developed by AlbaSim (www.albasim.ch), which is the "serious game" research axis of the Media Engineering Institute at the HES-SO.






## RELEVANT INNOVATION

This serious game offers a realistic immersion, reproducing triage activities like different mode of patient arrival i.e. ambulance transport, sounds and task interruption. Triage process could be reproduced using classical simulation with standardized patients or high-fidelity mannikins. Both solutions are very costly and difficult to integrate in a resource strained ED environment. Our approach is innovative, light and easy to use. Also, it proposes a valid alternative to initiate nurses to their triage function. This serious game is a valid tool to evaluate nurses' performance before exposing them to triage real conditions. Currently, there are numerous EDs using the SETS® in the French-speaking part of Switzerland. Our serious game also allows to analyze the performance between diverse EDs triage comparing different results like needs in nurse's triage training. Furthermore, it can be reprogrammed to customize the content for the junior year of nursing bachelor program when students learn the basis of patient anamnesis.

## PROJECT OUTCOMES & RESULTS

Our serious game was tested in a group of 80 triage nurses recruited in six Swiss EDs. Its main outcomes were to evaluate the serious game feasibility and acceptability:

- the serious game qualities were measured with the AttrakDiff® scale [7].
- the serious game realism was rated using a visual analogic scale, where the nurse evaluates the perception of the realistic reproduction of triage activities.
- the research team used a research diary to note all technical issues which happened while the nurses played the serious game on a laptop.

## CONCLUSION

This serious game is an innovative product to train triage nurses and improve their performance and the quality of the entire triage process, i.e. the accuracy of emergency level and patient complaints. Further research is planned to measure emotions like stress perception or clinical reasoning analysis. This is a first step to explore and analyze complex triage activities.

## PERSPECTIVES & NEEDS

To further evaluate our serious game possibilities, it is necessary to improve this first version by introducing stressors or adding other triage activities like waiting room management. A nursing doctoral thesis on measuring stress in triage nurses is being carried out. This serious game can also become a valuable tool for teachers and to improve quality in emergency departments. Its implementation with longitudinal measures in emergency departments can be proposed to emergency nurses' managers.

## REFERENCES


[1] Stanfield L.M. *Clinical Decision Making in Triage: An Integrative Review. J. Emerg Nurs: official publication of the Emergency Department Nurses Association.* 2015;41(5):396-403.

[2] Considine J., Thomas S., *Potter R. Predictors of critical care admission in emergency department patients triaged as low to moderate urgency. Journal of advanced nursing.* 2009;65(4):818-27.

[3] Dallaire C., Poitras J., Aubin K., Lavoie A., Moore L., Audet G. *Interrater agreement of Canadian Emergency Department Triage and Acuity Scale scores assigned by base hospital and emergency department nurses. Cjem.* 2010;12(1):45-9.

[4] Considine J., Le Vasseur S.A., Villanueva E. *The Australasian Triage Scale: examining emergency department nurses' performance using computer and paper scenarios. Annals of emergency medicine.* 2004;44(5):516-23.

[5] Rutschmann O.T., Kossovsky M., Geissbuhler A., Perneger T.V., Vermeulen B., Simon J., et al. *Interactive triage simulator revealed important variability in both process and outcome of emergency triage.* J Clin Epidemiol. 2006;59(6):615-21.

[6] Rutschmann O.T., Hugli O., Marti C., Grosgurin O., Geissbuhler A., Kossovsky M., et al. *Reliability of the revised Swiss Emergency Triage Scale: a computer simulation study. European Journal of Emergency Medicine.* 2017; Publish Ahead of Print.

[7] Hassenzahl M., Burmester M., Koller F. *AttrakDiff: Ein Fragebogen zur Messung wahrgenommener hedonischer und pragmatischer Qualität. In: Szwillus G, Ziegler J, editors. Mensch & Computer 2003: Interaktion in Bewegung. Wiesbaden: Vieweg+Teubner Verlag; 2003.* p. 187-96.

# 7 "END OF LIFE", A SERIOUS GAME TO DEVELOP SKILLS FOR HEALTHCARE PROFESSIONALS

**Gonzalez Sylvia, Charmillot Pierre-Alain, Senn Julien, Gobron Stéphane**
Haute Ecole Arc, HES-SO, Neuchâtel, Switzerland
*Contact: sylvia.gonzalez@he-arc.ch*

## ABSTRACT

The increase in life expectancy has an impact on all areas of medicine in Europe. Health professionals, particularly nurses will have to be better trained to meet the palliative care needs of an ageing population. Therefore, the Serious Game "End-of-Life" was created to involve caregivers in a realistic palliative care context. This game was first tested with nursing students. Given the use of questionnaires, the new objective wants to test whether the game contributes to behavioral changes. The current article focuses on the methodology and the used analyses to assess the game.

## KEYWORDS

Serious-game, palliative care, relational skills, communication, education, nursing, assessment.



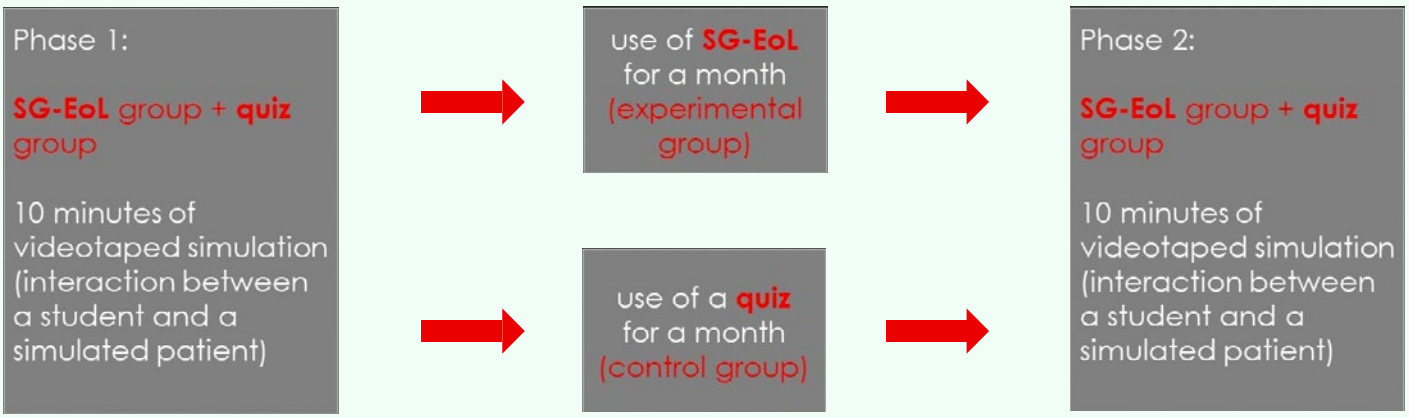



Table 1 : Procedure

## CONTEXT

Demographic change in Europe is responsible for a growing need of palliative care [1]. Successful interventions in palliative care may improve patient's well-being and health, in part through effective communication [2]. This implies that caregivers (particularly nurses) must have relational skills in addition to medical techniques [3]. Relational skill acquisition in nursing is complex because skills build up as the nursing experience unfolds. Scenario-based learning used in nursing education could lead students to apply clinical behaviours without improving their self-awareness which is crucial for relational skills development [4]. Thus, virtual reality is particularly suitable for such a training since it places the student at the center of a realistic scenario outside the educational context. As e-learning currently focuses on surgery, a Serious Game, – "End of Life" (SG-EoL), was created [5] to develop caregivers' relational skills. Through several chapters, SG-EoL recreates interactions between a young nurse (the player) and a patient at the end of his life. For each intervention, the player must choose among several responses and accumulates points that reflect his behavior appropriateness toward the patient. A user test was conducted with nursing students using a questionnaire. Since it does not assess the educational effectiveness of the SG-EoL [6], a behavioral assessment will be carried out through an experiment.

## TARGETED ISSUES

As mentioned earlier, the need for training in palliative care is rising. Nurses are the most concerned health professionals by this demand. They need to develop relational skills to meet "good practice" standards. Relational skills development is therefore crucial to the implementation of quality palliative care. The use of a SG-EoL could help to reach this goal. A first user test has already been carried out through questionnaires showing a good adhesion of nursing students to this tool. Now we must test the behavioral game influence to see if its use can significantly improve nursing students' relational skills.



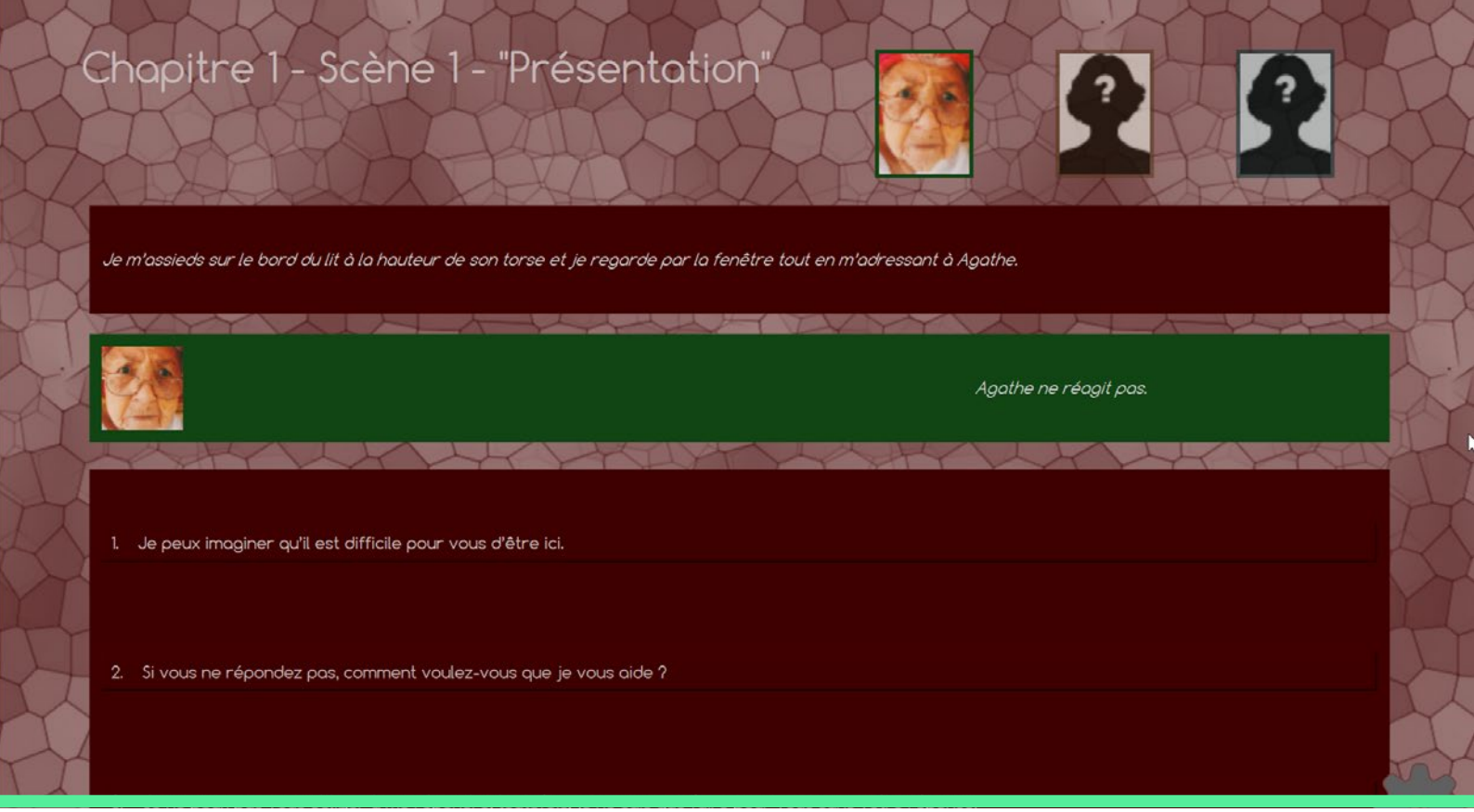
Thus, this project main objective is to investigate the SG-EoL effect on the development of nursing students' relational skills via an experiment.

As the project is currently underway, this article will focus on describing the methodology and analysing the statistical data, used to get to this objective, which explains why the operational hypotheses are exceptionally presented in the Results section.

## PROPOSED SOLUTION

*We expect students to develop self-awareness, which will lead to the development of relational skills*

An experiment was used to assess the SG-EoL efficiency. Nursing students were recruited to participate in the evaluation and were randomly assigned either to a test group where they trained with the SG-EoL or to a control group where they tested their palliative care knowledge with a quiz. Before and after using these games, the relational skills of both groups were assessed to determine if the SG-EoL influenced their development. Specifically, the research proceeded as follows (table 1): A first phase videotaped the student' relational skills with a simulated patient at the end of his life. Then, each group received either the SG-EoL or the quiz and played for a month at a minimum frequency of once a week. The game got two additional chapters that let students follow the patient from his arrival in the nursing home until his death. A second phase also videotapes the student with the same patient. The video content will then be annotated using ELAN (version 5.8) so as extract the verbal and non-verbal data linked to relational skills [2] and compare them. Verbal content (socio-emotional, emotional, content and silences) and non-verbal indicators (emotional touch, many glances indicating attentive listening, many affirmative gestures (such as nods) and a more patient-oriented position) are the variables of interest that will be compared in both groups between both phases.






## RELEVANT INNOVATION

Using an experimental method to assess the SG-EoL allows using state-of-the-art statistical analysis techniques. Mixed models will be conducted to measure the use of verbal and non-verbal modalities depending on the use of SG-EoL or the quiz. Since these modalities are qualitative, Generalized Linear Mixed Models (GLMMs) will be produced in order to test the influence of the SG-EoL and the quiz between phases 1 and 2 on each modality [7]. These analyses are an extension of the General Linear Model (fixed effect model such as ANOVA or Regression) and have the advantage of modelling repeated data (such as data produced in phases 1 and 2) by taking into account a fixed part that represents the effect on the students, and a random part specific to each individual. As in the case of an ANOVA, fixed effects in GLMMs are the factors for which we want to observe a change in the interest variable (for example, a difference on the verbal content between the test and control group and phases 1 and 2). Random effects concern the modeling of the variance around subjects (nursing students). The model thus considers 1) the inter-individual variability, i.e. the difference in population behavior between both phases and both groups; and 2) the intra-individual variability, that is i.e. each subject specific behaviour between both phases and groups. So, thanks to significant results from GLMMs we are able to generalize the results to the target population.

## PROJECT OUTCOMES & RESULTS

The project is currently underway, 30 students have been recruited so far and have gone through the first phase of evaluating their interpersonal skills. Based on the videos, we will annotate and quantify the modalities of both variables verbal content and non-verbal indicators. After coding the videos of the second phase, we will conduct the statistical analyses described above to determine the game impact on the evolution of nursing students' interpersonal skills. Although we do not yet have results, we formulate specific hypotheses which partly depend on the research presented in the first section (context): about our main objective, we expect students to develop self-awareness, which will lead to the development of relational skills, during the different interactions with the patient. This should be expressed by a posture change when caring for a patient at the end of his/her life: specifically, we expect to see more empathetic, compassionate behaviors which lead to an increase of some verbal and non-verbal modalities after the use of SG-EoL. In particular, we expect an increase of socio-emotional, emotional (patient-oriented) content and silences. In addition, the student would also produce more emotional touches, more glances indicating careful listening, more affirmative gestures (such as nods) as well as a more patient-oriented position. The SG-EoL group should show a greater increase than the quiz one.

## CONCLUSION

A SG-EoL was created to meet the need of palliative care training. With this game we want to place the caregiver in a realistic clinical environment. A first user test was carried out on nursing students but couldn't confirm its educational effectiveness. Therefore, the current project aims at assessing the SG-EoL through an experimental setting and use of GLMMs to determine whether it has an influence on the relational skills development in nursing students.

## PERSPECTIVES & NEEDS

As the SG-EoL use is intended for all healthcare professionals, the next step will be to measure the game influence on different medical professions (doctor, nurse, nursing assistant...) in varied medical fields. This will require further developments of the SG-EoL by adding a wider range of answers and allowing players to insert their own answers. Considering the specific answers of each player could improve the game and enable the development of a specific version for each medical field.

## ACKNOWLEDGEMENTS

Isabel Gindrat, Daniel Ducommun, Julien Senn, Nicolas Sommer (HES-SO), and Sandra Loconi (MSc in psychology). The University of Applied Sciences and Arts Western Switzerland. The Swiss Academy of Medical Sciences. The Stanley Thomas Johnson Foundation.

## REFERENCES



[1] Allen M. L. (2018). Examining Nursing Students' Stress in an End-of-Life Care Simulation. Clinical simulation in nursing 14, 21 – 28.

[2] Bone A. E., Gomes B., Etkind S. N., Verne J., Murtagh F.E.M., Evans C. J. & Higginson I. J. (2018). What is the impact of population ageing on the future provision of end-of-life care? Population-based projections of place of death. Palliative Medecine 32 (2), 329 – 336.

[3] Charmillot, P. A. & Gobron, S. (2017). Jouer pour mieux accompagner la mort de l'autre : est-ce bien sérieux ? Médecine & Hygiène 32, 37 - 44.

[4] Gorbanev, L., Agudelo-Londoño, S., González, R. A., Cortes, A., Pomares, A., Delgadillo, V., Yepes F. J., & Muñoz, O. (2018). A systematic review of serious games in medical education: quality of evidence and pedagogical strategy. Medical Education Online 23, 1438718.

[5] Lo, S. & Andrews, S. (2015). To transform or not to transform: using generalized linear mixed models to analyse reaction time data. Front. Psychol. 6:1171.

[6] Rawlings, D., Devery., K., Poole, N., (2019). Improving quality in hospital end-of life care: honest communication, compassion and empathy. BMJ open quality, 8: e000669.

[7] Terrill, A. L., Ellingtonb, L, Johnc, K. K., Latimerb, S., Xud, J., Rebline, M., Claytonb, M. F. (2018). Positive emotion communication: Fostering well-being at end of life. Patient education and counseling 101 (4), 631 – 638.

