Tampere University

Faculty of Information Technology and Communication Sciences

# Gamification Group

GL! HF!...GG!

# Immersive

## Final Report

http://gamification.group

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**Business Finland**
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**Alma Media**
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**Veikkaus**
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**Supercell**
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**Tactic Games**
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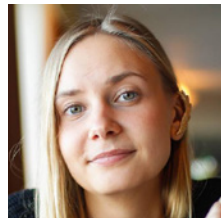

Henrietta Jylhä (M.Sc.) studies visual aspects in interactive environments related to consumer psychology. She has experience in quantitative methods, i.e. extensive international survey studies and online experiments.

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# Table of Contents

Introduction . . . . . 1

Virtual Reality . . . . . 4

Augmented Reality . . . . . 20

Immersive Industry Day . . . . . 39

Publications . . . . . 43

Outcomes . . . . . 49

# Introduction

Virtual and augmented reality technologies have moved from being regarded as esoteric technological curiosities to being increasingly considered a part of everyday life. While these technologies have not yet enjoyed complete mass adoption and while these technologies are still rapidly developing, there already exists a range of both consumer and business facing products and services that use these technologies to great effect. Even through VR technologies have existed for decades, the current wave of virtual reality (VR) enthusiasm was prominently sparked by the successful Kickstarter campaign for the Oculus Rift device in 2012 (acquired by Facebook in 2014). For many consumers, their first taste of augmented reality (AR) came as a smartphone game experience when Pokémon GO was released in 2016.

Throughout industries and fields, these mixed reality technologies have been received with a lot of both warranted and unwarranted positive expectations, however yet there has still existed a lot of uncertainty as to why and under which circumstances both individuals and organizations would adopt these technologies and as to what new functionalities and possibilities these technologies could ultimately afford.

This is why the Gamification Group/Tampere University and its industry partners initiated the IMMERSIVE -project, funded by Business Finland (project number 5479/31/2017).

The IMMERSIVE-project investigated how organizations can successfully adopt and utilize virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies. The project focuses especially on questions such as how and why do people use and consume VR/AR/MR media content and how can companies be supported in their utilization and adoption of these technologies. The IMMERSIVE-project examines the multifaceted VR/AR/MR phenomenon with a wide set of methodologies and thus produces rich, effortlessly adaptable knowledge on the topic. The work of the project was split into three distinct work packages.

WP1 focused on virtual reality, the motivations and factors that impact using this technologies, potential problem factors as well as how people spend money on virtual reality content and hardware. In addition to this, the work package looked at collaboration within virtual reality.

WP2 investigated augmented reality from several perspectives. Firstly, research looked into the physical dimensions of AR: how does the place where AR is used influence the content and how can reality be augmented outside of just placing digital elements on screens. Secondly, studies looked at already developed AR services and products, and how users are engaging with these.

WP3 focused on media consumption and how different consumption platforms impact the user experience. This particularly focused in virtual reality, where the method of consuming media content differs significantly from the forms of media consumption that are part of contemporary society and media consumption habits.

In addition to these three, WPX covered aspects related to the broader notion of immersive information systems, such as gamification and visual communication.

This report is structured into three distinct sections. The first section presents detailed research outcomes related to virtual reality, while the second section does the same for augmented reality. The third section provides an overview of the dissemination of knowledge throughout the project in the form of events that have been organized, press appearances and keynotes. Alongside these, the third section also lists all the relevant publications produced as part of this project.

Enjoy this brave new virtual world,

Juho Hamari
Principal investigator

&

Max Sjöblom
Project manager

# Virtual Reality

IMMERSIVE

# The adoption and use of VR

## A uses and gratifications approach of the adoption and continued use of virtual reality

During recent years virtual reality (VR) technology has developed to the point where there is an increasing amount of consumer grade device and content available. However, VR inhabits an intriguing niche of technologies where there may be large difference between the reasons why consumer adopt the technology in the first place and what predicts their continued use of the technology. VR can be considered a technology where expectations of the value of use can greatly differ from the actual experience-based value of using it. Therefore, the question as to why people adopt VR in the first place and why people continue using it remains an alluring question. Moreover, in terms of the theory and application, the difference of the expectation and experience is not only relevant in terms of VR experience but also related to the larger area of adoption and post-adoption of technology.

### PUBLICATION

Sjöblom, M., Hassan, L., Jylhä, H., & Hamari, J. (forthcoming).
**A uses and gratifications approach of the adoption and continued use of virtual reality.**

To investigate these differences of adoption and continued use, we used empirically collected survey data of both people who have used VR (N=681) and those who have not (N=433). We investigate 12 aspects of technology and technology use that may have an impact on the adoption and continued use of VR. For users, we look at the intent to continue using VR, as well as the intent to spend money on VR. Likewise, for non-users we investigate the intent to spend money of VR, and the intent of trying it in the future.

Our results cover both of motivations and enabling factors within the two investigated groups, as well as differences between the groups. For predicting spending money on VR, price value, expected performance and having suitable facilitating conditions were important in both groups. Additionally, social influence was a positive predictor among non-users. Hedonic motivations were also important for both groups, but increasingly so for the user group. The intent to spend money was negatively predicted by visual aesthetics among users, and by socializing among non-users.

For the behavioral intention on trying VR (among non-users), visual aesthetics, price value, hedonic motivations, performance expectancy, facilitating conditions and social influence were important positive predictors. Interestingly, a feeling of presence was a negative predictor on adoption intention. Continued use (among users), was positively predicted by performance expectancy, price value, hedonic motivations, and facilitating conditions. Aesthetic motivations and the ease of acquisition were negatively associated with continued use.

The results indicate that while users and non-users share several common threads, such as the appreciation of perceived value among the service and product offering, major differences also exist. A deeper understanding of these attitudes can help companies in the VR sector tailor their communication efforts in order to address such aspects as the value proposition, the easy of acquisition and the visual fidelity.

# Virtual Flow

## Flow of Virtual Reality: An examination of determinants, experiences and outcomes of the state of flow in VR

Flow is a psychological state that many aspire to experience in life. It represents experiences where one is immersed in an activity that they lose track of time and their surroundings. For example flow can occur when one is reading a book and think that they have spent an hour reading it, when in reality they have spent two hours reading and had missed the sound of their phone vibrating while they were immersed in their book. Experiencing flow is often linked to persistence at activities, improved outcomes from such activities and repeated engagement with the flow inducing activities over time. It appears, at least theoretically, that VR settings are optimal grounds for experiencing flow. VR aims to transport users to new realities; ones where they are fully immersed to the

### PUBLICATION

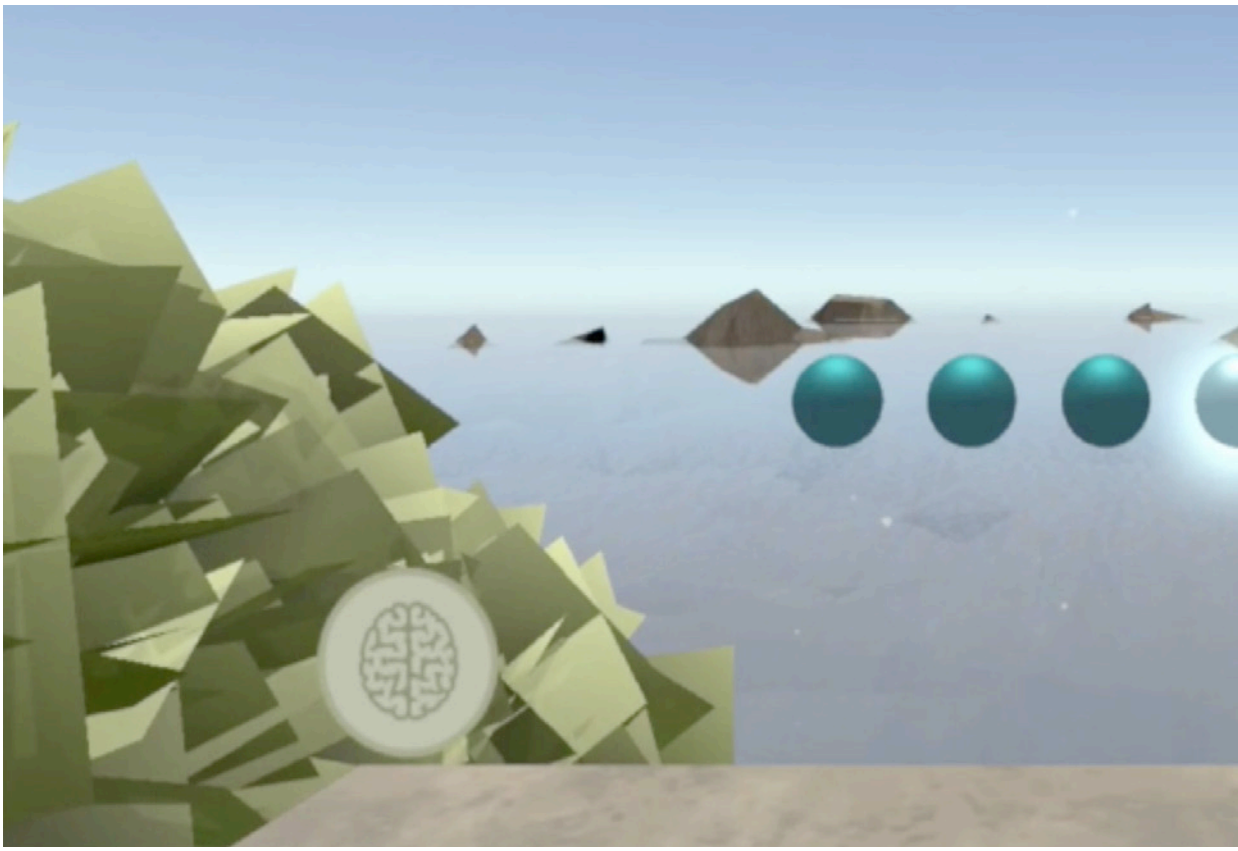
Hassan, L., Sjöblom, M., Jylhä, H., & Hamari, J. (forthcoming).

**Flow of Virtual Reality: An examination of determinants, experiences and outcomes of the state of flow in VR.**

exclusion of other realities around them that they may forget time or their physical environment. The more users are immersed in the VR world, the more they can be assumed to be in flow and to use VR longer per session and overall. Research, however, has rarely investigated how flow emerges in VR and if it leads to positive outcomes as it does in other settings. This research investigated experiences of flow in VR and their characteristics, determinants and behavioral outcomes. Flow is investigated through the nine flow constructs identified by Csikszentmihalyi, considered seminal in the understanding of flow experiences. The research employs survey data (n = 681) of individuals who have used VR. Data was analyzed through Structural Equation Modeling.

The results indicate that experiences of flow have a positive correlation with VR use session length and behavioral intentions to use VR overall. It additionally appears that balancing the challenges VR content presents its users and their skills as well as providing users a sense of control, and unambiguous feedback while in VR are amongst the determinants of experiencing flow. Presenting users, however, with clear goals does not appear to have a significant relationship with experiencing flow unlike what was expected. The flow users experienced was characterized with autotelic experiences, mergance of action and awareness, loss of self-consciousness and transformation of time. Such experiences are self-purposeful and have been similarly linked to prolonged use of systems and services in contexts outside of VR. The results provide recommendation for the design of VR content that immerses and exposes users to the optimal state of flow and may hence lead to increased and enjoyable use of VR. It is important to ensure that the VR content is not inappropriately challenging to the users, provides them the feeling of being in control, and clear feedback and directions as to what is happening in the VR world and what they are expect to do next, if any. Such use would possibly increase spending on VR and would be of a higher profitability for the VR industry. Researchers are further recommended to investigate specific VR content types and whether the determinants and outcomes of flow could differ from a context to another or across users with various demographic characteristics.