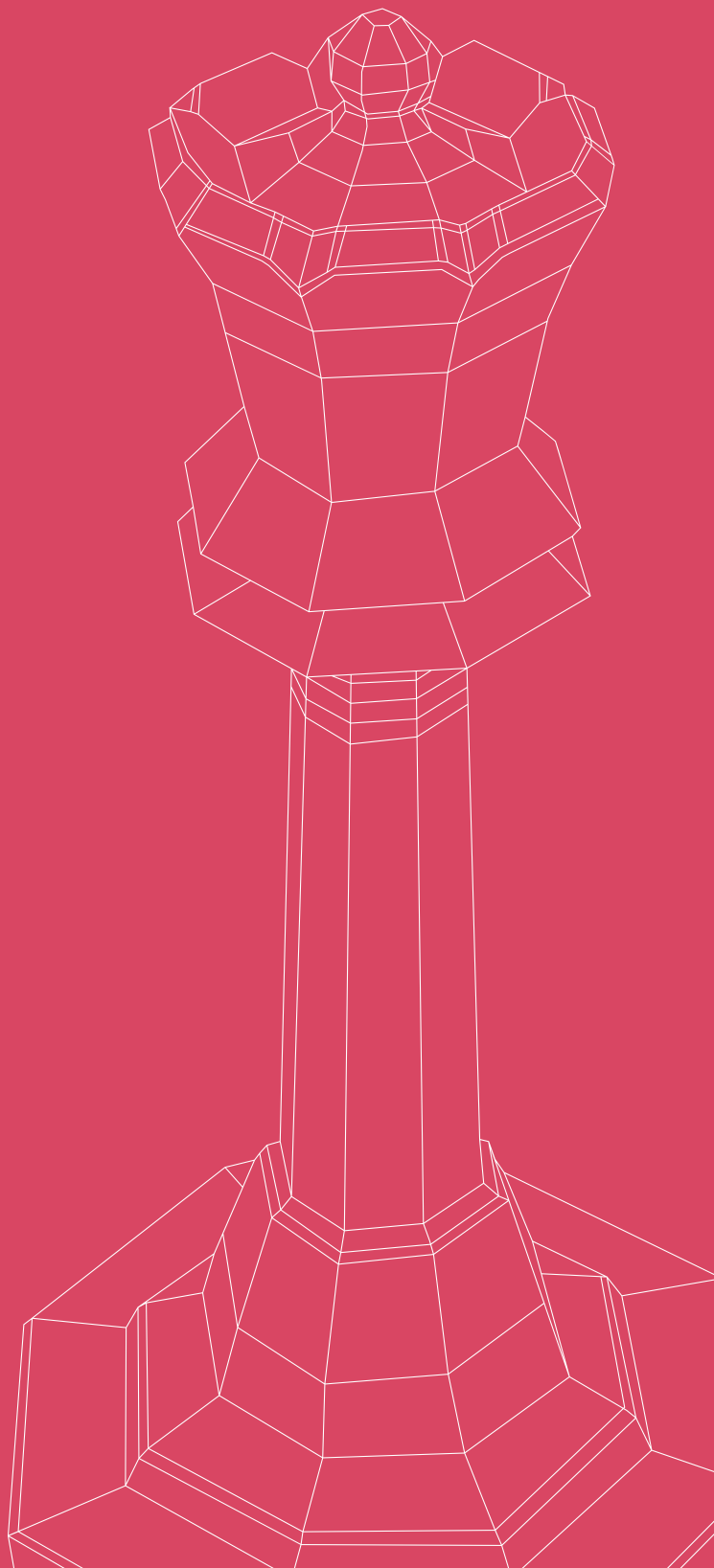
# SESSION PERSONAL & PROFESSIONAL TRAINING

**THURSDAY 8 OCTOBER**
16:00–17:15

MARIA SISTO

AXEL COLLET

STEFANO CARRINO



# 8 IMANUVISU: A VISUALIZATION AND GAMIFICATION SYSTEM FOR A MECHANICAL MAINTENANCE MANUAL

**Sisto Maria**
Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

*Contact: maria.sisto@he-arc.ch*

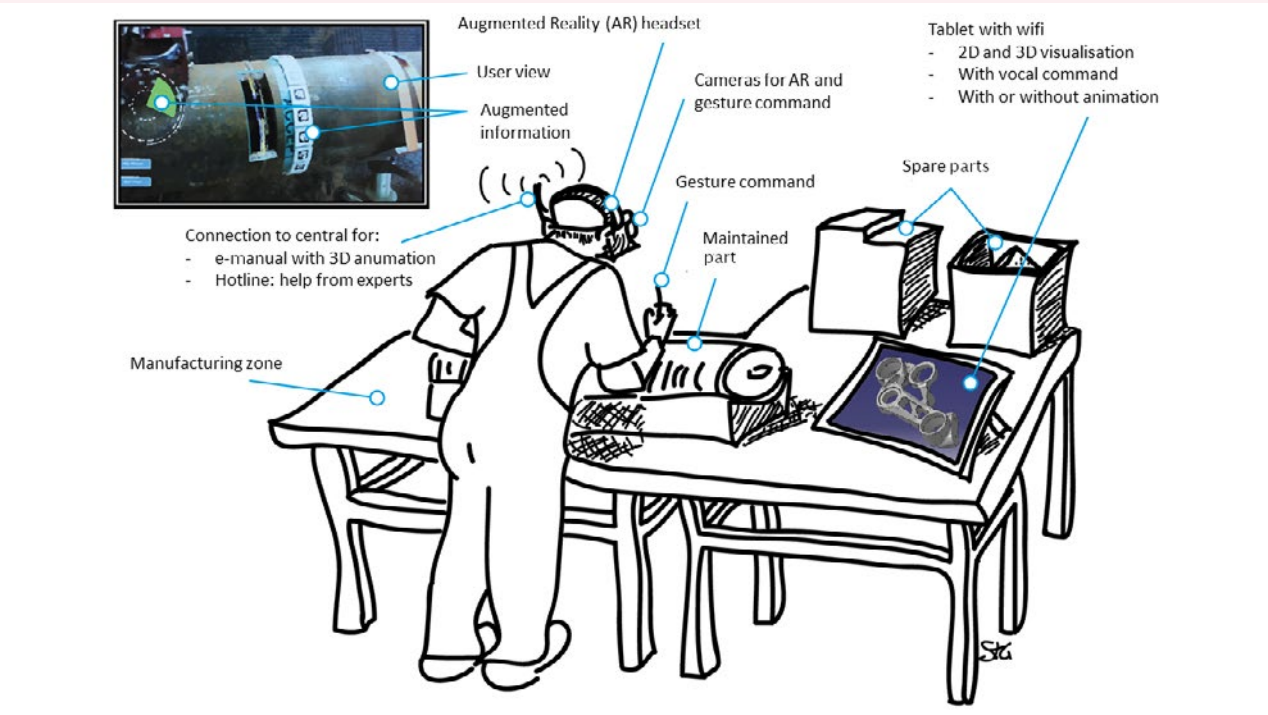
## ABSTRACT

In the industry, user manuals are usually complicated and impractical: indeed, finding the right information can be a challenge, especially for inexperienced technicians. This situation leads to a loss of time and an increased risk of human error. This project wants to ease finding information and provides an interactive and intuitive 3D training platform to visualize the procedure. Gamifying the platform is not only beneficial in the training phase but also in the manual phase, valorizing workers, and potentially increasing the quality of their work. At a longer term, the aim is to enable experienced workers to provide input and advice on procedures, easing personal experience sharing.

## KEYWORDS

Training, visualization, 3D animation, procedure.





## CONTEXT

Many industries, such as the railway sector, require the assembly and maintenance of complex and even dangerous equipment (e.g., train traction transformers). Nowadays, a paradoxical situation is taking place: complicated operations are done by qualified operators with a high risk of error. Furthermore, the maintenance information is provided in lengthy user manuals containing countless details on system and maintenance procedures. The critical and relevant information is, therefore, difficult to find, increasing the risk of the operator missing it and thus resulting in potential accidents and a waste of time, energy and money.

## TARGETED ISSUES

The current target issue focuses on a specific applied field: the world leader in train traction transformers, facing every day with maintenance operation, indoors, and outdoors. As the transformer models and their associated manuals are numerous, efficiently getting the right information is not possible for inexperienced technicians. Moreover, a slight error like a sequence inversion in the assembly can result in damage beyond repair and even cause an explosion. The consequences are immediate and cause financial loss or shipment delay.

## PROPOSED SOLUTION

This project goal is to create a software that helps technicians with the procedure. It aims to provide training as well as foster procedure access. Creating a library, containing the 3D models with their procedures, helps finding the right piece of information. The different procedures are transcribed into animated 3D models, allowing a better visualization and understanding of the different steps. Based on this, the app proposes two modes: user manual mode and training mode. The user manual mode should be usable during the maintenance procedure to assist the technician. By deploying it on a portable device (i.e. a tablet), the app provides step by step actions to be performed by the technician, including warnings and advice. The procedure is remote-controlled (voice or movement-activated) and allows hand-free navigation through the procedure. The training mode provides a virtual training environment, where the user can manipulate the models and try out procedures without real-life consequences.



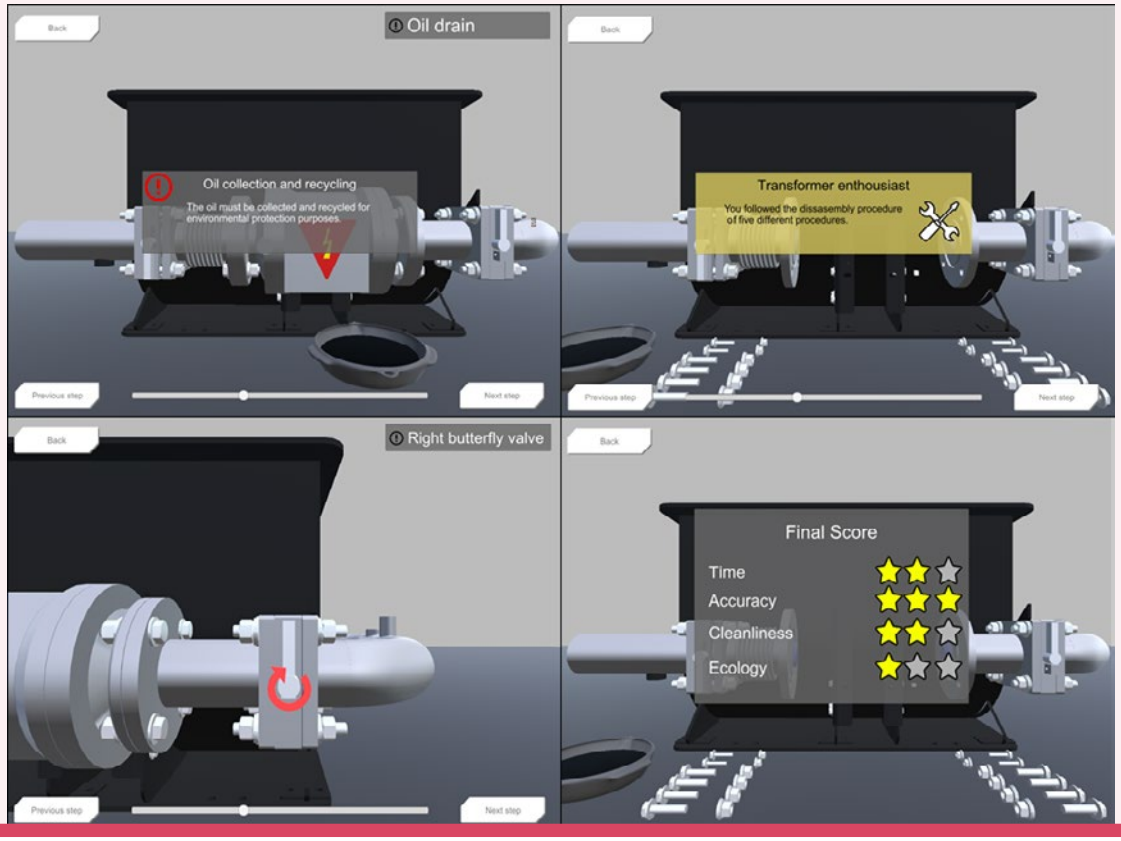
## RELEVANT INNOVATION

*This project goal is to create a software that helps technicians with the procedure*

In addition to providing a more accessible platform for procedure and training, the project aims at rewarding and promoting user engagement with gamification. A system of reward and achievements is used in both app modes. The different trained and followed procedures give achievements adapted to the procedure and model type (i.e. “You read the installation procedure for five different transformers!”). The training mode contains more gamification elements, with different levels of difficulties (easier levels giving more hints) and different activity contexts (inside a workshop, on-site, on an operating system). The score is computed on different criteria: time efficiency, cheapness, ecology, cleanliness, task completion. To highlight critical procedure parts, failing some task types means failing the level and starting over (i.e. forgetting to shut down the power source). The different training scenarios are generated by using the manual instructions. In the long run, the aim is to let certified users add content by providing pointed advice based on personal field experience.

## PROJECT OUTCOMES AND RESULTS

The current prototype allows an animated procedure visualization on a CAO-exported 3D model. The instructions are given as a user-editable file, which let filed experts generate procedures. The prototype has also been deployed as an Augmented Reality experience on iPhone and Microsoft HoloLens. These platforms’






usability and use case relevance are currently being assessed. Microsoft HoloLens, in combination with a tablet, is also strongly considered for on-site interventions.

## CONCLUSION

The project IManuVisu provides a solution to the error-prone labor tasks in assembling complex and dangerous equipment, by digitalizing the user manual in a 3D app. The app also gives training and gamification in a virtual environment.

## PERSPECTIVES AND NEEDS

The next step is to establish a catalog of a few models with associated procedures and realize the necessary scenarios for training. The prototype will be usable on both tablets and computers for a flexible use.

## ACKNOWLEDGEMENTS

Thanks to HES-SO for supporting this project.

## REFERENCES

[1] Busck, N.: 2017, *Assembly Instructions for the Swedish Manufacturing Industry of the Future., Master's Thesis, Chalmers University of Technology.*

[2] Warmelink, H., Koivisto, J., Mayer, I., Vesa, M., & Hamari, J. (2018). *Gamification of production and logistics operations: Status quo and future directions. Journal of Business Research.*

[3] M. C. Leu, H. A. Elmaraghy, A. Y C Nee, S. K. Ong, M. Lanzetta, M. Putz, W. Zhu, and A. Bernard., *CAD model based virtual assembly simulation, planning and training, CIRP Annals – Manufacturing Technology,* 62(2):799–822, 2013.

# 9 IMPROVING A DIGITAL MANUFACTURING OPERATION MANUAL THANKS TO AUGMENTED REALITY

**Collet Axel[1], Rosset Nicolas[1], Duay Valérie[1], Bourquin Stéphane[1], Gobron Stéphane[2], Abou Khaled Omar[3]**

**1 :** Haute école du paysage, d'ingénierie et d'architecture, HES-SO, Geneva, Switzerland

**2 :** Haute école d'ingénierie et d'architecture de Fribourg, HES-SO, Fribourg, Switzerland

**3 :** Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

*Contact: axel.collet@hesge.ch*

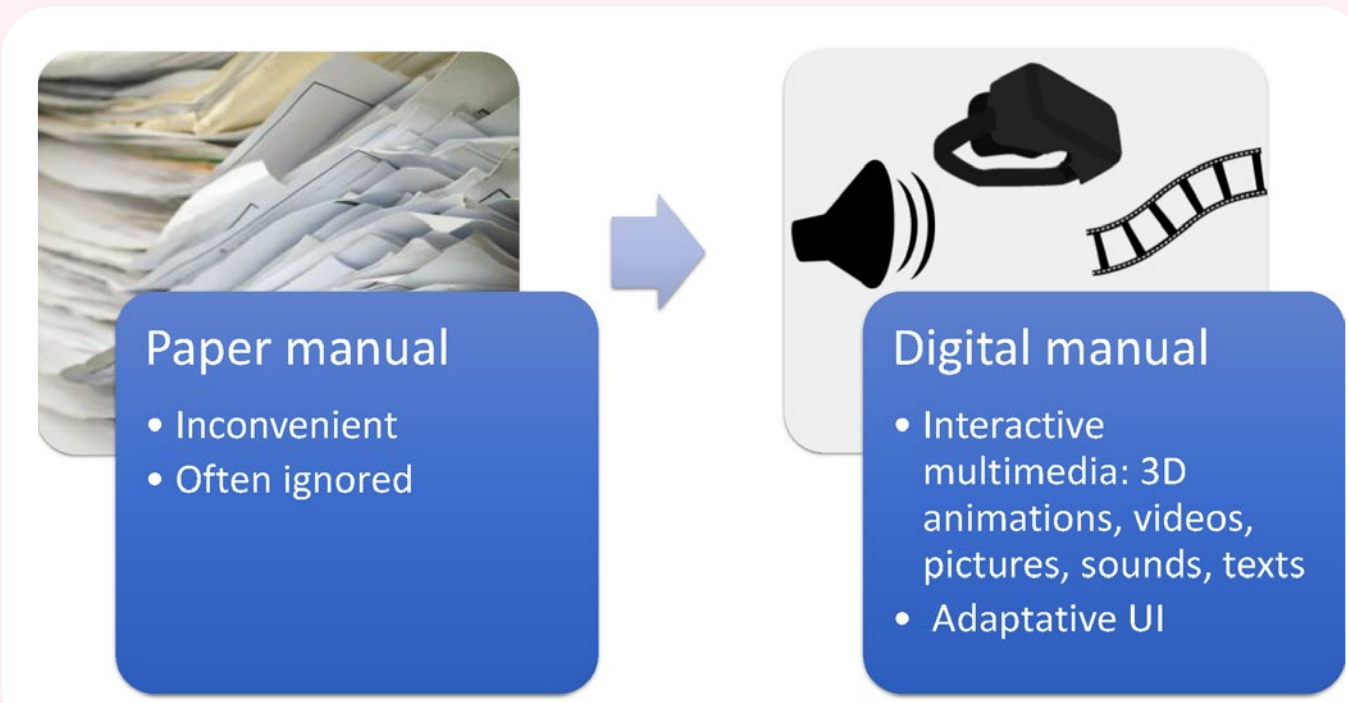
## ABSTRACT

A traditional paper guide for industrial maintenance tasks has been transformed into a digital one composed of three augmented reality supports: augmented reality glasses, spatial projection, and video stream superimposition. For the last two, the recording is done by a 6 degree of freedom (translation and rotations) tracking algorithms by deep learning on synthetically generated data. Tests in an industrial environment showed very good results and also that each support has its own advantages depending on the to-do task.

## KEYWORDS

Neural network, deep learning, Unity, augmented reality, spatial projection, HoloLens, 6 DOF tracking, industrial maintenance tasks.





## CONTEXT

In the industry sector, training and maintenance operations are essential tasks carried out by operators to ensure the proper machine functioning. Currently, these tasks are performed with the help of paper guides. Unfortunately, errors occurring during maintenance may seriously damage machines. Companies have reported two problem sources. They can come from inadequate training or from a technician, who because he carries out maintenance without referring to the guidelines, introduces manipulation errors. Paper guide use is rather monotonous and not pedagogical enough. Once trained, the employee will no longer refer sufficiently to the paper manual, increasing the risk of introducing errors.

## TARGETED ISSUES

We wish to cater companies while providing a more pleasant solution for maintenance technicians. Indeed, these maintenance steps are repetitive and thus monotonous.

In collaboration with the University of Applied Sciences HE-ARC, we have developed an augmented reality platform based on a new digital manual with 3D animations developed from one paper version and adapted to several augmented reality supports. These innovative supports give solutions to companies and provide technicians with a new training and maintenance solution, giving the operators more flexibility to choose what they like and need depending on the task they have to perform.

By improving these issues, we hope to contribute to the digital industry transformation (Industry 4.0) by providing companies with a solution that reduces maintenance errors. The firms and their employees could therefore be this development winners.



## PROPOSED SOLUTION

We developed the same digital manual on three different reality augmented supports in order to adapt as well as possible to training or maintenance assistance situations, by taking into account the machine operator's knowledge level. Moreover, having several different prototypes allows us to propose a comparison to companies and operators when defining their future needs and contributions that augmented reality may bring. We want to reduce the digital guide adaptation time into an augmented reality guide thanks to the 3D Unity game engine. Ease and time of adaptation are two essential criteria for this technology to be integrated into the industrial world. A more playful training will have two advantages: it will be more educational and will better capture the trainees' attention.

*Various augmented reality techniques used separately to transpose a digital guide onto the augmented reality support*

The first prototype we used is based on the HoloLens from Microsoft Corporation. These glasses work in two different modes, depending on whether the operator is working next to or far from the machine.