# Meditating in VR

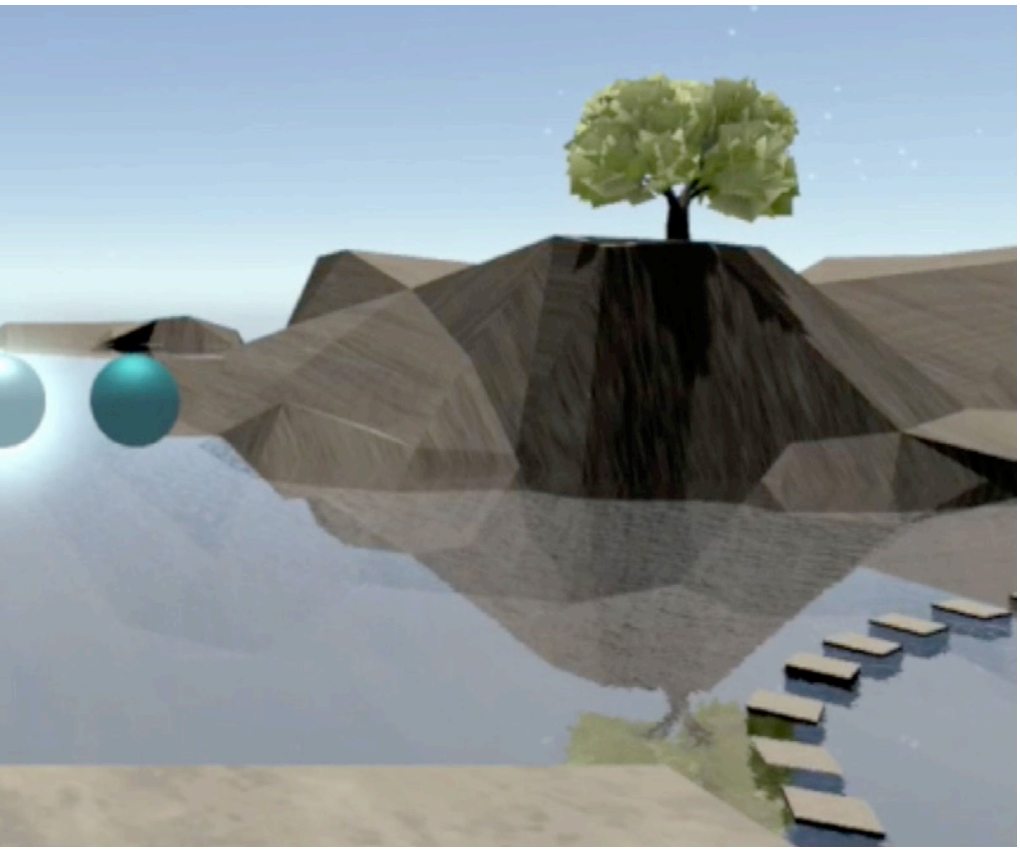


## Meditating in a neuro-adaptive virtual reality: Effects on sense of presence, meditation depth and brain oscillations

Recent advances in the technologies such as virtual reality (VR) and physiological computing open up opportunities for the developing of unprecedented methods for human-computer interaction for various training or learning applications. On one hand, VR technologies provide opportunities to build immersive environments where users can concentrate and receive guidance while conducting various types of training. On the other hand, physiological computing enables the monitoring of the psychophysiological state and attentional or affective responses of the users for real-time adaptation and customization through implicit feedback loops. Given such

### PUBLICATION

Salminen, M., Järvelä, S., Kosunen, I., Ruonala, A., Hamari, J., Ravaja, N., & Jacucci, G. (forthcoming).
**Meditating in a neuro-adaptive virtual reality: Effects on sense of presence, meditation depth and brain oscillations**.



possibilities, research is called to investigate how to develop techniques that combine VR and bio- or neuro-adaptive technologies, evaluate the benefits while describing and explaining underlying neurological and psychological mechanisms.

We developed a neuro-adaptive VR environment for learning and practicing of focused attention meditation. The system was designed to support strong immersion and sense of presence for the facilitation of the effective conductance of the meditation exercises. The neuro-adaptive functionality of the system provides continuous feedback on the user's brain activation and how the meditation exercise is proceeding. It is hypothesized that the immersiveness of using a head-mounted display and the neuro-adaptive functionalities would enhance the effectiveness of the conducting of the exercises, as measured by self-reports and neural responses.

We chose to use brain oscillations as the basis for the neurofeedback in the current VR system instead of, for example, the peripheral nervous system activity. There is already a vast amount of research on meditation related

brain oscillations to form a justified brain-based neuro-adaptive meditation system. In addition, compared to the other neuroscientific measurement technologies, the EEG (electroencephalography) is relatively easy to use and there are already promising consumer grade EEG devices in the market.

The neuro-adaptive functionality guided the user to increase the band powers of brain oscillatory indexes of concentration (frontal theta, 4-6 Hz) and relaxation (whole head alpha, 8-13 Hz), which have been identified previously as typical for meditation. The neuro-adaption was designed not only to guide the author to foster brain oscillatory activation typical to meditative states, but also to give the user a sense of interactivity, which would, in turn, evoke stronger sense of presence. The VR system is targeted to evoke strong sense of presence in the virtual environment with the goal to sustain attention to the meditation exercise.

Altogether 43 participants conducted the laboratory experiment. The results imply that the use of head mounted display increased the sense of presence and perceived meditation depth, when compared to the same exercise conducted on computer screen.
The use of neuro-adaptation led to increased sense of presence, and to changes in brain electrical activation that are indicative of sustained attention and conscious awareness. The findings provide evidence for the effectiveness of neuro-adaptive functionality in evoking desired types of neural activation and subjective experiences.

The main contribution of the currently described system is the combining of immersive virtual reality environment, used with a head-mounted display, with the neuro-adaptation functionality in the context of meditation exercise.

# Social mediation

The users are represented by the two illuminated statue like avatars. The coloured aura around the statuses and the illuminated bricks in on the connecting bridge visualize the user's physiological activation. In the pictured condition both, the EEG and respiration based adaptations are on.

## Social mediation in a bio-adaptive VR

With the currently popular consumer grade virtual reality (VR) and physiological measurement devices, new possibilities for mediated social interaction emerge and make it possible to immerse people in environments of which visual features adapt to users' physiological responses. In this study, we investigated whether and how individual and interpersonally shared bio-adaptation (visualised respiration and electroencephalography, EEG) enhance interpersonal synchrony in physiological activity and experienced empathy (or person's ability to understand the innate states of others and as the merging of affective states between persons) towards other in a form of compassion meditation exercise carried our in social VR. In these types of exercises sympathy is evoked towards those in need with a wish to help them; these thoughts are targeted towards oneself, others, or all living beings. The benefits of such practice have been shown to include, for example, increase in positive and decrease in negative affect, increased activation on emotion and empathy related brain areas, and empathic accuracy.

Respiration-based bio-adaptation was included since in some meditation traditions the observing of breathing is an integral part of the practice and, possibly due to the improved emotion regulation by the awareness of one's own internal states, the mindful breathing has been shown to be related to less mind-wandering and better mood. For neuro-feedback purposes most commonly the oscillatory responses of the EEG (electroencephalography) are used. Previous studies have identified specific EEG frequency bands for attentional, affective, and memory processes, as well as for meditative states. In the current VR, the visual feedback of both, respiration and EEG activation were included to promote self-reported empathy and physiological synchrony between the users.

The study was conducted as a laboratory experiment (N=72) employing a Unity3D based Dynecom social virtual reality environment and two amplifiers to collect the psychophysiological signals for the bio-feedback. Both of the users were represented by statue like avatars in the DYNECOM VRE. The avatars were seated in a circle with four other similar statuses; the design of the visual outlook of the VRE was inspired by a setting of relaxed social meditation by a campfire. The statuses were surrounded by a low wall and behind that a dark forest scenery was presented; this served to keep the user's attention to the statuses and thus discourage excess explorative scanning. Movement in the environment was not possible to keep focus to the task. An ambient pink noise audio track resembled the sound of wind.

The bio-feedback on EEG frontal asymmetry, that signalled other user's empathic feelings, led to higher self-reported empathy in the other user than the bio-feedback on respiratory activation, but the perceived empathy was highest when both adaptations were simultaneously on. The observed difference between the two bio-adaptations in the perceived empathy suggests that visualizations of the EEG based frontal asymmetry may have been perceived as a more relevant for the task of empathy evoking and targeting than the visualization of the respiration rate. Partner's visualized empathy related EEG frontal asymmetry was contagious to own perceived empathy. In addition, the users were instructed to pursue physiological synchronization during the empathising exercise by utilizing the bio-adaptive visualizations; synchronization of the empathy related EEG frontal asymmetries between the users led to increased perceived empathy. The presented results inform the fields of affective computing and social neuroscience on the possibilities that VR offers for different applications of empathic technologies.

The currently presented DYNECOM environment is, to the best of our knowledge, the first bio-adaptive social VRE that utilizes the synchronization of the bio-signals of two users as a feedback within the context of meditative

practices. The DYNECOM VRE represents a type of empathic technology that supports emotional converge by making empathy a more salient and impactful construct through inferring empathy related information from the users and their behaviour and then present this information as a feedback via visual cues or other modalities. In addition, the current study relates also to the fields of affective computing, where machine based emotion detection is studied; and to social signal processing, where machine based detection of socially relevant signals during interaction is studied.

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Salminen, M., Järvelä, S., Ruonala, A., Timonen, J., Mannermaa, K., Ravaja, N., & Jacucci, G. (2018). **Bio-adaptive Social VR to Evoke Affective Interdependence: DYNECOM.** In *23rd International Conference on Intelligent User Interfaces* (pp. 73-77). ACM. https://dl.acm.org/citation.cfm?id=3172991

Salminen, M., Järvelä, S., Ruonala, A., Harjunen, V., Jacucci, G., Hamari, J., & Ravaja, N. (forthcoming) **Evoking physiological synchronization and empathy: A study with bio-adaptive social VR.**

Järvelä, S., Salminen, M., Ruonala, A., Timonen, J., Mannermaa, K., Jacucci, G, Ravaja, N. (2019). **DYNECOM: Augmenting Empathy in VR with Dyadic Synchrony Neurofeedback.** In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019. http://hdl.handle.net/10125/59859

# Empathy through VR

## The Ultimate Empathy Machine: How Virtual Reality Affects Human Rights Attitudes

It has been proposed that our inability to empathize with others could be overcome by stepping into another's shoes. Computer technologies have become increasingly explored as a potential means to increase the empathy of mankind. Virtual reality (VR) technologies in particular have been popularly proposed (e.g. in TED talks) as the "ultimate empathy machines". VR is an effective method of placing viewers, both culturally and geospatially, into the the shoes of those whose feelings we wish to convey and, as a consequence, shaping beliefs and attitudes about human rights. In the "Clouds Over Sidra" VR documentary the viewer is immersed into the Za'atari refugee camp in Jordan, containing tens of thousands of Syrians displaced by civil war. The experience builds on the concept of perspective taking – the ability to adopt another person's point of view. In 2017 a special Oscar was

### PUBLICATION

Bujić, M., Salminen, M., Macey, J., & Hamari, J. (forthcoming).
**The Ultimate Empathy Machine: How Virtual Reality Affects Human Rights Attitudes.**

awarded to Alejandro González Iñárritu for Carne y Arena - an immersive VR experience that engages users in a dramatic illegal border crossing between Mexico and the United States. Even though the piece is currently only available at the exhibition sites and hence inaccessible to a wider audience, the awarded Oscar suggests that we should expect more similar experiences in the future. However, the issue of the effects similar content can have on individuals' attitudes and prosocial behavior is under-researched in computer and media sciences.

In this study, a between-subject laboratory experiment (N = 87) is used to investigate how media content affects our human rights attitudes. The experiment examined participant scores on the Human Rights Questionnaire before and after consuming 360-degree video immersive journalism content (Sea Prayer) via the following media: VR (n = 31); 360 video (n = 29); and Internet article (n = 27). Moreover, scores in involvement as a dimension of presence were investigated as a possible mediator.

The results suggest that viewing immersive journalism 360-degree video content on a computer screen or in mobile VR has a positive effect on users' HRA. Out of the three experimental conditions, viewing the content in VR elicited the most prominent shift in attitudes, while the article condition had no effect on individual's HRA. Furthermore, involvement was shown to have no mediation effect across the three conditions, although a statistically significant interaction contrast suggested that for the immersive conditions the high involvement led to a more prominent positive change in the human rights attitudes compared to the article condition.

Overall, this study indicates that even the most simplistic immersive journalism content can bring about a positive shift in users' human rights attitudes, and that VR in particular is the most effective platform. Contrastively, the traditional format of an Internet article elicited no attitudinal change in participants.

# Being there


## Being There: An Experiment on Experience of Presence in Immersive Journalism

Virtual reality (VR) industry has been on a constant rise during the past several years. Particularly, the development and commercialization of affordable mobile VR headsets sparked the growth of the virtual reality user base. The expanding number of users has led to increased production of content, including the emerging field of immersive journalism. Media and technology convergence call for an investigation of user experiences for the aim of understanding the strengths, weaknesses, as well as attitudinal and behavioral effects of consuming content on different platforms. Several previous studies have shown that the subjective experience of presence has an influence on, for example, emotional response and enjoyment, whereas immersive journalism aims to elicit empathy and engagement in users. However, more investigation is needed in the differences of those effects of the media depending on the platform on which the content is consumed.

### PUBLICATION

Bujić, M. (2018).
**Being There: An Experiment on Experience of Presence in Immersive Journalism.**
Master's thesis, University of Tampere, Tampere, Finland.