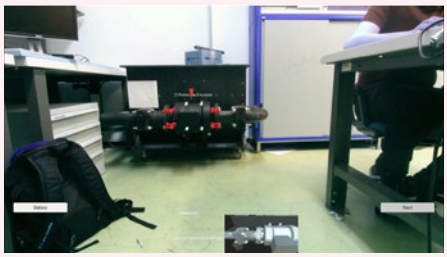
The second prototype is based on spatial projections. It uses a 6-degree of freedom (6DOF) tracker and a recording with Unity to display the information directly onto the machine. The adjustment allows orienting the projector in different ways without modifying the display.

The last prototype is a superimposition of the digital tutorial on a video stream that also uses the 6DOF tracker.

## RELEVANT INNOVATION

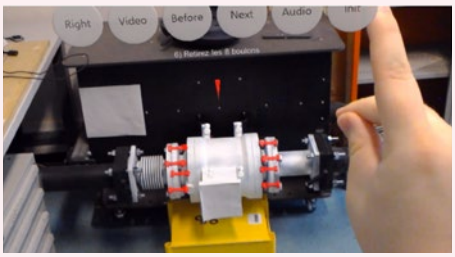
We worked on the assembly of various augmented reality techniques used separately to transpose a digital guide onto the augmented reality support. We based our project on Unity software to allow the digital guide and the user interface to be modified as independently as possible from the desired augmented reality media.

Our prototype HoloLens solves the problems of short-range use: by providing side-memory aids, we avoid



Superimposed on a video stream


Spatial projection




Augmented reality glasses



short range HoloLens misalignment errors and make HoloLens less tiring and oppressive for the technician over a long period of time.

The 6DOF tracker uses a color and depth camera developed by the university of Laval, image from the Kinect V2, and predicts the result with a trained neural network on synthetic images obtained with the machine 3D model. We brought additional image processing to track an object in an industrial environment.

## PROJECT OUTCOMES AND RESULTS

We managed to transpose the digital manual into three augmented reality manuals. Once the prototype has been created, adding or modifying a step can only be done through the Unity graphical interface, which simplifies guide modification by a non-expert in development. The prototype using HoloLens is the one that has been best received by technicians and companies. Thanks to its two operating modes, it can be used for training and maintenance assistance. It is also the only one that allows hands-free use without obscuring the image. The other two prototypes stand out more in a training assistance setting.

## CONCLUSION

The choice of the right user interface and the information conveyed by augmented reality are essential to offer an attractive and more playful help to the technician. For this purpose, we developed three different prototypes to let the user choose. The choice of the most adapted prototype for the use or the situation makes the training more pedagogical and can help to solve maintenance problems due to a lack of knowledge of the manual. Ergonomics is also an essential part which has to be taken into account in system conception, to limit the intrusive aspect reported by the operators.

## PERSPECTIVES AND NEEDS

Although HoloLens has received the best feedback, we believe that the multiple augmented reality supports are an asset for training and support. It gives the technician the possibility to choose which media he prefers. In the future, we would like to improve the 6 DOF algorithms, which showed very good results, by introducing automatic initialization.

## ACKNOWLEDGEMENTS

We would like to thank the HES-SO for its financial support for this project.

## REFERENCES

[1] *A 3D-Deep-Learning-based Augmented Reality Calibration Method for Robotic Environments using Depth Sensor Data,Linh Kästner and Vlad Catalin Frasineanu and Jens Lambrecht,2019,*arvix: 1912.12101. URL: https://arxiv.org/abs/1912.12101

[2] Mathieu GARON, Denis LAURENDEAU et Jean-François LALONDE. *"A Framework for Evaluating 6-DOF Object Trackers"*. In: CoRR abs/1803.10075 (2018). arXiv: 1803.10075. URL: http://arxiv.org/abs/1803.10075.

[3] Wadim KEHL et al. *"SSD-6D: Making RGB-based 3D detection and 6D pose estimation great again"*. In: CoRR abs/1711.10006 (2017). arXiv: 1711.10006. URL: https://github.com/yuxng/PoseCNN.

# 10 ENGAGING GUITAR LEARNERS WITH ARTIFICIAL INTELLIGENCE AND GAMIFICATION

**Carrino Stefano, Moret Jérôme, Nadalin Steve, Ghorbel Hatem**
Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

*Contact: stefano.carrino@he-arc.ch*

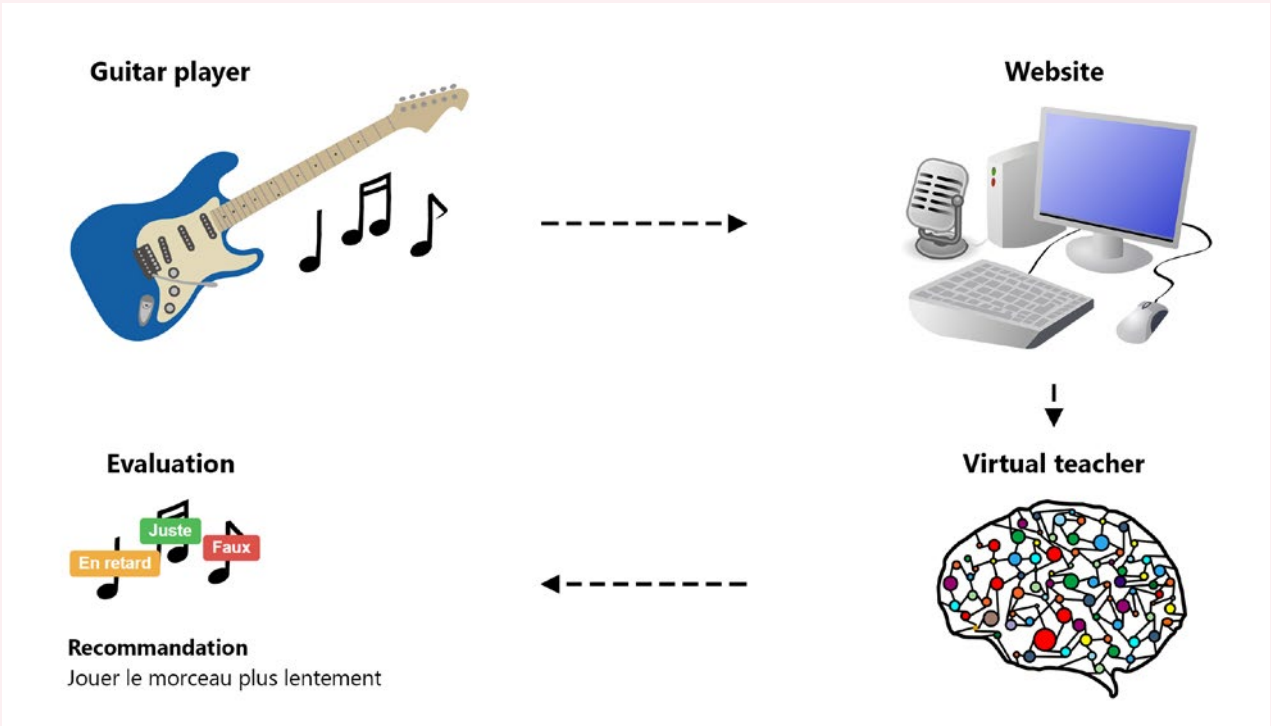
## ABSTRACT

With a growing number of web-based learning platforms users, live interactions with real teachers become sparse if not impossible. The consequence is a risk of the platform reduced effectiveness and a diminution in the user engagement. This research proposes an AI-based, gamified service for guitar learners, based on the HGuitare.com platform. We propose a virtual teacher capable of analyzing a learner's live performances, providing immediate, gamified feedback and recommendations.

## KEYWORDS

Virtual teacher, artificial intelligence (AI), learning, guitar, gamification.





## CONTEXT

HGuitare is a web platform that proposes guitar courses prepared by professional musicians. The current solution is composed of learning videos and live interactions between learners and professors. As the user number grows, live interactions become sparse if not impossible. Consequently, there is a risk of efficiency reduction of the platform as a learning tool as well as a decrease in the user engagement. Therefore, in order to satisfy the needs of an increasing number of web platform users, this research proposes a novel AI-based, gamified service: a virtual teacher. To enhance the current e-learning approach, the virtual teacher can analyze a learner's live performance and provide immediate, gamified feedback. In addition, recommendations provide personalized instructions and guidelines to tell the learners what to do next to keep improving considering positive psychology and progression-based design.

## TARGETED ISSUE

Web-based solutions are the ideal platform to reach a large public providing uninterrupted availability (24/7 service) of learning material as, together with continuous practice, an evaluation from an expert musician is crucial for the student progression and a guitar teacher is a very valuable solution and unfortunately cannot be physically available 24/7 to listen learners and provide feedback. Moreover, without interaction and feedback loops the user can be easily demotivated.

Nevertheless, providing AI feedback is a very challenging task. In fact, typical human feedback includes rich, experience-based recommendations about tempo, pitch correctness or even the overall feeling about a performed routine. Moreover, the evaluation can be adapted to the learner level (e.g., less strict requirements for beginners). In other terms, providing a feedback takes time and knowledge. And, since online solutions enable more and more students to learn, the long feedback process is proportionally increasing with the number of learners.



In addition, technical challenges should be considered for the realization of an automated solution. Recording the audio and automatically detect the executed chords can be hard. Every student will have different setups (mixed quality microphones, well- or bad-tuned guitars, etc.). This means that the AI algorithm will make mistakes - which can affect the user experience and his trust towards the platform.

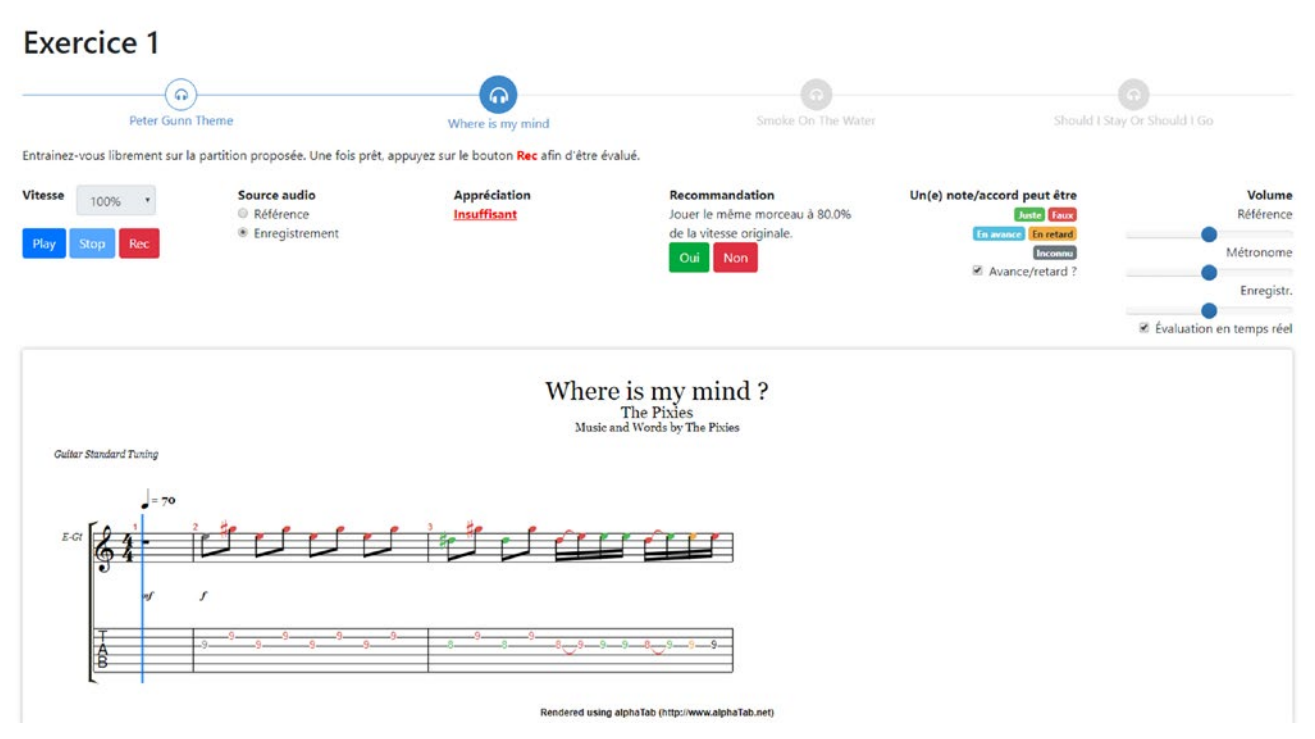
## PROPOSED SOLUTION

To address the previous issues, we propose a virtual teacher realized on a web platform empowered by artificial intelligence (implemented using a deep neural network architecture **[1-4]**). A playful design and a gamification approach are proposed to 1) foster long term engagement and 2) balance the AI limitations.

*Virtual teacher evaluates the user performance and provides personalized recommendations*

We want the students to log in on the website through their computer, select the song they want to practice or an exercise (a progressive sequence of songs and song excerpts designed by an expert human professor) and thanks to the display of a dynamic musical score, we want them to play and receive a direct feedback in real time.

Playful design and positive psychology have been applied for the feedback design. For instance, the AI algorithm outputs are converted to a performance score and positive, encouraging messages are displayed ("quite good", "good job", "need to work more on the song", etc.). Educational suggestions (like changing the song tempo) are also provided to foster the learning process (it is easier to learn a song with a slower tempo). Before starting to play, the user can also listen to the song to perform. The user gets a real time feedback while playing. Then, at the end, the website displays an overall appreciation and the learner can still look back on which note, or chord have been missed and which one was correctly performed.






## RELEVANT INNOVATION

This project brings two relevant innovations. The first one is the use of Artificial Intelligence (and deep neural networks in particular) to model the human teachers' knowledge for the virtual teacher. The virtual teacher evaluates the user performance and provides personalized recommendations and advice in real-time – a delayed feedback will badly affect the experience quality.

The second one is related to the user experience. The final prototype allows any user in the world to connect on the web site, take a guitar and... just play. No other technologies, or special devices are required to start learning. The web platform composed of dynamic music sheets can display precise and rich feedback. Such a platform can respond in real time to the user performance and convey the virtual teacher feedback. The system can handle different student's setups, for example it managed different microphone qualities, different guitar types, and different guitar outputs like distortion or overdrive effect. The virtual teacher and the platform are connected in real time. This means that any evaluation can be immediately provided enabling the creation of gamified solutions.

In fact, the HGuitare web platform is gamified. The gamification concept aims at transposing the learning needs into game mechanics such as points, badges and levels. Similar to an RPG environment: completing lessons will provide experience points.

## PROJECT OUTCOMES & RESULTS

From a software perspective, the project outcome is a web platform hosting a virtual teacher. A learner can come with her/his music and start practicing with the available exercises on the platform.

The virtual teacher performance and User Interface were evaluated enrolling HGuitare users throughout the project. Indeed, more than 300 users were invited to test the prototype at several steps of the development. For the final prototype, around 20 users of the traditional HGuitare solution (with different musical experience and backgrounds) assessed the prototype on four aspects with grades 1 to 5 (5 being the best). The solution achieved very encouraging results. For the AI aspects, the virtual teacher got an average rate score of 4.20 on pitch correctness rating. It means that the users agreed with the virtual teacher judgments: the AI correctly pointed out notes or chords that were poorly performed. Users also agreed (average rate of 4.35) with the evaluation on the whole performance, as well as for the recommendation to the next exercise (4.30). About the "user interface and the overall experience with the platform", users also expressed a very positive feedback with an average rate of 4.35.

## CONCLUSION

With this project, we proved that it is possible to create a virtual assistant to support learning playing the guitar. Our solution, presented via dynamic music sheets, provides rich, playful feedback fostering student engagement and improvement process.

## PERSPECTIVES & NEEDS

The proposed solution has still room to improve the game design. In particular, the web-based backend will allow to move from a gamified solution to a proper serious game enabling music competitions for guitar players all around the world.

In addition, we are willing to collaborate with music schools and music teachers. We think that such collaborations would enrich our platform and enhance the relationship between teachers and learners with novel possibilities.

## ACKNOWLEDGEMENTS

This work has been partially funded by Innosuisse - Swiss Innovation Agency, the Hasler foundation and HMonster sarl

## REFERENCES

[1] Dittmar, C., Männchen, A., & Abeber, J. (2013, July). *Real-time guitar string detection for music education software. In 2013 14th International Workshop on Image Analysis for Multimedia Interactive Services* (pp. 1-4).

[2] Fuentes, B., Badeau, R., & Richard, G. (2012). *Blind harmonic adaptive decomposition applied to supervised source separation. In 2012 Proceedings of the 20th European Signal Processing Conference* (pp. 2654-2658).

[3] Sigtia, S., Benetos, E., & Dixon, S. (2016). *An end-to-end neural network for polyphonic piano music transcription. IEEE/ACM Transactions on Audio, Speech, and Language Processing,* 24(5), 927-939

[4] Sleep, J. (2017). *Automatic Music Transcription with Convolutional Neural Networks using Intuitive Filter Shapes*

# SESSION CULTURE & URBANISM

**THURSDAY 29 OCTOBER**
16:00–17:30

LISSA HOLLOWAY-ATTAWAY

LOÏC HANS

MATTIA THIBAULT

ATSUSHI YAMAJI

# 11 PLAYING WITH LOCAL HERITAGE: CO-DESIGNING GAME STORIES FOR YOUTH

**Holloway-Attaway Lissa**
University of Skövde, Skövde, Sweden
*Contact: lissa.holloway-attaway@his.se*

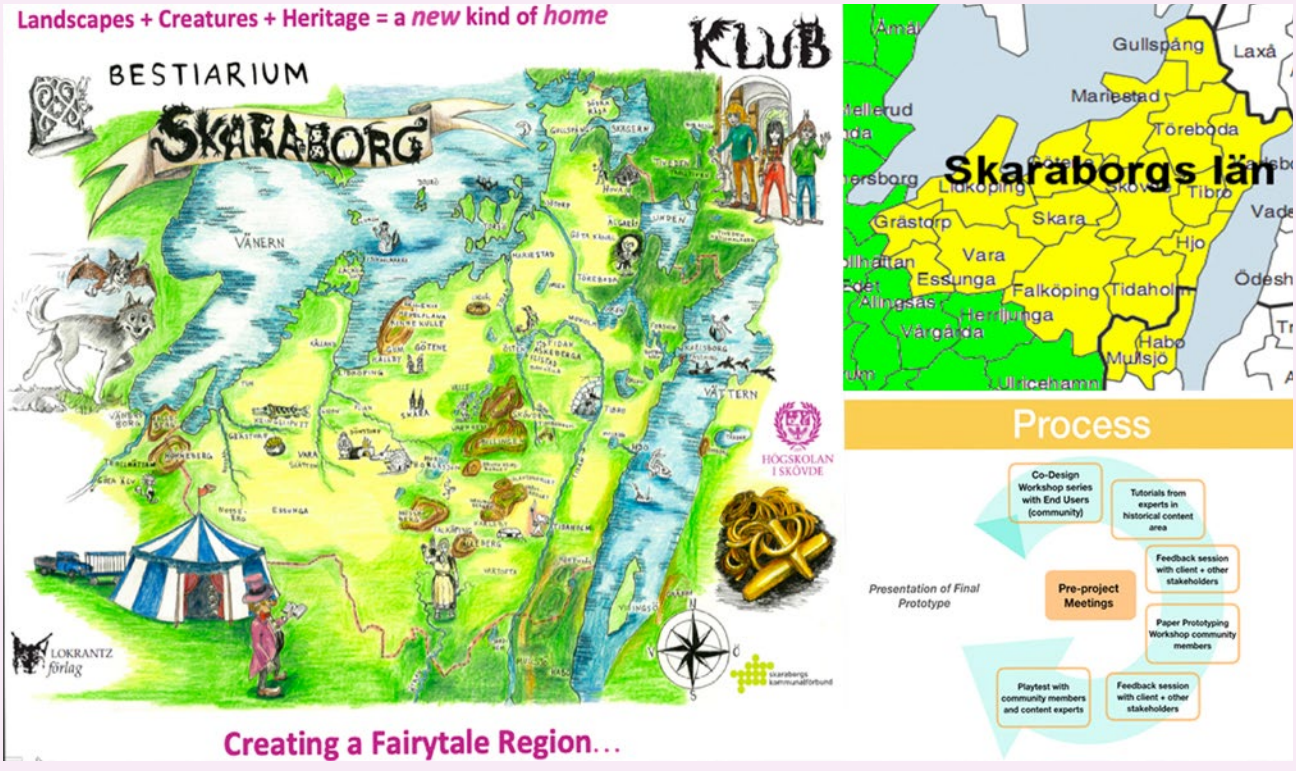
## ABSTRACT

As technologies are integrated in museum and cultural heritage contexts, digital heritage design depends increasingly on innovative and playful storytelling features to engage users, particularly youth. To support such engagements, researchers and designers in the KLUB project work to encourage young people to play with local heritage by exploring historical sites and landscapes and learning from the folktales and magical fairytale creatures associated with their region in western Sweden. KLUB uses intra-disciplinary transmedial storytelling techniques, gaming technologies and co-design methods with cultural stakeholders to create an Augmented Reality (AR) enhanced children's book series and related media (board games, locative experiences) to uncover hidden, intangible local heritage in our region.