The purpose of this study is to investigate whether there is a difference in the reported sense of presence when consuming immersive media content on different mediums. Particularly, between virtual reality (on mobile head-mounted display), 360-degree video (in 2D on a computer screen), and Internet website (the content of the video presented as an Internet article).

We designed a between-subjects experiment (N = 87) that included three conditions (article, N = 27; 2D, N = 29; and VR, N = 31). As the stimulus, we have used content of a 360-degree immersive journalism video Sea Prayer (Guardian VR). Participants were administered a questionnaire measuring the subjective experience of presence.

We have conducted an exploratory factor analysis on the obtained data and identified four dimensions in the presence scale: involvement, location, distraction, and naturalness. The results showed no significant difference in the mean overall presence scores depending on which platform the content was consumed. However, analyses implied a significant difference in two out of four presence dimensions. For involvement and distraction, we found differences between the article on one side and both 2D and VR conditions on the other. For location and naturalness, no differences were significant.

The levels of certain dimensions of presence differed between the article and the other two conditions, but no differences were found between 2D and VR. Overall, this study suggests that viewing this type of a 360-degree video in VR compared to viewing on-screen does not provide any benefits for the experience of presence.

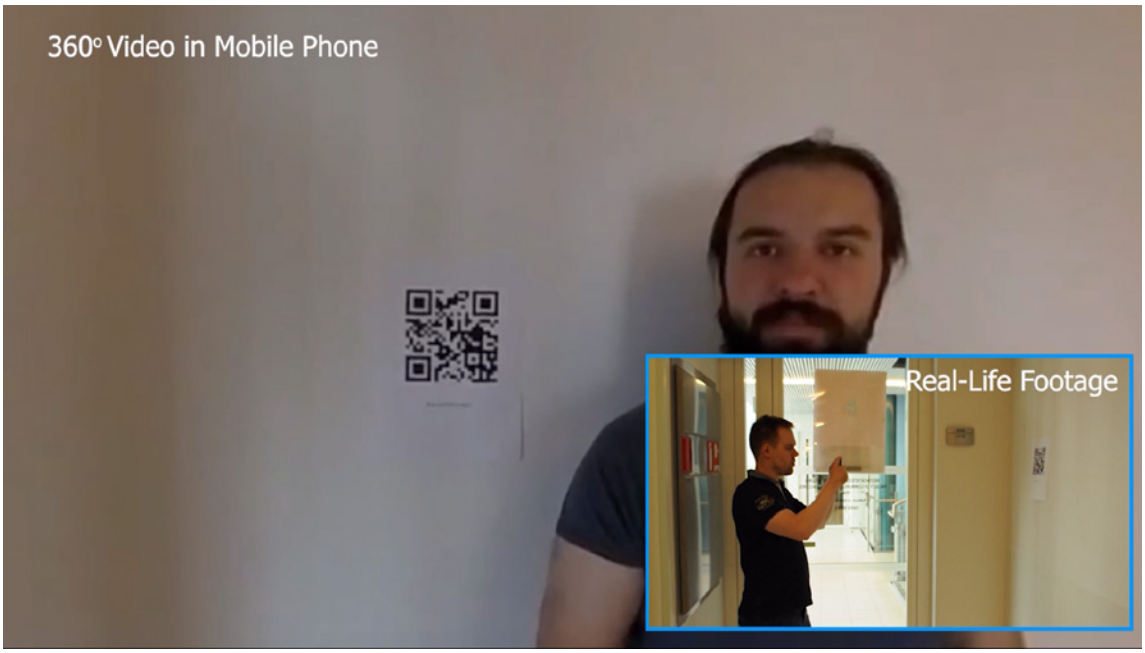
The results of this experiment indicate that it might not be effective to produce this type of immersive journalism videos. The technological immersiveness of mobile VR headsets, such as stereoscopic view, might not be the determining factor for the evoked sense of presence when viewing panoramic 360-degree videos. Considering that the sense of being-there is the defining factor of IJ compared to traditional journalistic media, we could say that this video does not satisfy that expectation.

We argue that affordances of viewing media content in VR should be utilized in a more comprehensive manner. Particularly, incorporating embodiment of a virtual avatar, interactive mechanics, and movement through the content would greatly enhance users' sense of presence.

# Augmented Reality

IMMERSIVE

# Space Pace




Footage of the Space Pace first prototype

## Method for creating augmented reality tours based on 360 videos

Traditionally, creating augmented reality for creating a guided tour experience is a demanding process as it requires long implementation processes and expertise in fields such as coding or 3D modelling. It may also require specific applications and high-quality hardware by users, to run the prepared content.

However, with the advent of 360° cameras, location-based sensors and mobile devices with high quality audio-visual outputs becoming mainstream consumer devices, the possibility for anyone to produce augmented-reality 360° content has become accessible. However, while this technology now exists in the hands of consumers and non-technology centred organizations, there has still been a lack of processes and methods to undertake such productions.

### PUBLICATION

Nummenmaa, T., Buruk, O. T., Bujić, M., Sjöblom, M., Holopainen, J., & Hamari, J. (forthcoming). **Space Pace: Method for creating augmented reality tours based on 360 videos.**

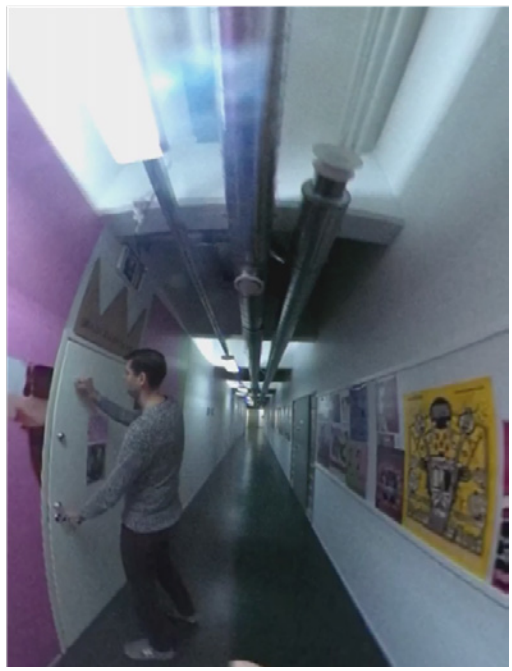
The Space Pace method is a low-cost and practical solution for this problem, that will accelerate the process for preparing augmented 360° guided tours. It mimics characteristics seen in augmented reality tours, using simpler hardware and more easily approachable methods that can be used by non-expert practitioners. The method includes shooting a 360° video in a specific location or along a route with a guide who will lead the user in the exhibition area. By modifying the environment during the video production, video authors can add information to the target locations which may not be possible or feasible to display in real life and at the time of experiencing the exhibition area. The Space Pace method can be used in many kinds of use cases as it is usable by anyone and allows creating content which is realistic and quite close to genuine augmented reality applications

We have derived initial guidelines for the method via a pilot implementation of the tour experience. The guidelines were divided into three pillars; (1) Essentials, (2) Recommendations and (3) Considerations. The essential guidelines direct to points that should be applied to make the video work in the intended way. Recommendations refer to issues that might be good to apply but can be modified according to content, context, location and users. Considerations communicate points that caused or may cause obstacles according to our observations. All in all, 11 guidelines were produced.

The workflow for the final trial experience used to derive the guidelines was composed of: 1) Planning the tour, 2) recording the video, 3) exporting from the recording application, 4) uploading to YouTube, 5) creating a QR code using a QR code generator and printing it on a page with the text “Scan me for a tour!”, 6) attaching the page on the wall. When recording, the starting orientation of the camera was made to be such that the video would start oriented towards the QR code and tour guide when the video was opened. This would make the video start with the correct orientation when a user scans the QR code to start the video.

The study showed us, that the approach is promising as a new way to create content and experience locations.

# Playful design for AR



## Playful design for location specific augmented reality

A playful three-day workshop was organized to design location specific augmented reality applications and solutions at the well-known cultural center Kaapelitehdas in Helsinki, Finland, as a test bed for creating location specific augmented reality (AR) and internet of things (IoT) applications. The workshop focused on how AR and IoT as technological approaches can be used for designing different ways of engaging with the history and socio-cultural atmosphere of the cultural center. Play and playfulness were chosen as larger themes as they encourage engaging with the world and matters at hand in fundamentally liberating, engrossing, and inclusive ways [6], reflecting the values of the cultural center.

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6. Sicart, M., 2014. **Play matters**. MIT Press.

The approach and aims in the workshop were closely aligned with playful design (e.g., [3,1,2,5]) both from the resulting artifact point of view and the methods and the attitude used in the workshop activities themselves. The aims of creating artifacts and interactions that elicit a playful mindset in the users are also similar to the ludic design or designing for Homo Ludens approaches [4]. The constraints for the design workshop were based on the following factors: findings on the current state of AR applications, findings on the current state of smart space solutions, specific location related constraints, and findings from discussions with research project partners.

During the three day period, the workshop participants first explored the design space, then participated in design tasks and finally presented interactive quick and dirty prototypes to people external to the workshop group. After-workshop beers were also had at the end of each day. The workshop resulted in the creation of four low tech interactive prototypes: a 360 video walk, a footprint projection for a dance lesson, a real-world drawing that comes alive, and an AR view floorplan of the building. Also, an additional prototype was planned involving a multi-use object that would be carried around the building and used to execute certain tasks in certain locations, viewable as a virtual rendition of a real object through an AR window.

We found that running playful design workshops to explore certain design spaces can be beneficial in multiple ways and the findings from this research demonstrate the effectiveness of the workshop setup, and act to guide similar future workshops. The produced prototypes followed the goals and constraints given at the beginning of the workshop. The participants learned about the current state of the art in technology and design. They realized the potential and limitations of creating applications tied to a specific location. It became apparent that great things can be accomplished with relatively simple solutions and exposed how ideas can be realized with low effort. A certain amount of unpredictability is inherent in this sort of a process. However, with careful planning in method and prop selection, and not being afraid to abandon certain approaches when the time comes, potential issues with unpredictability can be mitigated.

# Adventures in AR

## Developing an AR adventure game

Many of the augmented reality experiences available on mobile platforms today are often such that overlay content on the real world, without much focus on location and the context that a location could bring to an experience. A playful three-day workshop was organized to design location specific augmented reality applications and solutions at the well-known cultural center Kaapelitehdas in Helsinki, Finland, as a test bed for creating location specific augmented reality (AR) and internet of things (IoT) applications. Among the results of the workshop, mostly consisting of ideas fleshed out as simple prototypes on location at the workshop, an additional idea was created involving a multi-use object that would be carried around the building and used to execute certain tasks in certain locations, viewable as a

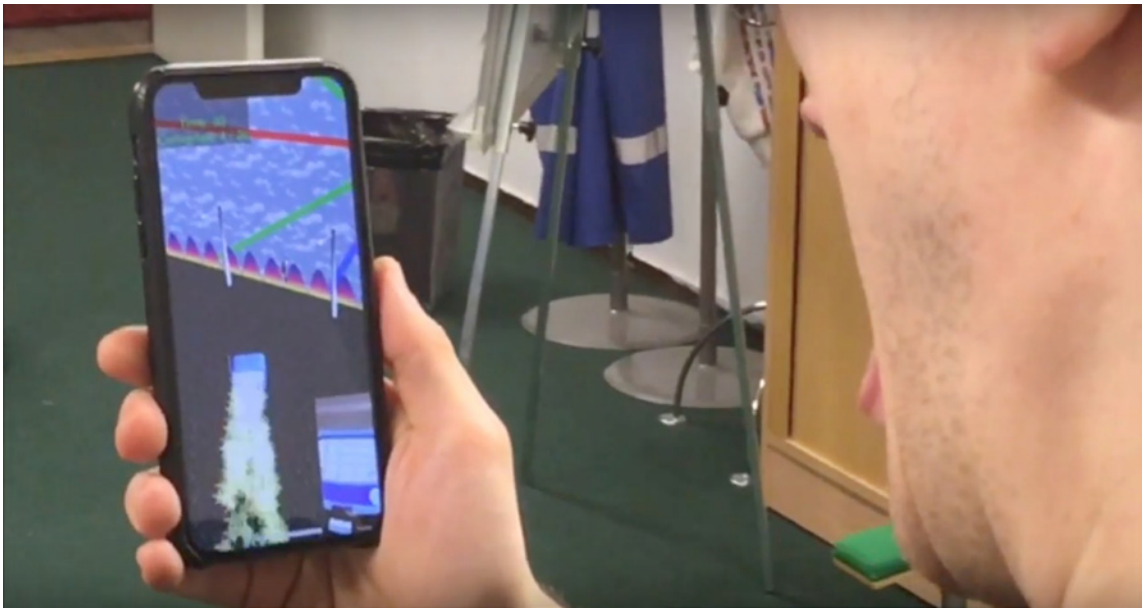
virtual rendition of a real object through an AR window. Creating a prototype of this idea was left as future work due to limited time, but the idea was presented to the audience and it received much interest.