## KEYWORDS

Cultural heritage games, augmented reality, transmedia, co-design.





## CONTEXT

Research and scholarship on the evolving nature of the new digital museum have emerged as digital technologies have been integrated in museum and cultural heritage contexts over the past decade. Much of this research is centered on the increasingly distributed and pervasive nature of heritage spaces that have overflowed traditional museum exhibition spaces and architecture. New spaces invite new ways to explore them, and as digital museums increasingly overtake non-digital spaces, the possibilities to transform visitor interactivity with museum and out-of-museum assets have exponentially increased. As such, opportunities to integrate multiplayer gaming technologies, serious games and immersive mixed reality (MR) systems that create recursive relationships between physical and virtual spaces are standard in many heritage contexts. However, the processes of creating these specialized digital heritage games and nuanced considerations of the storytelling and narrative affordances needed to support playful user experiences (rather than a focus on technologies) is still underexplored. This is particularly true when considering young 'users'.

## TARGETED ISSUES

Games, Mixed Reality technologies (MR/AR), critical co-design and participatory approaches have particular advantages to offer cultural heritage and museum contexts, particularly to those who choose to foreground narrative-based experiences. Story Games, that is games that incorporate play as embodied forms of reading and writing in interactive virtual/material worlds, are particularly suited to such dense, hybrid encounters. The KLUB universe and the mobile AR experience it supports, where users discover and collect game creatures and characters on their phones or tablets, offers such a context for research. Additionally, other related game media (KLUB board games, for example) offer alternative and layered ways to uncover and experience the story world across different registers of play.



## PROPOSED SOLUTION

*Digital technologies have been integrated in museum and cultural heritage*

We argue that transmedial and game-based approaches to storytelling with MR technologies for cultural heritage greatly enrich user experiences, particularly for young players. In our research and our iterative development to engage heritage visitors and work with cultural stakeholders in the design and delivery process of our KLUB materials, we work to refocus on the young heritage visitor's body, voice, and agency through story and play. We shift emphasis away from designing digital tools/systems that (hyper-)focus attention on heritage objects and artifacts (as with other digital heritage tools such as laser scanning, photogrammetry, topography and GIS data, for example) but that may be inattentive to the storytelling frameworks. The locative aspects of the experiences we create, for example, are key, and we work to enhance, emphasize, and individualize the multiple places/spaces users encounter as they explore the playful worlds we create through stories about places they 'know' but have yet to discover.

## RELEVANT INNOVATION

KLUB aims to strengthen the sub-regional cultural infrastructure where it is set (in Skaraborg in Western Sweden), and it is connected to promoting issues of sustainable growth, innovation, and renewal within 'experience' industries (heritage, tourism, for example). A central method to achieve this has been by refining methods to develop the AR book series and related (gaming) media to show how game technology may be used to support visitor/player experiences. In this way, the tools and media, but also their use and integration, have been carefully workshopped, communicated, and explored within a growing cultural network during our research. As such, KLUB is an exemplary model to illustrate that digital cultural heritage games should be seen as part of a living nexus of activities to be carefully orchestrated, a kind of ecosystem of influence and experience design.




## PROJECT OUTCOMES & RESULTS

As of mid-2019, 14 playable AR books have been published, one for each village or town in the region. More are being developed with KLUB characters, but also with spinoff characters that may be featured in a related work, or that may be used, based on the KLUB model, for an entirely different content. For example, we are developing characters that will also work in other AR-enhanced game-books, but also for web-based delivery for children, and in playable locative media focused specifically on learning about environmental and scientific issues connected to local geological formations at a regional Geopark. The original funding from the project (from 2015-2018) has been extended for three additional years (2019-2021) to allow further research and development. The project (which has included many game students in its development) has also been used to refine a Masters Program based on cultural heritage and game technologies at our university targeted to train game students interested in working in the cultural sector - with museums, for example.

## CONCLUSION

With interactive narrative complexity through game stories, simplified technical development with a focus on youth user experience and collaborative co-design methods at the core of KLUB, our work offers many insights into cultural heritage games. Our goal was to include technical developers and cultural stakeholders (libraries, art galleries, heritage experts and influencers, schools, and politicians), as well as game students to cross intra-disciplinary boundaries.

## PERSPECTIVES & NEEDS

KLUB is useful to support developers and researchers working within cultural heritage games to create sustainable experiences that use co-design methods with an emphasis on user experience and narrative innovation.

## ACKNOWLEDGEMENTS

KLUB is funded with the support of Skaraborgs Kommunalförbund, several local municipal authorities, and co-financed by the University of Skövde (primarily within the MTEC Research Group).

## REFERENCES


**[1]** Anderson E F, McLoughlin L, Liarokapis F, Peters C, Petridis P, de Freitas S (2010) *Developing serious games for cultural heritage: a state-of-the-art review.* In: Virtual Reality 14 (4): 255-275

**[2]** Barba E, Rouse R, Bolter J D, MacIntyre, B (2010) *Thinking inside the box: Meaning-making in handheld AR experiences.* In: 2010 Proceedings of the Ninth IEEE International Symposium on Mixed and Augmented Reality:19-26

**[3]** Cameron F, Kenderdine S (eds) (2007) *Theorizing digital cultural heritage: a critical discourse.* MIT Press: Cambridge

**[4]** Engberg M, Bolter JD (2015) *MRx and the aesthetics of locative writing.* In: Digital Creativity 26 (3-4): 82-192

# 12 LES BARONS – AN URBAN TREASURE HUNT THROUGH LA CHAUX-DE-FONDS' WATCHMAKING HERITAGE.

**Hans Loïc[1], Marikit Taylor[2]**

**1 :** Entrée de Jeux, La Chaux-de-Fonds, Switzerland

**2 :** Historian, La Chaux-de-Fonds, Switzerland

*Contact: loic@entree-de-jeux.ch*

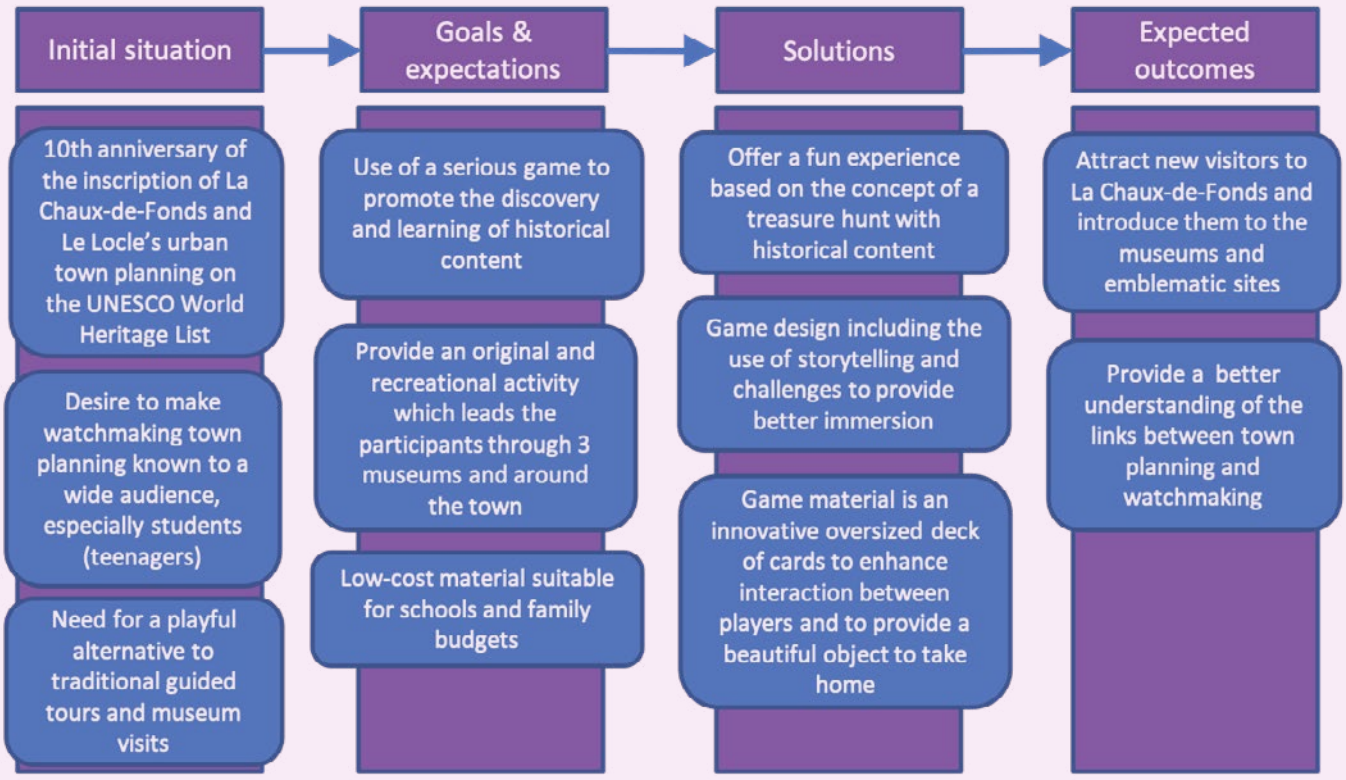
## ABSTRACT

La Chaux-de-Fonds was built in the 19th century by watchmakers for watchmaking. It is an exceptional example of the symbiosis existing between industry and urban planning. In 2019, the town celebrated the 10th anniversary of its inscription on the UNESCO World Heritage List. On this occasion, an innovative treasure hunt was created to introduce the general public to this particular form of urban development. This serious game is now a permanent cultural and touristic offer.

## KEYWORDS

Watchmaking town planning, UNESCO World Heritage, cultural heritage, La Chaux-de-Fonds, serious game, treasure hunt, storytelling, immersion, communication, education, architecture, industry, history, art nouveau, urbanism, fun.





## CONTEXT

Once a large village, La Chaux-de-Fonds was virtually burned to the ground by a fire in 1794. Born from the ashes was a rationally organised town whose urbanism planning favoured not only the watchmaking industry but also the wellbeing of its inhabitants. Thanks to the boom of the watchmaking industry, the town developed rapidly during the second half of the 19th century. By 1900 it was known as the "Watchmaking Metropolis". On 27 June 2009, the watchmaking town planning of La Chaux-de-Fonds and Le Locle was inscribed on the UNESCO World Heritage List. A call for projects was issued to mark the 10th anniversary of this recognition in 2019.

The selected project proposed by "Entrée de Jeux" aims to explore this complex topic in the form of a treasure hunt through the museums and the town.

The game can be found at the International Watchmaking Museum, the History Museum and the Fine Arts Museum of La Chaux-de-Fonds, in partnership with Tourisme neuchâtelois. It was funded by the "Fondation en faveur de la mise en valeur du site de La Chaux-de-Fonds / Le Locle inscrit sur la Liste du patrimoine mondial de l'UNESCO".

## TARGETED ISSUES

The main challenge for the game creation was to make this rather technical subject pleasant and accessible to a large and varied public. Watchmaking town planning is not a trendy subject, especially for the younger generation.



For the game to be educational and based on historical facts, it was necessary to unveil this rich watchmaking universe filled with interesting places, colourful characters and anecdotes related to this secretive industry, as well as other aspects such as architectural concepts.

The aim was to meet the need for a funny and original offer to complement the traditional museum visits and city tours. To showcase three of the town's museums, it was requested that the first challenges of the game take place inside these institutions; the rest of the route could then take place throughout the city streets.

*A funny and original offer to complement the traditional museum visits*

Teenagers are the game's target audience. The game is conceived to appeal to class outings organisers and to introduce the public to the Watchmaking Metropolis history. As adolescents are a difficult audience to captivate, a judicious choice of game format and content was essential, which include storytelling and regular challenges allowing a better immersion. Families and tourist groups are secondary target audiences. The game must therefore be adapted to a variety of profiles, including children and seniors. The number of participants is highly variable. The treasure hunt can be enjoyed alone or in groups of up to 6 people.

## PROPOSED SOLUTION

The chosen solution was proposed by "Entrée de Jeux", a cooperative company formed by game authors and historians (among other skills), which specialises in highly themed serious games creation.

"Les Barons" tells the story of emblematic places and watchmaking town planning in a playful way. Historical facts are mixed with an imaginary story which takes the participants through various emblematic places. The narrative provides a true immersion feeling. Players go in search of Uncle Louis', a fictional character, stolen watch. As they investigate, they get to know the four potential suspects, who were powerful and real watchmaking factory directors. The treasure hunt is driven by a gripping story full of twists and turns.




Observation-based enigmas lead to the discovery of clues regarding the potential guilt or innocence of the suspects. Period and modern photographs with offbeat titles accompany the players. Specific "Did you know?" sections offer true anecdotes. The game, which lasts 2 hours on average, ends with the analysis of the collected clues and the opening of a secret box... This activity is suitable for teenagers from the age of 12, or younger children if accompanied by an adult.

The game support is an oversized deck of cards, the size of a postcard. There is one card for each stage of the adventure. The graphic design is fashionable with bright colours and illustrations presented like the social networks galleries.

## RELEVANT INNOVATION

The creation of a serious game allowing to discover the characteristics of watchmaking town planning in a playful way seems to be a first. Though many urban treasure hunts exist in the region, their themes are generally designed to make the game immersive, and thus offer a purely recreational experience. "Les Barons" is entirely based on historical content: almost every detail can refer to facts and specific historical and industrial notions. The game is conceived so that participants may learn this content in a subtle way and thanks to amusing touches. The game therefore stands out of traditional guidebooks.

The decision to publish an oversized deck of cards instead of using a brochure or a digital application is original and brings an important advantage. Players can complete the tasks together or share out the roles as they desire. It is up to them to decide who manages the cards, guides the group, reads the story and collects the clues. Thus, all the group participants can be involved.

Moreover, the game is also a beautiful object which can be kept and re-read at home. A postcard is included in the pack. As the game material was relatively inexpensive to produce (less than CHF 10.-/deck), the activity can be provided at a very attractive price. This makes it accessible to all audiences alike, especially school groups and families.

We took care to use symbols that adapt the game to colourblind people (8% of males and 0.5% of females of Northern European descent)..

## PROJECT OUTCOMES & RESULTS

A first series of 180 copies has been available since June 2019 and on sale in the museums and tourist offices over the summer and autumn. Several schools from the towns surrounding La Chaux-de-Fonds have already chosen to discover the exceptional history of the Watchmaking Metropolis by taking part in this treasure hunt. The demand from school teachers for this kind of experience is confirmed. The game's innovative support, an oversized deck of cards, definitely enhances the interaction between players. Feedback from students and teachers is positive as is the feedback from families and groups of friends. The game works well, and they discovered the basics of watchmaking town planning and enjoyed a pleasant time, including in the museums. Now that the concept has been proven, further developments are in progress.

Along with the four points of sale, an internet page promotes the game and provides practical information. Promotional actions for 2020 are in progress. Now convinced of the potential of "Les Barons", the project partners (Tourisme neuchâtelois, the museums and the "Fondation en faveur de la mise en valeur du site de La Chaux-de-Fonds / Le Locle inscrit sur la Liste du patrimoine mondial de l'UNESCO") are invested in promoting the game further. The objective of perpetuating this treasure hunt for several years is being achieved.

## CONCLUSION

With the presence of a new urban treasure hunt, La Chaux-de-Fonds has a complementary tool to attract visitors, including classes with teenagers. This serious game is available all year round. It allows participants to discover watchmaking town planning in a playful and immersive way thanks to the gripping narrative and observation enigmas. It combines different levels of information going from basic notions to historically precise details to meet the interests of a varied public.



## PERSPECTIVES AND NEEDS

Recently, the Ludesco Game Festival, which attracted 10,000 players in 2019, has become a partner. In March, it's 11th edition will serve as a platform to promote the game among its participants.

Soon, the game will be edited for a second time in French. A translated edition in German is also about to go to press. This means that more than 600 additional copies will be available in 2020 and that Swiss-German classes and groups will be able to get to know "Les Barons".

## REFERENCES


**[1]** *Practical information about the game:* www.enquete-horlogere.ch & www.entree-de-jeux.ch/lesbarons/ (2020.01.17)

**[2]** *Main website about watchmaking town planning*: http://urbanisme-horloger.ch/ (2020.01.17)

**[3]** J.-D. Jeanneret, A. Hellmann, J.-M. Piguet, R. Gogniat (2019). *Urbanisme horloger, Tourisme neuchâtelois.*

**[4]** J.-D. Jeanneret, M. Taylor, A. Henchoz, J. Heim (2015). *Bon pied Bon oeil* – La Chaux-de-Fonds, Métropole horlogère – *262 objets du patrimoine à découvrir.* Fondation pour le patrimoine, Ville de La Chaux-de-Fonds.

# 13 JURASSIC TAMPERE & URBAN TOYIFICATION

**Mattia Thibault**
Faculty of Information Technology and Communication Sciences, Tampere University, Tampere, Finland

*Contact: mattia.thibault@tuni.fi*

## ABSTRACT

This short paper elaborates on the concept of urban toyification defined in the context of ludification as a subset of gamification. Different toyification strategies are outlined, focusing on the use of actual toys or toy aesthetics. Theoretical considerations are supported by the study of Jurassic Tampere, a urban toyification activity. A survey conducted by expert participants provided valuable feedback for possible future implementations.

## KEYWORDS

Toyification, city, public spaces, gamification, ludification.



## CONTEXT

Cities have always hosted various forms of play, in the private spaces of homes and schools as well as in the streets, parks and other public spaces. From fairs and carnivals to street sports, urban areas are often turned into playgrounds, putting side by side serious and playful activities. Some specific forms of play such as pervasive or location-based games such as Pokémon Go use this coexistence between a playful activity and a non-playful context as the fulcrum of their mechanics.