After the workshop, implementation of a prototype was initiated as a student project, where the research project acted as a client. A team consisting of 6 students set out to further design the idea and then to create a working implementation. The target prototype would be composed of a mobile application, a server for story building and cubes made out of e.g. wood, featuring QR codes on all sides, that would be used to play. Due to development issues, the project was later changed so that the application would be a pc application, instead of a mobile application. In the end, the resulting implementation was not functional enough to be used. Lessons were learned from the process, however.

The key lessons that learnt by the project team were focused on ambitiousness, the importance of certain technical skills, knowledge of minimum results, structuring of work, roles and responsibilities, management and communication with the client of the project. From the perspective of the client, it was clear that with different choices regarding tools, libraries and platforms, that would have been more based on the target of completing the project, instead of personal development and learning, would have resulted in a more successful project from the perspective of the client. Indeed, while the result of the student project could be seen as a failure, the learning outcomes of the project can be seen as being successful.

Not long after the student project had ended, another student project was initiate that would lean on certain lessons learnt in the first project. This new project is currently ongoing.

# Face control



## ARKit face tracking as a controller

With the release of the iPhone X, Apple introduced a method to unlock the phone using a depth sensing camera. This camera, however, also had the potential to be used for much more. With a simple Unity-plugin, it was very easy to develop augmented reality applications that would use the depth sensing camera and superimpose 3D models on the users face. The technology could also be used for other purposes, as it was possible to capture various data about the face in real time and very accurately. During the Global Game Jam 2018 event, at the Finnish Game Jam Tampere site, the technology was put to use in one of the developed games, where one project member was a part of the team. The result was Max Wake Radiohead. In the game, the player takes the role of a character that had a radio as a head, and who shoots trance music out of its mouth to turn bored people into pumped up dancers. The third person game is solely controlled using the jaw and facial muscles. The game was even made to penalize blinking too often, just because it was possible to do so. The game demonstrated successfully the potential of using face tracking as a control mechanism.

Access the game:
https://globalgamejam.org/2018/games/max-wake-radiohead

# Health through Pokémon

## Getting healthy by catching them all: A study on the relationship between player orientations and health benefits in an augmented reality game

In recent years, location-based augmented reality games such as Pokémon Go have become increasingly popular. These games not only afford a novel gaming experience, but also have the potential to alter how players view their physical realities and alter the dynamics of traditional game play from its sedentary nature towards a more physical one. In this paper we investigate what kinds of players (achievement, immersion or social interaction -oriented) are more likely to derive health benefits from playing augmented reality games. We employ online survey data gathered among players of Pokémon Go (N=1190). The results show that playing location-based augmented reality games has a positive association with perceived mental, physical and social health outcomes overall. The results also suggest that the way in which players approach the game and what kinds of aspects of the game they emphasize can have a differential dynamic on how the health benefits of the game manifest. Results show that social gaming orientation is positively associated with physical, mental and social health outcomes, whereas achievement and immersion orientations are associated with physical and mental health outcomes.

## PUBLICATION

Koivisto, J., Malik, A., Gurkan B., & Hamari, J. (2019). **Getting healthy by catching them all: A study on the relationship between player orientations and health benefits in an augmented reality game.** In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

http://hdl.handle.net/10125/59618

# Why do people play AR games?

## Why Do People Play Location-Based Augmented Reality Games: A Study on Pokémon GO

Pokémon GO brought the location-based augmented reality games into the mainstream. To understand why people play these games, we created an online survey (n=2612) with open questions about the reasons to start, continue, and quit playing Pokémon GO, and composed categories of the answers through a thematic analysis. Earlier experiences especially with the same franchise, social influence, and popularity were the most common reasons to adopt the game, while progressing in the game was the most frequently reported reason to continue playing. The player's personal situation outside the game and playability problems were the most significant reasons to quit the game. In addition to shedding more light on the Pokémon GO phenomenon, the findings are useful for both further studying and designing location-based augmented reality game experiences.

### PUBLICATION

Alha, K., Koskinen, E., Paavilainen, J., & Hamari, J. (2019).
**Why Do People Play Location-Based Augmented Reality Games: A Study on Pokémon GO.**
*Computers in Human Behavior, 93*, 114-122.

https://www.sciencedirect.com/science/article/pii/S0747563218305946

# Uses and gratifications of Pokémon GO

## Uses and gratifications in Pokémon Go: Why do people play mobile location-based augmented reality games?

### PUBLICATION

Hamari, J., Malik, A., Koski, J., & Johri, A. (2018). **Uses and gratifications in Pokémon Go: Why do people play mobile location-based augmented reality games?** *International Journal of Human-Computer Interaction.*

https://www.tandfonline.com/doi/abs/10.1080/10447318.2018.1497115

https://www.tut.fi/Gamification/2018/10/22/uses-and-gratifications-in-pokemon-go-why-do-people-play-mobile-location-based-augmented-reality-games/

In recent years, augmented reality games (ARGs) such as Pokémon Go have become increasingly popular. These games not only afford a novel gaming experience but also have the potential to alter how players view their physical realities. In addition to the common experiences and gratifications people derive from games, (location-based) ARGs can afford, for example outdoor adventures, communal activities, and health benefits, but also create problems stemming from, for example privacy concerns and poor usability. This raises some important research questions as to what drives people to use these new applications, and why they may be willing to spend money on the content sold within them. In this study, we investigate the various gratifications people derive from ARGs (Pokémon Go) and the relationship of these gratifications with the players' intentions to continue playing and spending money on them. We employ data drawn from players of Pokémon Go (N = 1190) gathered through an online survey. The results indicate that game enjoyment, outdoor activity, ease of use, challenge, and nostalgia are positively associated with intentions to reuse (ITR), meanwhile outdoor activity, challenge, competition, socializing, nostalgia and ITR are associated with in-app purchase intentions (IPI). In contrast with our expectations, privacy concerns or trendiness were not associated with reuse intentions or IPI.