Nowadays, actions of urban gamification positioning playfulness at the heart of public spaces are often described as an antidote to the alienation of city environments caused by gentrification, to the anonymity brought by globalization and to the cold technocentrism of smart cities. Many important examples of urban gamification (such as pride parades, parkour or park(ing) day), as well as frameworks to describe and implement them (the ludic city **[1]**, playable cities **[2]** or the Fun Theory by Volkswagen), insist on the potentials of urban play to help citizens reclaim their cities, reappropriate them.

## TARGETED ISSUE

There is a building consensus on the need to find new ways of helping citizens to engage in their cities and reclaim them. If the changes brought by globalization **[3]** and the ICT revolution **[4]** make citizens feel increasingly powerless and disconnected, the situation is even direr for lower classes, minorities and immigrants whose right to the city is often questioned by politics or gentrification. As urbanization progresses quickly (in Europe around 75% of the population lives in urban areas), there is a need for solutions that are economically, ecologically and socially sustainable.



ReClaim is a research project dedicated to exploring different ways of using playfulness and games to promote city reappropriations – that is, different strategies of urban gamification. Despite the growing interest around this topic, there is little or no work on the role that toys and objectual play could have in it. This presentation, then, aims to briefly explore the toyification of city spaces by drawing a typology of possible implementations and engaging in an actual project of urban gamification: Jurassic Tampere.

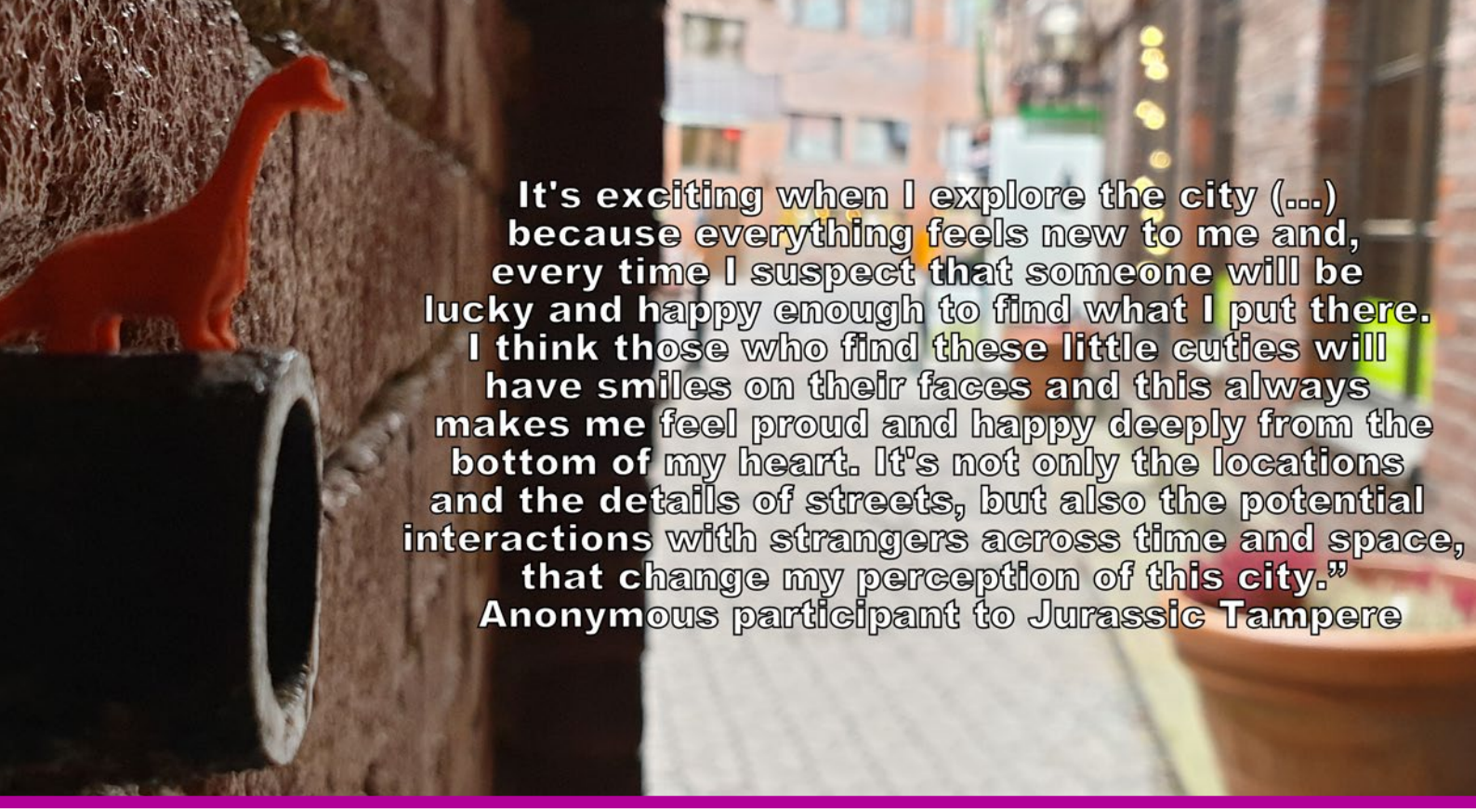
## PROPOSED SOLUTION

In this short paper we investigate how toyification can affect urban spaces. The term toyification, has only been defined recently **[5]**. It is part of a larger play-related cultural trend: ludicisation – a paradigm used to describe the increasingly relevant role of playfulness and games in our culture. Toyification communicates the idea of an entity being reinforced by toyish elements (an object, a character or a human being acquiring a toyish appearance, form or function through intentional behavior **[6]** and of toys finding their way in contexts that were traditionally excluded. If on the one hand many contemporary physical, digital and hybrid products demonstrate toyified tendencies (kitchen appliances, furniture, cars, mobile phones, and even food products such as cupcakes), on the other hand it is increasingly common to find toys displayed in office spaces and at funerals or used in higher education contexts. We can distinguish, therefore, between two forms of toyification:

*Using playfulness and games to promote city reappropriations*

1. A first one based on the application of a toy aesthetics (that is, having features such as small scale, colorfulness, lightness and safety) to non-toy objects in order to give them a playful feel.

2. A second one based on the use of actual toys in unexpected contexts that will, in turn, be reshaped by them.






## RELEVANT INNOVATION

So, what will happen if we apply toyification strategies to the city? Cities are complex multi-layered entities and sophisticated semiotic devices [7]. Their structural heterogeneity makes it possible to adopt toyification strategies aiming at their different layers. Due to its objectual nature, we will engage especially the physical reality of public urban spaces and, in particular, we will focus on two possible areas of intervention: buildings and objects (with this generic name we refer to street furniture, statues, trees and other objects that can be found in urban spaces).

If we cross the toyification strategies with these two areas of intervention, then we outline four possible types of urban toyification:

- Toy aesthetics applied to buildings (for example in the work of the architects Antoni Gaudì and Freddy Mamami, but also in the Lego Bridge in Wuppertal, Germany);
- Toy aesthetics applied to objects (we can think of the Life-Sized Unicorn Gundam Statue in Tokyo, or the Red Army memorial in Sofia, Bulgaria, that was painted to make the soldiers look like US American heroes, including Superman, Santa Claus and Ronald McDonald);
- Cities made of toys (such as theme parks like Legoland, but, in a way, also the replicas of Venice or of the Tour Eiffel adorning casinos in Las Vegas and Macau);
- Toys placed in the city (as the mouse-scale buildings installed by Swedish art collective "Anonymouse", or several instances of toy photography).

## PROJECT OUTCOMES & RESULTS

Jurassic Tampere is an urban toyification activity that was carried out in Tampere, Finland in December 2019 in order to test some of assumptions regarding urban toyification. During the activity, a group of nine participants walked around the Tampere city center for three hours positioning in the public spaces 420 small rubber dinosaurs, taking pictures of the toys and observing the reactions of passersby. After the activity they answered a short open survey.

The main idea was that positioning toys in the city makes the environment look different: the objects around are re-scaled by the toys and new meanings can arise from their interpretations and interactions.

The survey results seem to indicate that the activity was successful. All respondents mentioned that during

Jurassic Tampere they started to notice minor details and gaps in the city, to observe people's abandoned things, to pay attention to the colors of the city (in relation with the colors of the toys) and to ongoing activities that are part of the urban diversity and dynamism. However, all respondents reported that the effects of Jurassic Tampere on their perception could not last more than a few weeks. Several participants also suggested that the activity could benefit from more structures, and could be made part of a game or a flash mob. Many respondents felt the desire to connect more directly with the people who collected the toys.

## CONCLUSION

Our short typology helped us to outline different forms of urban toyification and group under one concept a series of practices that are not always immediately recognizable as akin but that go under several different labels (play, street art, photography, artistic installations). The Jurassic Tampere survey, furthermore, underlines the potential of toys placed in city spaces, but also highlights the need to combine it with other more structured, gamification strategies.

## PERSPECTIVES & NEEDS

This is still and exploratory study. Future research should focus on the measurable effects of urban toyification in cities and what could be its possible synergies with other forms of gamification.

Future research should also enlarge the focus in order to include digital toys and digital cities, but, most importantly, digital extensions of real cities, so to investigate the potential of the toyification of the smart city too.



## ACKNOWLEDGMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement N° 793835.

## REFERENCES

[1] Stevens, Q (2007) *The ludic city: exploring the potential of public spaces.* Routledge.

[2] Nijholt, A (2019) *Making Cities More Playable.* Springer.

[3] Cross M & R Moore (2002) *Globalization and the New City.* Palgrave Macmillan.

[4] Caragliu, A, Del Bo, C & P Nijkamp (2011) *Smart cities in Europe. Journal of urban technology*, 18(2), 65-82.

[5] Thibault, M, and K Heljakka (2019) *"Toyification: a conceptual statement" in G. Brougère & M. Allen, proceeding of 8th ITRA.*

[6] Heljakka, K (2015): *Toys as Tools for Skill-building and Creativity in Adult Life, Seminar.net. International Journal of Media, Technology and Lifelong Learning* (11)2, pp. 134-148.

[7] Volli, U (2008) *Il testo della città – problemi metodologici e teorici.* Lexia 1–2, 9–12.

# 14 INTERACTIVE RHYTHM MAKING SYSTEM USING TABLET AND LARGE SCALE DISPLAY

**Yamaji Atsushi and Onishi Katsuhiko**
Osaka Electro-Communication University, Osaka, Japan

*Contact: yamaji@osakac.ac.jp, onishi@osakac.ac.jp*

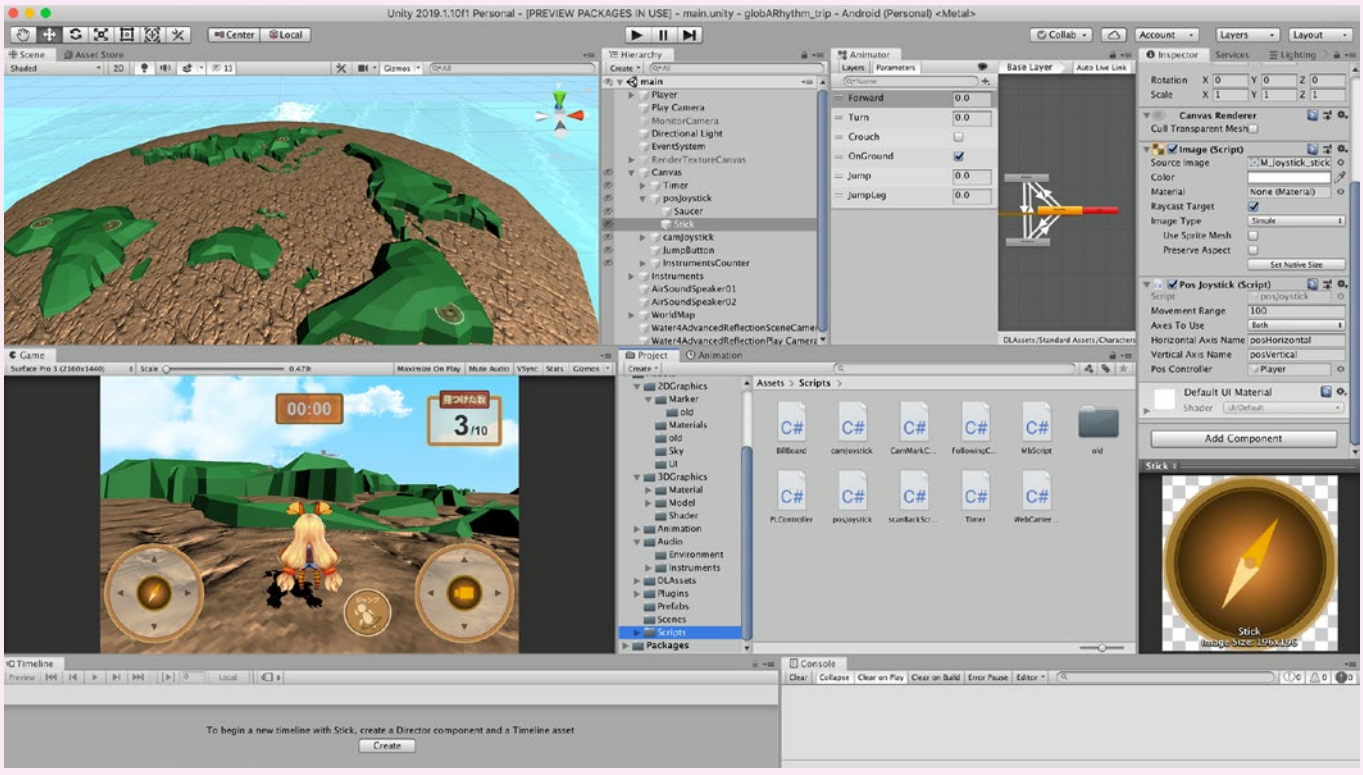
## ABSTRACT

The game "globARhythm!" is designed to offer children an opportunity to experience the rhythms of folk (ethnic) instruments from around the world. As children rarely get a chance to play these instruments, this game can stimulate their interest in different cultures. This is for educational serious game content, and it has an Augmented Reality system that shoots the markers that move in the game-play video on a large display with a tablet PC and virtually plays music.

## KEY WORDS

Video game, Music performance, Music education for children,
Folk (Ethnic) musical instruments, Augmented reality.





## CONTEXT

At museums that own ethnic instruments as a part of the cultural world heritage section, it is desirable to allow viewers to touch the displayed instruments and offer them an opportunity to make and hear the sounds so they can gain a deeper knowledge of the exhibits. However, even though it would be a wonderful means of educating children, it is not possible to touch these valuable and delicately stored instruments. The game, "globARhythm!" has been developed so that people can experience the sounds made by these instruments. The game has a rhythm playing system that uses a tablet terminal. The terminal displays markers corresponding to the rhythm of various ethnic musical instruments and a number of these can be played through this.

## TARGETED ISSUE

Most of the exhibits in museums have commentary videos and the interaction with visitors is limited. Consequently, it is difficult to stimulate a deep interest in the exhibits. In recent years, support systems that have interactive exhibits and create a virtual environment using a head mounted display have been introduced. However, learning how a musical instrument is played can be difficult and visitors are rarely interested in the context behind these instruments, such as their regionality and history. In this game, the instruments can be "played" by touching the screen and thus the music can be experienced. The image of the instrument is displayed on the TV screen and is recognized as a marker by the tablet camera and accordingly the appropriate sound is heard. This is an interactive system that reproduces content so that players can learn about the background of these musical instruments.



## PROPOSED SOLUTION

Users can play the sounds of the ethnic instrument on the game screen with the tablet. An AR marker is assigned to each musical instrument. Once the AR marker is photographed by the tablet, the animation or music from the instrument can be seen and heard. The game on the large screen features a travel adventure that moves across the world while "capturing" musical instruments of all origins. The game is designed in a manner that the background music and the music from the instrument "captured" by the tablet are in harmony as the player finishes different stages in the game.

*This game was developed to address the need for an auxiliary display tool for museums*

## RELEVANT INNOVATION

At this point, a system that can enable people to learn about the rhythm of rare musical instruments that are displayed in museums by playing an educational interactive video game has not been introduced. Hence, this is an innovative and new method. Particularly, if the video game content can be integrated in a tablet and displayed on a large screen monitor, it can become a new guideline for technical interactive methods that can be used not only in museums, but also in general public spaces, for adults and children and for all kinds of music.

## PROJECT OUTCOMES & RESULTS

We asked approximately three hundred users to play this game before conducting a questionnaire. We were able to get a high rating, and this confirmed the usefulness of this concept. A number of the participants were parents and children, and the interest of the parents from an educational perspective was quite high and also, the children's degree of interest in the game was very strong. Most of the children were enthusiastic about the game and wanted to repeat the experience over and over again. Channelizing such interest in digital gadgets is considered useful for introductory educational content related to music culture.




## CONCLUSION

This game was developed to address the need for an auxiliary display tool for museums. The usefulness of this as an educational game has been proved through the opportunity for users to experience playing the game. Going forward, the marker recognition rate and detect the marker movement trajectory should be improved. Also, the game should be able to empirically analyze the user's assistance to play musical instruments.

## PERSPECTIVES & NEEDS

It can be analyzed if this system can be used for exhibition assistance in places where actual musical instruments are displayed, such as museums. The simple, easy, and intuitive operability of the game enables the user to experience a simulated playing of a musical instrument without any prior knowledge about the instrument or performance skills.

## ACKNOWLEDGEMENT

Takayuki SHINONOME, Osaka Electro-Communication University; co-author.

## 3 TO 7 REFERENCES

[1] B. V. Dijk, A. Lingnau, G. Vissers and H. Kockelkorn, *"Individual and collaborative Personalization in a Science Museum," In: Nijholt (ed.), Playful user interface*, pp.185–208, 2014.

[2] R. Yoshida, H. Tamaki, T. Sakai, M. Saito, R. Egusa, S. Kamiyama, M.Namatame, M. Sugimoto, F. Kusunoki, E. Yamaguchi, S. Inagaki, Y. Takeda, and H. Mizoguchi, *"Experience-based learning support system to enhance child learning in a museum: touching real fossils and "experi-encing" paleontological environment," In Proc. of the 12th International Conference on Advances in Computer Entertainment Technology (ACE '15), Article 25, 2015.*

[3] K. Onishi, K. Teramoto, and A. Yamaji, *"Interactive rhythm making system for musical instruments in museums," In Proc. of 2017 IEEE 6th Global Conference on Consumer Electronics (GCCE)*, pp.280–281, 2017.

[4] Vuforia Developpers Portal, https://developer.vuforia.com/

# SESSION TRANSPORT & ENVIRONMENT

**THURSDAY 5 NOVEMBER**
16:00–17:30



NANA TIAN



QUENTIN METEIER



RICHARD WETZEL



FRANCESCO CARRINO

# 15 THE EFFECT OF RECLINING HORIZONTAL PLANE ON VR SICKNESS

**Tian Nana[1], Clément Romain Lucien Joseph[2], Lopes Louis Philippe Simoes [1], Boulic Ronan[1]**

**1:** Immersive Interaction Group, EPFL, Lausanne, Switzerland

**2:** Master student, EPFL, Lausanne, Switzerland

*Contact: nana.tian@epfl.ch*

## ABSTRACT

Virtual reality (VR) sickness is still an inevitable adverse effect when using VR systems, resulting in different levels of discomfort, and potentially breaking the immersive experience. The study goal was to explore two different factors: the existence of movement, horizontal plane position and how they relate to VR sickness and game experience. The final results indicate that the horizontal position design is effective in mitigating VR sickness in lying-down position, especially for games with acceleration.

## KEYWORDS

VR sickness, Human Computer Interaction.



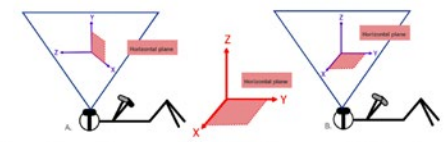


Figure 1: The two different point of view : A. Vertical posture and B. Horizontal posture. The red axis are the real world axis and the blue are the VEs axis

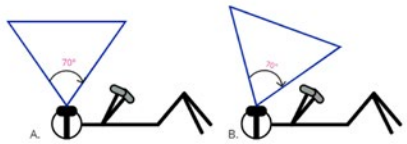


Figure 2: Two possible configuration, B. has been chosen.

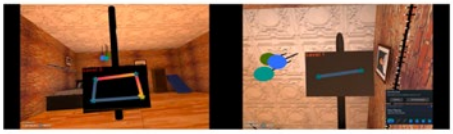


Figure 3: Static game with the 2 posture, on the left the vertical posture and on the right the horizontal posture

Figure 4: Dynamic game with the 2 posture, on the left the vertical posture and on the right the horizontal posture

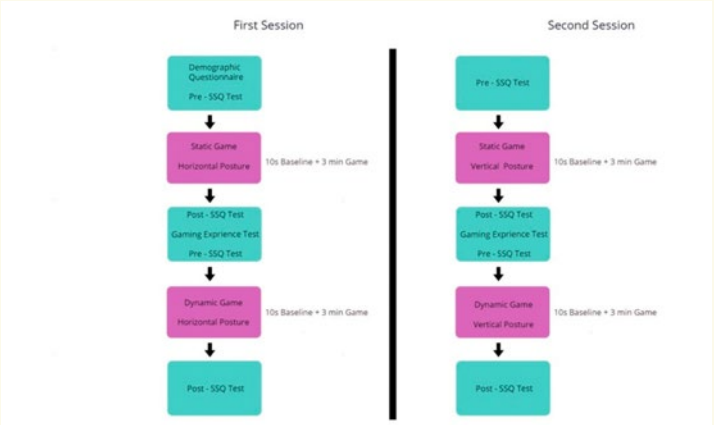



Figure 6: Flow of the experiment for a subject that start with the Horizontal posture

## CONTEXT

Recently, thanks to the development of low-cost and high-performance head-mounted displays (HMDs), virtual reality (VR) has been used for various purposes like entertainment, rehabilitation or education [1]. In most scenarios, users often experience VR applications in a sitting position. Though, the position could be sometimes confined to lying-down position for specific needs, like monitoring brain activities using functional magnetic resonance imaging (FMRI) during the VR experience [2]. Moreover, a spine position or a lying down position is expected to be more relaxing for VR experience at home or on a bed in rehabilitation institutions [1]. However, none of the VR games or applications are specifically designed for such a position.

A previous study using a 3D Pacman game compared the effect of different VR sickness mitigating factors for both lying-down and seated positions. Results [3] indicate that lying-down position can trigger VR sickness symptoms for experienced participants whereas they report no such symptoms for the sitting position. Another previous study [4] found that the angle of the perceived horizontal plane changes depending on the upper-body angle. However, it is not clear how the virtual gravity and horizontal plane position impact the perceived horizontal plane and VR sickness.

Hence, there is a pressing need to explore whether there is an optimal design choice for VR games in the lying down position.

## TARGETED ISSUES

The majority of games or applications are developed for people who play while sitting or standing. Often, if someone wanted to play those applications in the lying position, the developer should tilt the applications to a 90-degree angle. However, according to the previous study [3], even the experienced VR player experienced severe VR sickness with such design. The primary goal of this project is to see whether a better point of view exists that avoids VR sickness in the lying down position. We defined two kinds of positions in our experiment: a horizontal and a vertical one. (see image above) The main research questions are:

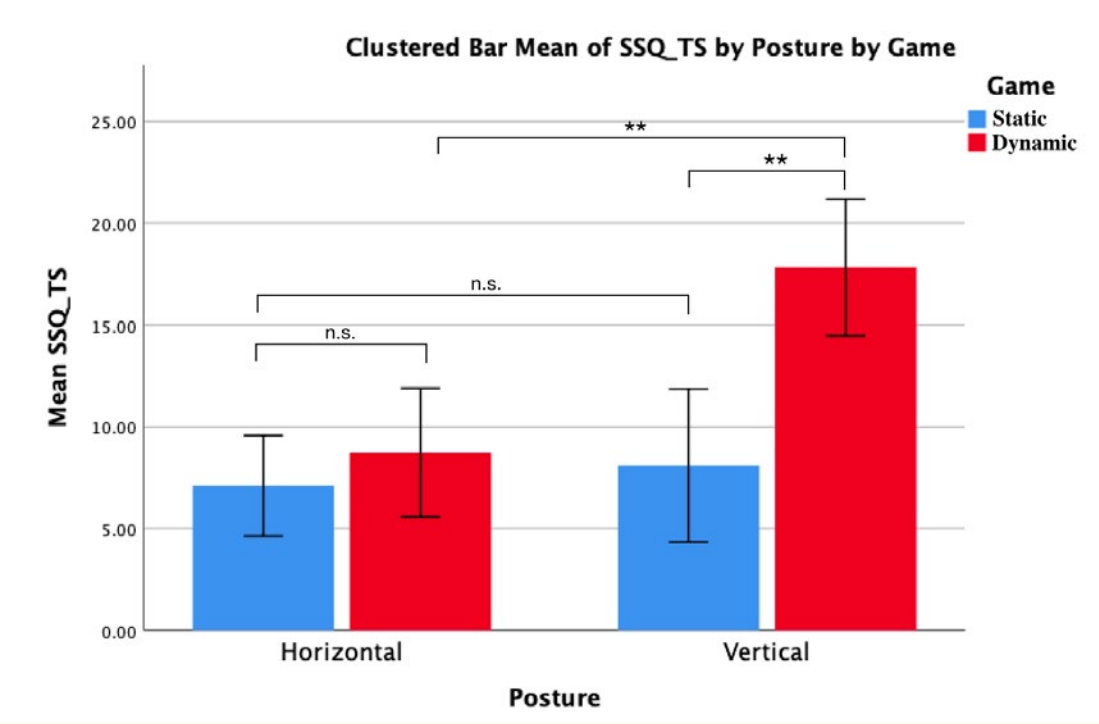
1. Do people feel less sickness if they are also "lying down" (the horizontal posture) in the virtual world?
2. Would subjects prefer playing in the horizontal position?

*Horizontal position design really mitigates VR sickness in lying down position*

The experiment takes place over the course of two different sessions of around 45 minutes each. Each session is conducted on two different days (with a maximum interval of ≈ 1 to 3 days). For each session, a participant plays both games (a static and a dynamic one) with the same position (horizontal or vertical) with a 5-minute short break. To ensure an equal balance between both variations and mitigate an "order" bias, the first session played by each participant alternates from one participant to the next. It is important to keep in mind that all participants play in all conditions. Each session employs the same sequence.

## PROPOSED SOLUTION

For the purpose of the experiment, two games have been developed— a static and a dynamic one. Each of the games is then designed for two different positions: horizontal and vertical. For simplicity, we named the four conditions as: Dynamic Horizontal (DH), Dynamic Vertical(DV), Static Horizontal(SH), and Static Vertical(SV). Previous studies highlighted the link between visual perception of motion and VR sickness. Thus, the first game developed is a puzzle game without any motion and the second one has some translation motion laterally. Furthermore, subjects are asked not to move their head, ensuring minimal motion that could cause VR sickness. Both games share the same background environment, which is a bedroom with the same






decorations. The challenge is to ensure that subjects are in similar virtual environments for both positions. The horizontal position design simulates the real situation as we are lying down on the bed. To extend the sight of view, we slightly tilted the first-person viewpoint to an angle of 20 degrees. The assumption is that it will not be perceived by the subjects but it will allow them to see not only the ceiling but also the top parts of the walls. We did a pilot test with 5 people and the angle was not noticed.

## RELEVANT INNOVATION

In the puzzle game, players must connect stars without being able to go back through the already validated paths. When a level is completed, particles appear and the next level loads automatically.

Particles have a physical and simulated gravity, which is very important because it allows players to feel the sense of gravity of the 3D environment which is not necessarily the same as the real world.

In the dynamic game, the players must avoid orange stars so as not to lose lives and collect green stars to earn points. The rate of green and orange stars, their speed and their size are randomized. All these variables are clamps between a minimum and maximum value to ensure similar gaming experiences for all subjects. Unlike the static game, players need to control themselves to move in the environment, which considerably would induce more VR sickness than the static one. The player uses two-valve index controllers. When the left hand is closed, players are doing a translation movement to the left and the same with the right hand. The valve index controller enables force detection when a hand is closed.

We did a pilot study with 5 people to ensure that the acceleration was not too high so that the VR sickness would not be too severe: a maximum speed of 5m/s and an acceleration of 200m/s.

## PROJECT OUTCOMES & RESULTS

In total, 30 subjects participated in this experiment. There were eight women and 22 men aged from 18 to 27 years old. They were asked not to drink alcoholic beverages 12 hours before each session.

For the evaluation purpose, we used the simulator sickness questionnaire (SSQ) and a revised Gaming Experience Questionnaire (GEQ) to measure the VR sickness level and individual game experiences.

Differences between the post and pre-SSQ are calculated as Δ SSQ. Since the difference data were not normally distributed, Wilcoxon Signed-Rank Tests were conducted. Statistic results show a significant difference between the DH and DV condition ($p = 0.007$). A significant difference was found in any of the SSQ scores between the SV and DV condition ($p = 0.008$). No significant difference was found between SH and SV, neither between SH and DH.

## CONCLUSION

In this study, we investigated the effect of horizontal plane position and game type on VR sickness and personal game experience. In general, the main results indicate that the horizontal position design really mitigates VR sickness in lying down position, especially for games with acceleration. Games without acceleration or deceleration tend to be less sickness-inducing. Also, negative correlation was found between cybersickness and fun level. Using the pre-SSQ remains disputable. However, our experiment showcases the importance of collecting information about the subject's health before the test. Namely, there is a pressing need to come up with an optimal health examination without implying possible sickness that the participants might experience in the follow-up experiment. Challenges still exist to understand better and mitigate VR sickness. It is vital to screen out the main contributing factors and find their design thresholds to fit various sensitive individuals; the findings could provide preliminary insights into design games for a lying down position, which could potentially be used for rehabilitation purposes or medical studies.

## PERSPECTIVES & NEEDS

Using the pre-SSQ remains disputable. However, our experiment showcases the importance of collecting information about the subject's health before the test. In other words, there is a pressing need to get an optimal health examination without telling participants about the possible sickness they might experience in the following experiment. Also, it would be very interesting to increase acceleration and add more movement axes.



## REFERENCES


[1] L. Rebenitsch and C. Owen. *Review on cybersickness in applications and visual displays.* Virtual Reality, 20(2), pp. 101–125, 2016. doi: 10.1007/s10055-016-0285-9

[2] Hoffman, H. G., Richards, T., Coda, B., Richards, A., & Sharar, S. R. (2003). *The illusion of presence in immersive virtual reality during an fMRI brain scan.* CyberPsychology & Behavior, 6(2), 127-131.

[3] J. Marengo, P. Lopes, R. Boulic. L. Rebenitsch and C. Owen. *On the Influence of the Supine Posture on Simulation Sickness in Virtual Reality 2019 IEEE Conference on Games* (CoG), 2019. doi: 10.1109/C

[4] Kawai, H., Hara, H., & Yanagida, Y. (2018, March). *Effect of Reclining Angle on the Perception of Horizontal Plane for HMD Users.*

# 16 INSIDE THE COCKPIT OF THE SEMI-AUTONOMOUS CARS OF TOMORROW

**Meteier Quentin[1], Capallera Marine[1], De Salis Emmanuel[2], Angelini Leonardo[1], Abou Khaled Omar[1], Mugellini Elena[1], Bresciani Jean-Pierre[3], Widmer Marino[3], Sonderegger Andreas[3], Carrino Stefano[2]**

**1:** HumanTech Institute, HES-SO//University of Applied Sciences Western Switzerland, Fribourg, Switzerland

**2:** Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

**3:** University of Fribourg, Fribourg, Switzerland

*Contact: quentin.meteier@hefr.ch*

## ABSTRACT

Simulations play a crucial role to investigate hazardous situations that are impossible to test in real-life conditions without endangering the user's safety. This paper presents a simulator of conditionally automated cars aiming at enhancing the driver safety and driving comfort. In addition, thanks to the simulator's highly repeatability, integrated sensors and controlled conditions we collected valuable scientific data, which is otherwise very difficult to gather.

## KEYWORDS

AR/VR simulator, conditionally automated vehicles, psychophysiological signals acquisition and processing, evaluation framework.



## CONTEXT

The main goal of the "Ad Vitam" project is to study how to design human-car interfaces, which will be operated at different levels of attention (focused, peripheral and implicit interaction) [1] in shared control driving to keep the driver in the loop, at the optimum cognitive load.

This paper describes the work carried out to design and improve an evaluation framework (e.g., driving scenarios) for conditionally automated vehicles. In particular, it focuses on the simulator used as a platform to design and evaluate novel conceptual interfaces. In fact, the simulator does not only represent a driver inside the cockpit of a semi-autonomous vehicle, it also enables the acquisition of indicators from the driver, metrics representing the driving performances and statistics from the environment surrounding the vehicle. The simulator has been developed to investigate hazardous situations that are impossible to test in real-life conditions without endangering the user's safety.

## TARGETED ISSUES

There are still many road accidents each year, with an annual number of 1.35 million deaths in 2018 [2]. The development of autonomous vehicles wants to improve traffic safety and driving experience by reducing road accidents, making traffic easier, reducing pollution and assisting the driver in the various driving tasks. Transition to fully autonomous vehicles will not be immediate. We can expect to see a transition from vehicles with little or no automation (level 1 or 2) to conditionally automated vehicles (level 3 to 4) before seeing fully automated solutions (level 5) [3]. In conditionally automated cars, the automated system and the driver share the car control, with only one of them being responsible for driving, depending on the situation. Specifically, the car remains in control 1) until it encounters a situation it cannot handle, or 2) if the driver wants to regain control.

This take-over maneuver is a critical situation and could endanger the driver's life and his surroundings if it is not correctly and timely communicated and executed [4].

*Simulations play a crucial role to investigate hazardous situations that are impossible to test in real-life*



## PROPOSED SOLUTION

In our study we propose to consider the driver's psychophysiological state in order to provide a suitable feedback. For instance, a tired, sleepy driver will require a different take-over request (TOR) from a driver that is just looking at social media on the smartphone.

Nevertheless, in order to validate our approach and design suitable Human Vehicle Interfaces (HVIs), we need to investigate hazardous situations and get signals from the driver and the environment. To do so, we created a simulator representing the car cockpit.

The simulator has physical components (seats, seat belts, steering wheel, pedals, etc.) and augmented/virtual elements that can be presented to the user via a VR headset or a large screen where the driving simulation software is displayed. We also installed a small screen behind the steering wheel in order to display the vehicle's dashboard with speed indicator, lap indicator and autonomous system status (ON/OFF or TOR).

For the driving simulation, we used the GENIVI open source software, developed by a consortium of several companies, including some car manufacturers. It is developed under Unity and it uses some scripts in C#. This simulator allows a better graphic rendering and a higher level of immersion compared to other simulator programs that we tested. Moreover, it already has an Autopilot function implemented in one of the three proposed scenarios.




## RELEVANT INNOVATION

Since the adoption of this simulator, we profoundly modified the GENIVI software to suit our project needs. Our software solution proposes 2 types of scenarios:

- Rural environment: the rural environment models Yosemite National Park where a 20-minute autonomous driving is available. It is also possible to trigger some obstacles such as falling trees, bears, rockslide, etc. We implemented the most important factors that a restrain the proper functioning of autonomous systems as identified here [5]. These limitations are sloping road, adverse weather (heavy rain), fading lane marking, stationary obstacle (rock on the left lane) and a mobile obstacle crossing the road (deer) which leads to a takeover request.
- Urban environment: the urban environment model is San Francisco. The scene has many intersections and the autonomous traffic is already implemented. It is also possible to trigger some obstacles such as pedestrians, dogs, stationary cars on the lane, etc. The main improvements are the autopilot implementation and some limitations addition (unclear lane markings, external human factors such as pedestrians and bicycles, construction zones, ...) in the scene.

## PROJECT OUTCOMES & RESULTS

The current simulator version provides information on the car and its surrounding environment, including indicators of the driving quality. Sensors are integrated to obtain psychophysiological signals from the user in the cockpit. This includes electrodermal activity (EDA), heart rate and heart rate variability (computed from ECG) and respiratory rate.

The hardware is hackable and multiple add-ons have been tested (such as a haptic seat or a smart seat belt enriched with sensors).

Multiple experiments were conducted to validate the simulator quality. In one experiment, 90 participants were enrolled: half of them had to perform a cognitive loading secondary task while the car was driving in conditional automation during 20 minutes (the control group had no secondary task to perform). 6 take-over requests were triggered to each driver. In such situations, participants' ECG, EDA and respiration rate were collected. First results show that the learning system has 97% of accuracy to classify drivers that performed the secondary task for 20 minutes. The takeover situation data, used to classify drivers' situational awareness, are currently being analyzed.

## CONCLUSION

Simulations play a crucial role to investigate hazardous situations that are impossible to test in real-life conditions without endangering the user's safety. In addition, highly repeatability and controlled conditions allow to get scientifically solid evidence that is otherwise very difficult to reach. In this paper, we presented a simulated cockpit of a semi-autonomous vehicle, conceived to be an evaluation framework to study critical, possibly life-threatening conditions.

## PERSPECTIVES & NEEDS

We are developing multimodal solutions to trigger and display TOR. An AI module is also in development, the goal being to select the best modality combination in real time and according to the environmental, car and driver state.

## ACKNOWLEDGEMENTS

This work is part of a project funded by the Hasler Foundation.

## REFERENCES

[1] Bakker, S. and Niemantsverdriet, K., 2016. *The interaction-attention continuum: considering various levels of human attention in interaction design.* International Journal of Design, 10(2), pp. 1-14.

[2] Arkonac, et al. (2019). *In-Car Distractions and Automated Driving: A Preliminary Simulator Study. Proceedings of the 11th International Conference on Automotive User Interfaces and Interactive Vehicular Applications Adjunct Proceedings - AutomotiveUI 19.*

[3] SAE International. 2018. *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles.*

[4] Bueno, M., et al (2016). *How different mental workload levels affect the take-over control after automated driving.* 2016 IEEE 19th ITSC.

# 17 TO BEE OR NOT TO BEE: PROTOTYPING A VR TRAINING GAME FOR BEEKEEPERS

**Burgess Naomi[1], Kellerhals Ursina[2], Wetzel Richard[1]**

**1:** Immersive Realities Research Group, School of Information Technology, Lucerne University of Applied Sciences and Arts, Switzerland.

**2:** Institute of Communication and Marketing, School of Business, Lucerne University of Applied Sciences and Arts, Switzerland.

*Contact: naomi.burgess@hslu.ch*

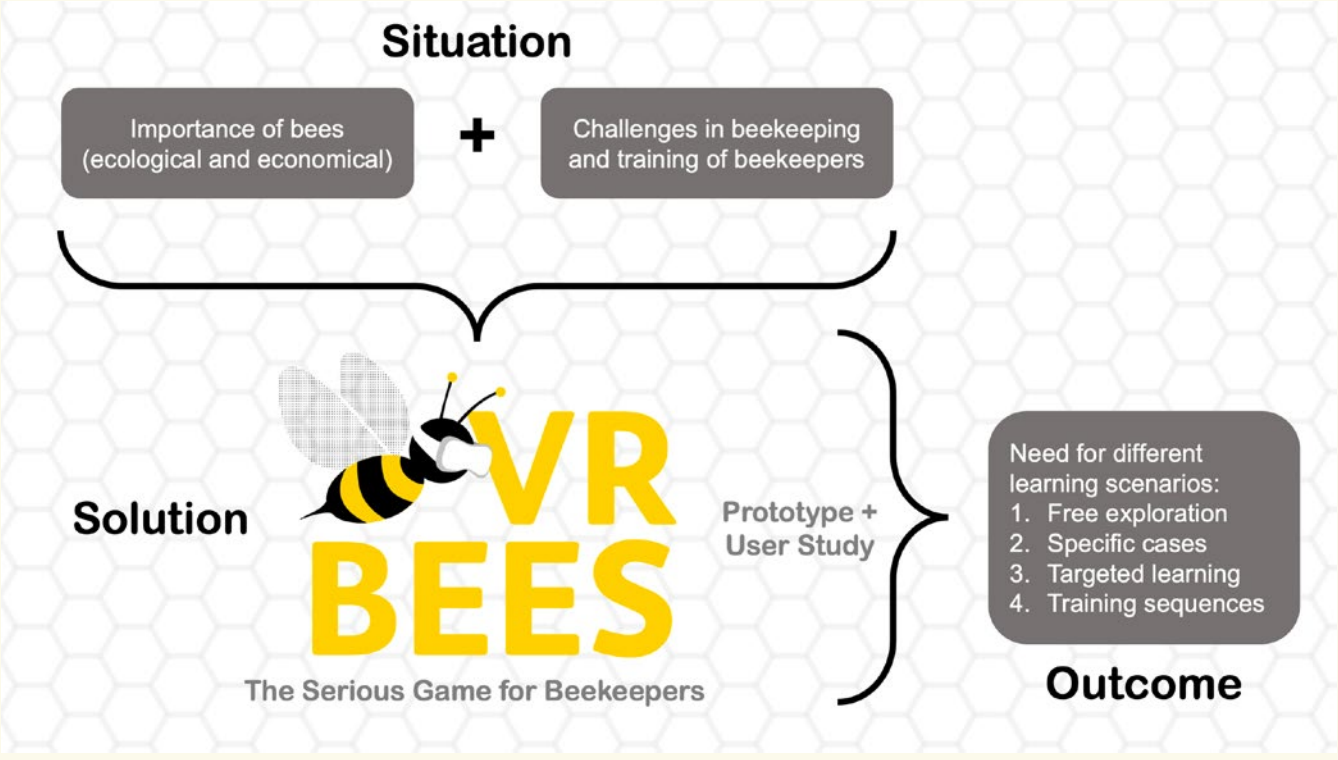
## ABSTRACT

While bees are crucial from both an ecological and an economical point of view, beekeeping is itself a complex and demanding activity. Together with BienenSchweiz (the beekeeper association of the German-speaking part of Switzerland), we are developing a virtual reality serious game called "VR Bees" to support practical training of beekeepers. Our first prototype allowed us to gather insights into ideal learning scenarios a virtual hive will offer beekeepers of different experience levels.

## KEYWORDS

Virtual reality, serious game, bees, beekeeping, training, learning.





## CONTEXT

The honey bee is vital with regard to biodiversity, as well as national economies. In Switzerland, each bee colony accounts for an annual value of approximately CHF 1,000 in pollination. In the years 2013 and 2014, about 17,500 beekeepers looked after a total of 165,290 bee colonies in Switzerland [1]. As beekeeping has become a popular pastime in recent years, these numbers are likely to have increased since.

Despite beekeeping's popularity, the situation for the discipline's central organism is dire [2]. Switzerland has one of the highest "bee densities" (number of colonies per km2), which increases the risk of highly contagious diseases spreading quickly between hives. In addition, today's agricultural practices (monocultures), pesticides, pollution, and climate change weaken bee colonies and render modern beekeeping a highly complex activity [2]. The main threat facing honey bees, however, is the varroa mite, which rapidly destroys a colony if not kept in check. The mite—or rather, beekeepers not dealing with it correctly—is the main reason for colony losses during the winter [3].

In light of these issues, and with so many colonies being looked after for leisure, it is crucial that beekeepers are not only aware of the time-consuming and complex nature of their "hobby" but are also extremely well-trained from the start [2]. Arguably, the bee's worst enemies are inadequately trained or inexperienced beekeepers who—either unknowingly or accidentally—disrupt the fragile organism. Even though such actions may be well-meaning, they might still prove harmful—and, in many cases, even fatal—for the bees [2].

## TARGETED ISSUES

Currently, BienenSchweiz (the beekeeper association of the German-speaking part of Switzerland) offers a two-year beginners' course [4]. Like beekeeping itself, training beekeepers is a challenging task for several reasons: [1] Honey bee colonies are sensitive organisms that suffer or even die from either too many interventions or a few clumsy interventions. [2] As is the case with nature in general, colonies do not always adhere to patterns of behavior found in textbooks. [3] Beekeeping is extremely seasonal and it is very difficult to plan ahead, as the timing of various tasks depends on weather and temperature [2]. Taken together, these factors make it extremely difficult for BienenSchweiz to provide novice beekeepers with:

- (a) sufficient practical training with actual bee hives,
- (b) first-hand experience with a wide variety of eventualities, and
- (c) ability to prepare for crucial tasks ahead of time

Our project goal is to identify gaps in the current beekeeper education and provide tools and methods to overcome the aforementioned challenges, thereby making the learning process more encompassing, more immersive and—first and foremost—more practical.

*Pollution and climate change weaken bee colonies and render modern beekeeping a highly complex activity*

## PROPOSED SOLUTION

We believe that virtual reality has high potential to shape the future of beekeeper—and many other types of hands-on—training. Indeed, in a VR application—and specifically within a VR game—trainees can benefit from learning-by-doing and learning-through-play [4]. Additionally, a virtual reality bee hive allows us to overcome the various educational gaps we have previously mentioned. By creating such a game for use in a BienenSchweiz-run course, we can simulate bee hives in various states, thereby showing the impacts of disturbing/damaging a hive with too many interventions or improperly-handled or careless ones, effects of different diseases and how to identify them, and more (without any harm coming to real-life colonies). Training can also be provided year-round regardless of temperature or weather (allowing beekeepers to prepare ahead of time for upcoming seasonal challenges), and can promote the repetitious physical activity necessary to



continually construct new knowledge through periods of self-guided experimentation, encouraging trainees to gain confidence in their actions [4]. In short, VR enables us to implement different training scenarios focusing on embodied interactions and hands-on experiences.

## RELEVANT INNOVATION

Currently, the majority of BienenSchweiz's content is theoretically taught, with the help of textbooks, pictures and videos. During the majority of sessions, most instructors avoid using live colonies, which means that novice beekeepers have very few opportunities to practice handling actual bees. What is more, trainees cannot physically observe how their actions affect the inner workings of a hive.

In order to address this, we are developing a VR serious game to support beekeeper training with a virtual space in which users can explore and practice different beekeeping techniques, observe the results of their actions (e.g. through gauging bees' condition via their behavior), and then adjust their methods accordingly. Through playful practice and repetition [4], our game will help both new and advanced beekeepers gain the experience they need to be better prepared for the challenges they will encounter in this complex field, all within a safe (and ultimately forgiving) environment.

Overall, we expect to further explore the role of VR in the learning process, and how it can best be used for teaching a set of tasks that relies so much upon intentional physical motion/practice, as well as one's observational skills.

Moreover, we are identifying the potential of different learning scenario types for learners with different experience and requirement levels, ranging from more competitive set-ups to explorative play.

## PROJECT OUTCOMES & RESULTS

We developed a first VR prototype of "VR Bees" to evaluate what the final application should entail. We set up a simple scenario: a single hive box (containing seven frames in total) sits on top of a wooden table in a flowery field. Players can inspect the box and its environment, as well as pull out the virtual hive's frames holding the combs. Each comb features bees that bustle about, with only one containing a queen bee. Additionally, bees fly back and forth between various areas in the tall grass surrounding the immediate perimeter. The distinct sound of bees buzzing completes the scenario. We developed the prototype in Unity, and we chose the Valve Index as our VR headset, as we required high image quality and resolution.

We used this prototype to carry out an exploratory user study with 12 participants (3 novices, 6 average to first-level-expert beekeepers, and 3 high-level experts). Each beekeeper was given the task to find the queen in the hive, a common task for beekeepers. Before play sessions, we asked the current participant general questions about their beekeeping background; afterwards, we prompted them to reflect on the game they had just experienced. Each two-part interview lasted about 40 minutes, in addition to about 10 minutes in VR.

We then conducted a qualitative study analysis, which focused on how beekeepers of different levels could benefit the most from a VR game and how it could support their training. With these results, we can shape the next version of VR Bees to match beekeepers' requirements and close gaps in existing training programs.

## CONCLUSION

Our study has shown that an effective training game will have to prioritize a combination of game design elements. So far, we have identified the following features that should be incorporated: 1) free exploration scenarios (allowing for long-term observation of choices and their impacts), 2) set cases that require specific decisions and offer feedback concerning trainees' actions, 3) the ability to select different scenarios and practice in a targeted manner, and 4) haptic training sequences that instigate time-pressure as a central dynamic.

## PERSPECTIVES & NEEDS

Going forward, we will have to tackle a variety of tasks. Rendering an active bee hive is computationally demanding (especially in VR), and accurately simulating bee behavior is challenging. On the game design side, we will develop more playful methods of hive interaction to cover aforementioned learning scenarios. Lastly, we will also incorporate physical beekeeping equipment into our game's overall set-up to increase both realism and sense of presence.



## ACKNOWLEDGMENTS

We thank our project partner BienenSchweiz for their ongoing support. The project was funded by Lucerne University of Applied Sciences and Arts via the ITC Digital Transformation of the Workplace grants programme, the School of Information Technology, and the School of Business.

## REFERENCES

[1] Charrière, j.-D., Frese, S. & Herren, P. (2018). *Bienenhaltung in der Schweiz im Jahr 2014.* Agroscope Transfer, 250, 4-24

[2] Götti Limacher, M. (2018). *Imkerei in Der Schweiz: Ausbildung und Öffentliches Interesse.* Interview

[3] Morawetz, L., Köglberger, H., Griesbacher, A., Derakhshifar, I., Crailsheim, K., Brodschneider, R., & Moosbeckhofer, R. (2019). *Health status of honey bee colonies (Apis mellifera) and disease-related risk factors for colony losses in Austria.* PLoS ONE, 14(7)

[4] BienenSchweiz. (n.d.) *Bildungskonzept.* Retrieved from http://www.bienen.ch/bildung-wissen/bildungskonzept.html

[5] Roussou, M. (2004). *Learning by doing and learning through play: an exploration of interactivity in virtual environments for children. Computers in Entertainment.*

# 18 BOMBUSCAR: GAMIFICATION DESIGN OF A CARPOOLING-BASED FREIGHT TRANSPORT

**Francesco Carrino[1], Quentin Vaucher[2], Richard Pasquier[1], Vincent Bourquin[1], Omar Abou Khaled[1], Elena Mugellini[1], Stéphane Gobron[2]**

**1:** Haute école d'ingénierie et d'architecture de Fribourg, HES-SO, Fribourg, Switzerland

**2:** Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

*Contact: francesco.carrino@hefr.ch*

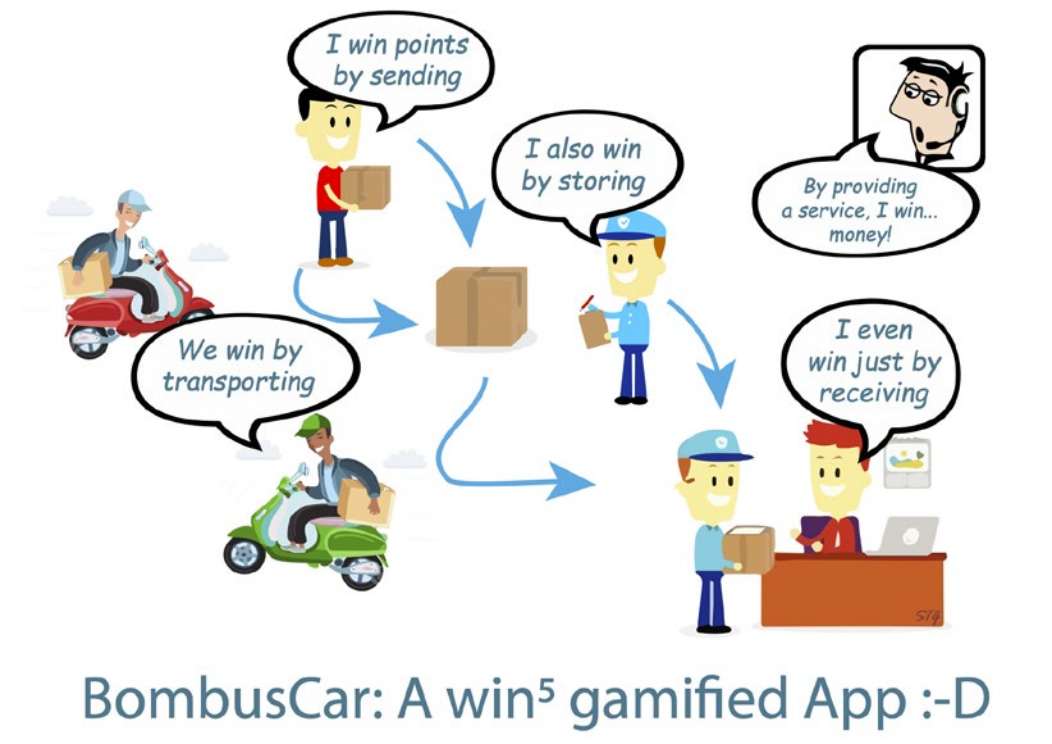
## ABSTRACT

The environmental and societal cost of traditional logistics, based on the "Hub and spoke" model, is increasingly unfavorable. Digitization allows new approaches that have proved effective in people transportation (e.g., Uber, BlaBlaCar). This project proposes the creation of a smart distribution network for the goods transport by exploiting existing transport capabilities. We present the gamification design of the user interface (UI) to foster users' motivation and trust to the platform.

## KEYWORDS

Carpooling, gamification, dynamic flow simulation.





## CONTEXT

Currently, the transport of parcels is mainly based on the "Hub and spoke" model: the nodes of the network consist of a single central point (the hub) to which all the transport lines (the spokes) converge. In practice, several hubs are connected to each other to cover the entire concerned territory. This model has been used with varying success degrees in several areas (e.g., computer networks, aeronautics, etc.). However, this model comes with a few important drawbacks: it generates a concentration of traffic near the hubs; the hubs represent network failure "single-points"; last but not least, a parcel sent from one city to another separated by a few kilometers will pass through a route of a hundred kilometers to reach the closest hub and come back (currently, throughout Switzerland, there are only three hubs). This issue is even more dramatic if both cities belong to adjacent regions referring to different hubs.

While the Hub and spoke model has a high cost-effectiveness optimization thanks to a limited number of high-performance centers, in terms of sustainable mobility, the package does not follow the shortest path (and therefore energetically optimal).

Our project, called BombusCar, is a work in progress that proposes the creation of an intelligent, flexible and secure distribution network for the parcels transportation by exploiting existing transport capabilities. The main idea is to adapt the carpooling concept to the transportation of goods.

## TARGETED ISSUES



From the users' point of view, our platform takes the form of a mobile application. The user can register as sender, carrier, or collector (for temporary storage). The sender (an individual or a reselling company) specifies the characteristics of the parcels to be sent (origin, destination, volume, etc.). The carrier indicates its route and transport capabilities. The collector gives his storage availability.

To bring the package to the destination, the system will choose the "optimal" combination of sender/transporter(s)/collector(s). Optimal in terms of cost, time and environmental impact. A digital shipment tracking until the package delivery will prevent possible abuse and give assurances that the goods will arrive at their destination.

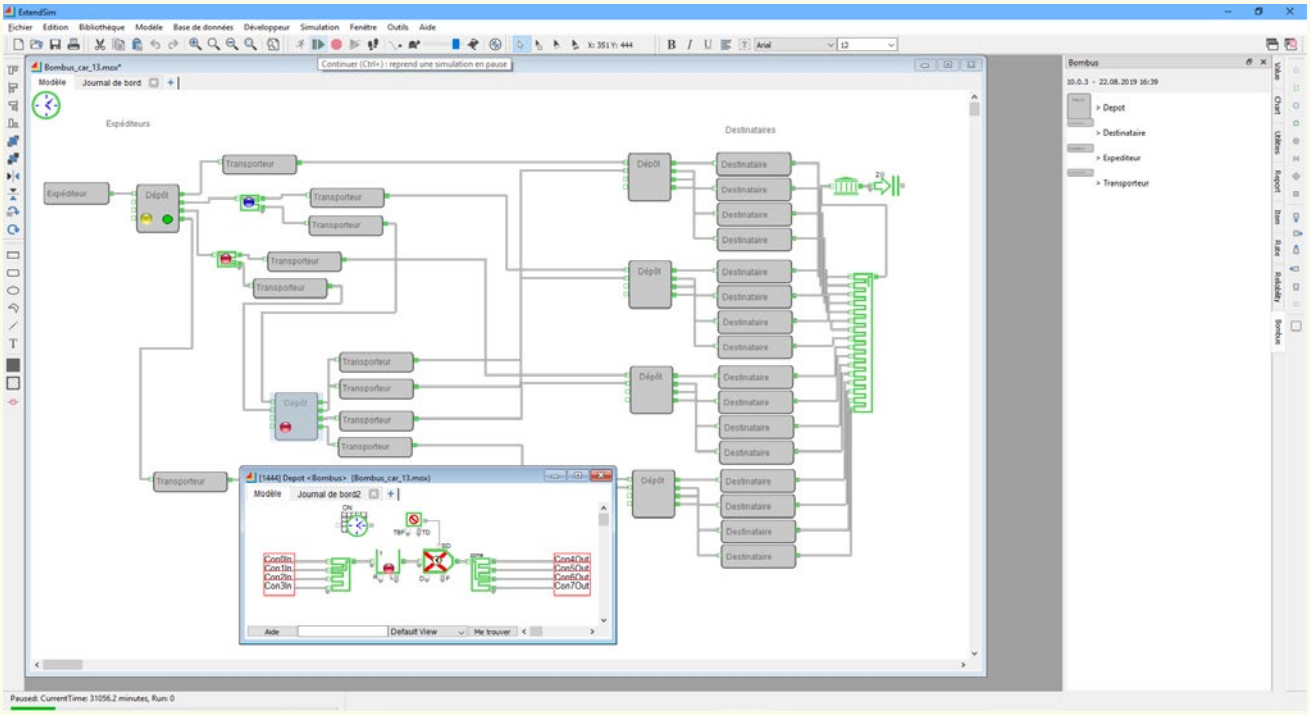
One of the key factors for the viability of such a project is the long-term participation of people as carriers and collectors, to transport and temporary stock the goods, respectively. The "green appeal" of the project and extrinsic motivations (such as pecuniary rewards for the service provided as carrier or collector) can only partially face this challenge. For this reason, the user interface should be adapted to foster users' motivation, platform fidelity and trust.

*An intelligent, flexible and secure distribution network for the parcels transportation*

## PROPOSED SOLUTION

Gamification-specific elements have been successfully used in the past as a support for behavior change techniques, for example to encourage people to maintain a healthy lifestyle in adolescents [1] or in seniors [2].

In this project, we use gamification to empower the users and foster their fidelity to the platform. In particular, a gamified approach has been designed to encourage carriers to modify their route when needed (itinerary, departure time, etc.), to meet the network needs and optimize ecological costs. The gamification design takes into account all the actors in the platform (see image above). In addition, in order to predict needs and adapt rewards, we developed a network simulator replicating our network specificities, e.g., carriers' and collectors' location, availability and other constraints such as max capacity, payload, etc.






In this paper, we present the simulator we developed to analyze the network dynamics and we introduce the gamification design implemented in our platform.

## RELEVANT INNOVATION

The field of logistics is currently undergoing major changes. In the goods distribution many solutions consider at the use of drones or autonomous vehicles [3-5]. All these projects require the creation of new infrastructures or the use of systems which are not yet fully usable in everyday life. Furthermore, none of these projects presents a sustainable vision similar to the carpooling we offer. Some examples of freight-oriented carpooling are Cocolis, Kartoffeltaxi, Roadie, Piggybee, Bring4You. However, many of them are simple web platforms that facilitate the encounter between carriers and senders and, at the best of our knowledge, none of them use advanced gamification approaches to motivate and involve their users.

Undeniably, the less people take part in the system, the lower the quality of service (QoS) that such a platform can provide. Another key specificity of the network is its dynamicity. The ever-changing state of the system leads to continuously evolving needs which will require large amounts of data to train the models able to predict the system's future states.

Our goal is to use gamification as data-based leverage, guiding the users towards actions fulfilling the current needs. To do so, gamification has to act symmetrically with the platform, resulting in dynamically generated "game events" that depend on the current system state.

## PROJECT OUTCOMES & RESULTS

We implemented a dynamic flow simulation to test the limits and key points of the parcel transport system. The modelling aims to highlight the different parameters that influence the performance of the overall transport solution. This information is used to feed the gamification system.

The dynamic simulation model reproduces the behavior of the various interacting entities (senders, carriers, collectors and receivers). By recreating a routing grid passing through intermediate points representing the stages of the journey, the model reproduces the network behavior (see image above). This allowed highlighting the importance of different parameters to guarantee the whole system performance, such as the need for many users to couple carriers' schedules with the opening collectors' hours and the importance of carrier's capacity in terms of volume and/or payload.

These aspects should be considered for the UI design. Thus, the gamification is designed around three objectives:

- Firstly, ensuring the system's equilibrium through daily objectives generated as a function of the system state;
- Secondly, increasing end-user's fidelity through long-term objectives;
- Finally, developing QoS hand in hand with the community through:
  + Ranking (experience system based on a logarithmic levelling formula);
  + Badges (such as "Eco-friendly", "On Time", etc.);
  + Titles (awarded to highly specialized users, e.g., able to reliably transport precious objects, perishable goods, etc.).

## CONCLUSION

BombusCar is a work in progress that aims at creating an intelligent, flexible and secure distribution network for the transport of parcels based on carpooling. In this paper, we presented (i) the design of the gamified interface for a mobile application that encourages users to answer the needs of the platform and (ii) the conception of a dynamic simulation model to predict these needs. The simulator will be used to analyze different scenarios and, thus, adapt the rewards strategy.

## PERSPECTIVES & NEEDS



This project fits into two visions. In the short-term, the system can be integrated into the current transportation network made up of private vehicles (cars, bicycles, etc.) and logistics operators. In a longer-term vision, it will be able to follow technological development and integrate into a network made up of autonomous cars and other innovative transport systems (Hyperloop, Magway, etc.). This while keeping the same requirements in terms of performance, environmental impact and safety.

## ACKNOWLEDGEMENTS

This work was supported by the HES-SO "P2" funding system, grant entitled "BombusCar" (2019-2020). The authors would also like to thank the QoQa company for the insight provided and their partnership in the future practical application in the field.

## REFERENCES AND BIBLIOGRAPHY

[1] Caon, M., Carrino, S., et al. (2018). *Teenagers' Usage of a Mobile-Wearable-Cloud Platform to Promote Healthy Lifestyles: the PEGASO Experience.*

[2] El Kamali, M., Angelini, et al. (2018). *Towards the NESTORE e-Coach: a Tangible and Embodied Conversational Agent for Older Adults.* (pp. 1656-1663). ACM.

[3] Walmart Autonomus Delivery, Engadget. https://www.engadget.com/2019/01/09/walmart-autonomous-deliveries-arizona/

[4] Segway Autonomus Delivery, CNET. https://www.cnet.com/news/segway-to-introduce-autonomous-delivery-robots-at-ces-2019/

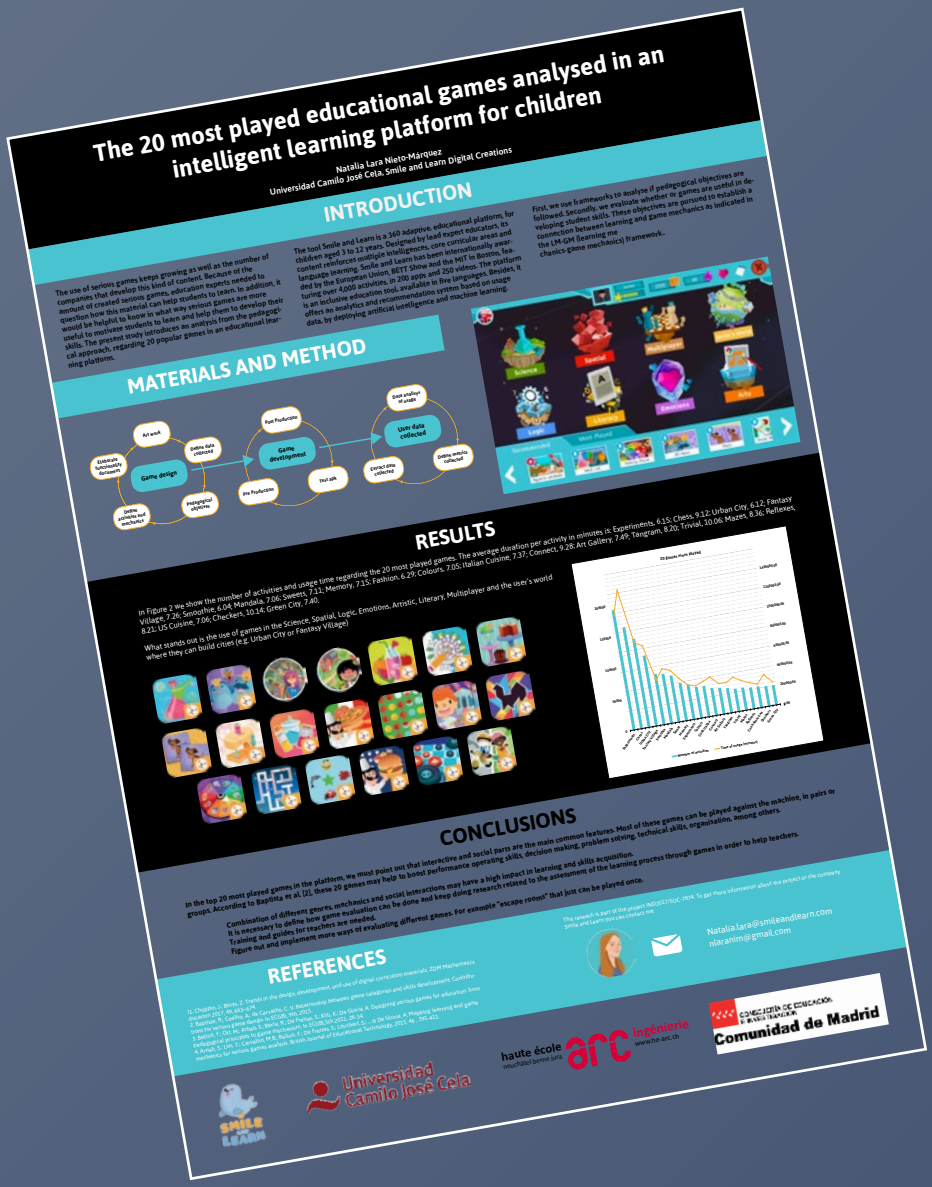
[5] Continental, robot delivery dogs, TechCrunch. https://techcrunch.com/2019/01/07/robot-delivery-dogs-deployed-by-self-driving-cars-are-coming/

# DEMO & POSTER

# THE 20 MOST PLAYED EDUCATIONAL GAMES ANALYSED IN AN INTELLIGENT LEARNING PLATFORM FOR CHILDREN

**Natalia Lara Nieto-Márquez**
CHUV, Centre hospitalier universitaire vaudois, Lausanne, Switzerland

*Contact: nlaranim@gmail.com*






Full Paper in session Education & Learning

# DON'T BE BORING: THE CASE OF A GAMIFIED GOOGLE CLASSROOM

**Jedel Izabella[1], Gillberg David[2], Palmquist Adam[3]**
**1:** The University of Gothenburg, Göteborg, Sweden
**2:** Insert Coin, Göteborg, Sweden
**3:** University of Skövde, Skövde, Sweden

*Contact: izabellajedel@hotmail.com*




Full Paper in session Education & Learning

# STRATEGIOUS

**Xavier Wilain**
XW_SeriousGames, Bex, Switzerland
*Contact: xw.serious.games@gmail.com*


My constant will of entertaining my student's learning has naturally led me to the creation of tabletop serious games. I want to reduce the nominal gap existing between entertainment and learning which has been originally defined by Walt Disney himself (1954). In a module I am teaching in the final year of a Bachelor in Hospitality and Events Management in the Swiss Hospitality Management School, called Entrepreneurship for events, I have created a tabletop serious game to guide and motivate my students to critically integrate several elements of the module such as personality assessment, negociation, and finance management. A reading of a study of Southall and Wason (2016) gave me the idea of integrating an element of the Human Resources module : talent management, transforming my idea in a synoptic activity. Here is how the tabletop serious game Strategious - Team entrepreneur was born.

# AMBASSADOR PRE-CRISIS DECISION-MAKING

**Ashish Amresh**
Arizona State University, Tempe, USA

*Contact: amresh@asu.edu*


We propose to demonstrate a simulation-style training that imparts flexible, observation- and analysis-based decision-making skills to newly-appointed Ambassadors. The simulation gives Ambassadors the opportunity to experience various pre-crisis situations; educates Ambassadors in the various sources of intelligence relevant and available in the situation; builds Ambassadors' capacity to develop and evaluate options while gaining and maintaining situational awareness; builds Ambassadors' systems thinking and anticipatory competence so that they may anticipate outcomes, systemic impacts and cascading effects, and maintain resilience amidst adverse outcomes; and many others. The simulation also establishes a post-experience environment for reflection and dissection of the experience.

There are four main elements that distinguish the design of our simulation, these four elements – a dynamic visual "roadmap" to pre-crisis thinking; a crafted meta-experience narrative conducive to learning; fictional yet authentic settings; insightful representations of possible futures – create a simulation space for the Ambassador that we feel will be best able to inculcate the flexible, observational, reflective decision-making necessary to operate in a world of increasing complexity and decreasing security.

# INSIDE THE COCKPIT OF THE SEMI-AUTONOMOUS CARS OF TOMORROW

**Quentin Meteier[1], Marine Capallera[1], Emmanuel De Salis[2], Leonardo Angelini[1], Omar Abou Khaled[1], Elena Mugellini[1], Jean-Pierre Bresciani[3], Marino Widmer[3], Andreas Sonderegger[3], Stefano Carrino[2]**

**1:** HumanTech Institute, HES-SO//University of Applied Sciences Western Switzerland, Fribourg, Switzerland

**2:** Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

**3:** University of Fribourg, Fribourg, Switzerland

Contact: quentin.meteier@hefr.ch




Full Paper in session Transport & environment

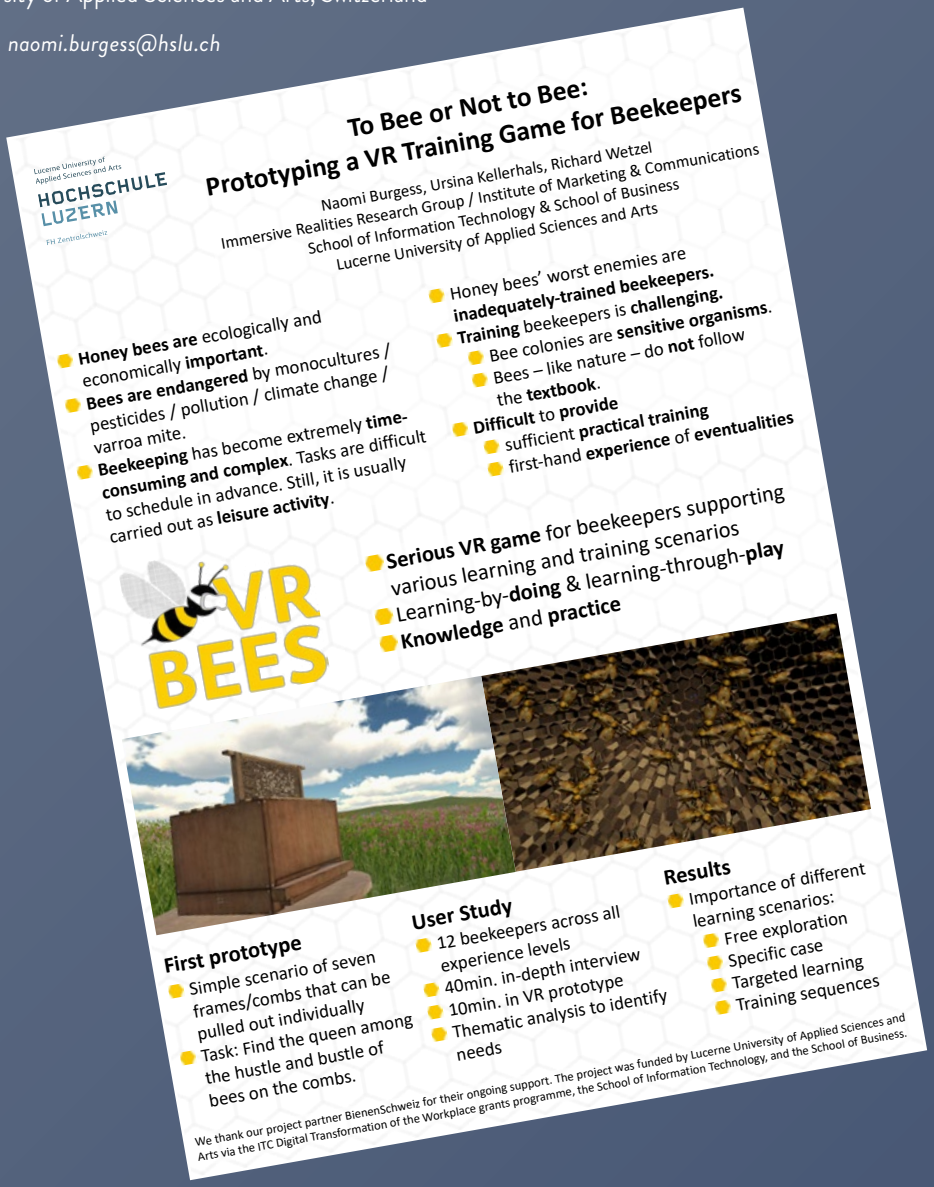
# TO BEE OR NOT TO BEE: PROTOTYPING A VR TRAINING GAME FOR BEEKEEPERS

**Naomi Burgess[1], Ursina Kellerhals[2], Richard Wetzel[1]**

1: Immersive Realities Research Group, School of Information Technology, Lucerne University of Applied Sciences and Arts, Switzerland

2: Institute of Communication and Marketing, School of Business, Lucerne University of Applied Sciences and Arts, Switzerland

*Contact: naomi.burgess@hslu.ch*






Full Paper in session Transport & environment

# LES BARONS – AN URBAN TREASURE HUNT THROUGH LA CHAUX-DE-FONDS' WATCHMAKING HERITAGE.

**Hans Loïc**[1], **Marikit Taylor**[2]

**1 :** Entrée de Jeux, La Chaux-de-Fonds, Switzerland

**2 :** Historian, La Chaux-de-Fonds, Switzerland

*Contact: loic@entree-de-jeux.ch*




Full Paper in session Culture & Urbanism

# SAINT URSANNE CIRCUIT SECRET

**Maria Sisto, Julien Senn, Stéphane Gobron**
Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

*Contact : stephane.gobron@he-arc.ch*




The city of St-Ursanne, located in the Swiss Jura, is a city with a rich historical and religious heritage. For the 1400th anniversary of its founder, saint Ursanne, it was decided to modernize the visit of the town through a location-based mobile app. The user has to visit the city in search of the disappeared Jura historian Perceval Clèvre, who invented a device to establish communication with the stones. At each visited point, the user gets a new chapter of Perceval notebook, with new information about the city. Each point provides a unique interaction with the user, with illustrations, videos, 3D models, Augmented Reality and projections. The collaboration with JuraTourism (JT) and the city of St-Ursanne allows the use of JT Circuit Secret door control system and provides access to places rarely open to the public. Under the artistic direction of John Howe, the application is a combination of storytelling, technology, and art.

# SPEAKERS & MODERATORS

**Quentin Meteier**
Transport & Environment

**Xavier Wilain**
Skills Development

**Natalia Lara Nieto-Marquez**
Education & Learning

**Maria Sisto**
Personal & Professional Training

**Lissa Holloway-Attaway**
Culture & Urbanism

**Izabella Jedel**
Education & Learning

**Nana Tian**
Transport & Environment

**Stéphane Gobron**
Health Staff-oriented

**Richard Wetzel**
Transport & Environment



**Fantin Reichler**
Education & Learning

**Axel Collet**
Personal & Professional Training

**Loïc Hans**
Culture & Urbanism

**Fiorentino Assunta**
Health Staff-oriented

**Julien Schekter**
Round table chair

**Francesco Carrino**
Transport & Environment

**Mattia Thibault**
Culture & Urbanism

**Atsushi Yamaji**
Culture & Urbanism

**Stefano Carrino**
Personal & Professional Training

**Ashish Amresh**
Skills Development

**Sylvia Gonzalez**
Health Staff-oriented

**Michael Kickmeier-Rust**
Education & Learning

# MANY THANKS TO

ISBN (ONLINE): 978-2-940387-26-7

ISSN (ONLINE): 2297-914X

SPONSORED BY:

haute école
neuchâtel berne jura
arc

NIFFF
NEUCHÂTEL
INTERNATIONAL
FANTASTIC FILM FESTIVAL
THE OMEGA EVENT FOR FANTASTIC FILM, ASIAN CINEMA & DIGITAL CREATION

Hes·so
Haute Ecole Spécialisée
de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts
Western Switzerland

—HEAD
Genève

h e p i a
Haute école du paysage, d'ingénier
et d'architecture de Genève

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

**Innosuisse – Swiss Innovation Agency**

DIGITAL
KINGDOM

Graphic Design: Contreforme