# Game cooperation in AR


## How games induce cooperation? A study on the relationship between game features and we-intentions in an augmented reality game

Seamless cooperation between individuals is essentially a crucial aspect of any successful endeavor. A host of literature has been published in the academic realm about how cooperation could be cultivated. However, true cooperation often forms organically without external enforcement. Recently, there has been one special example of a context where cooperation seemed to have effortlessly sprung up between people who might not even have had previous connections. The context is video/online games; games such as Ingress, Pokémon Go, and World of Warcraft bind people together to work against insurmountable odds and to overcome jointly

### PUBLICATION

Morschheuser B., Riar, M., Hamari, J., & Maedche, A. (2017).
**How games induce cooperation? A study on the relationship between game features and we-intentions in an augmented reality game**. *Computers in Human Behavior, 77*, 169-183.

https://www.sciencedirect.com/science/article/pii/S0747563217304946

held challenges. Organizations of many types have recently begun to gamify their structures and services in order to cultivate such seamless cooperation.

However, before this potential of games can be successfully wielded outside video games, we need to understand better how games are able to cultivate such cooperation. Therefore, in this study we investigate how games can induce and cultivate we-intention of working as a group. Specifically, we investigate how cooperative game features affect different forms of group dynamics and how they further translate into we-intentions. We employ data from users of the augmented reality game Ingress (N = 206).

The results show that cooperative game features induce we-intentions via positively increasing group norms, social identity, joint commitment, attitudes toward cooperation, and anticipated positive emotions. The findings imply that practitioners who are looking to increase cooperation should find that gamification inspired by cooperative game design is beneficial and preferable over individual-based gamification efforts.

# Cooperation or competition?

## Cooperation or competition – When do people contribute more? A field experiment on gamification of crowdsourcing

Information technology is being increasingly employed to harness under-utilized resources via more effective coordination. This progress has manifested in different developments, for instance, crowdsourcing (e.g. Wikipedia, Amazon Mechanical Turk, and Waze), crowdfunding (e.g. Kickstarter, Indiegogo, and RocketHub) or the sharing economy (e.g. Uber, Airbnb, and Didi Chuxing).

## PUBLICATION

Morschheuser B, Hamari J, Maedche A. (2018). **Cooperation or competition – When do people contribute more? A field experiment on gamification of crowdsourcing.** *International Journal of Human-Computer Studies.*

https://www.sciencedirect.com/science/article/pii/S1071581918305822

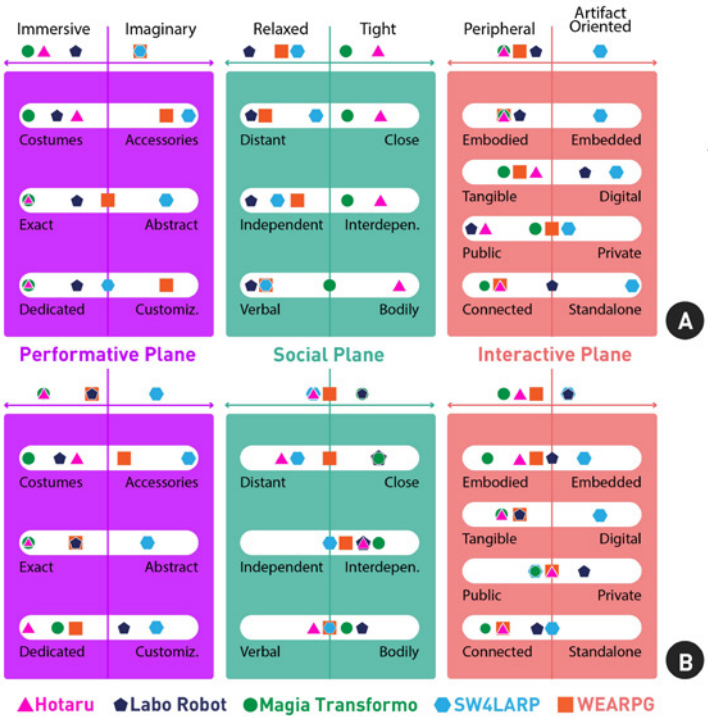
https://www.tut.fi/Gamification/2018/12/13/788/

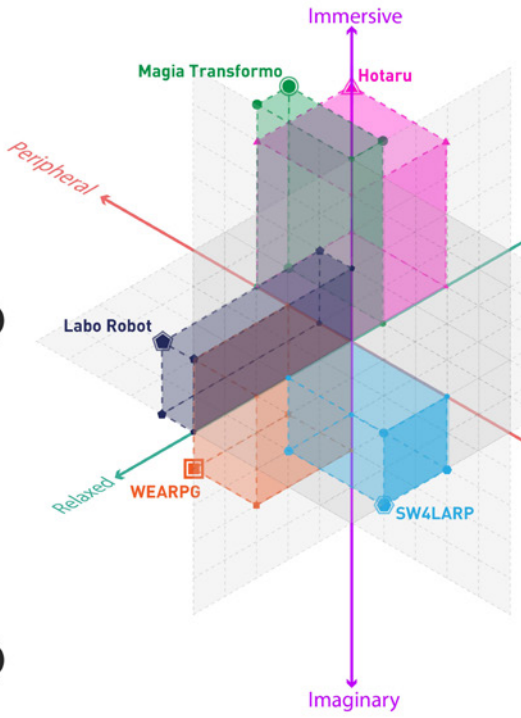
Since the sustainability of these IT-enabled forms of resource coordination do not commonly rely merely on direct economic benefits of the participants, but also on other non-monetary, intrinsic gratifications, such systems are increasingly gamified that is, designers use features of games to induce enjoyment and general autotelicy of the activity.

However, a key problem in gamification design has been whether it is better to use competition-based or cooperation-based designs. We examine this question through a field experiment in a gamified crowdsourcing system, employing three versions of gamification: competitive, cooperative, and inter-team competitive gamification. We study these gamified conditions' effects on users' perceived enjoyment and usefulness of the system as well as on their behaviors (system usage, crowdsourcing participation, engagement with the gamification feature, and willingness to recommend the crowdsourcing application).

The results reveal that inter-team competitions are most likely to lead to higher enjoyment and crowdsourcing participation, as well as to a higher willingness to recommending a system. Further, the findings indicate that designers should consider cooperative instead of competitive approaches to increase users' willingness to recommend crowdsourcing systems. These insights add relevant findings to the ongoing discourse on the roles of different types of competitions in gamification designs and suggest that crowdsourcing system designers and operators should implement gamification with competing teams instead of typically used competitions between individuals.

# Playful wearables

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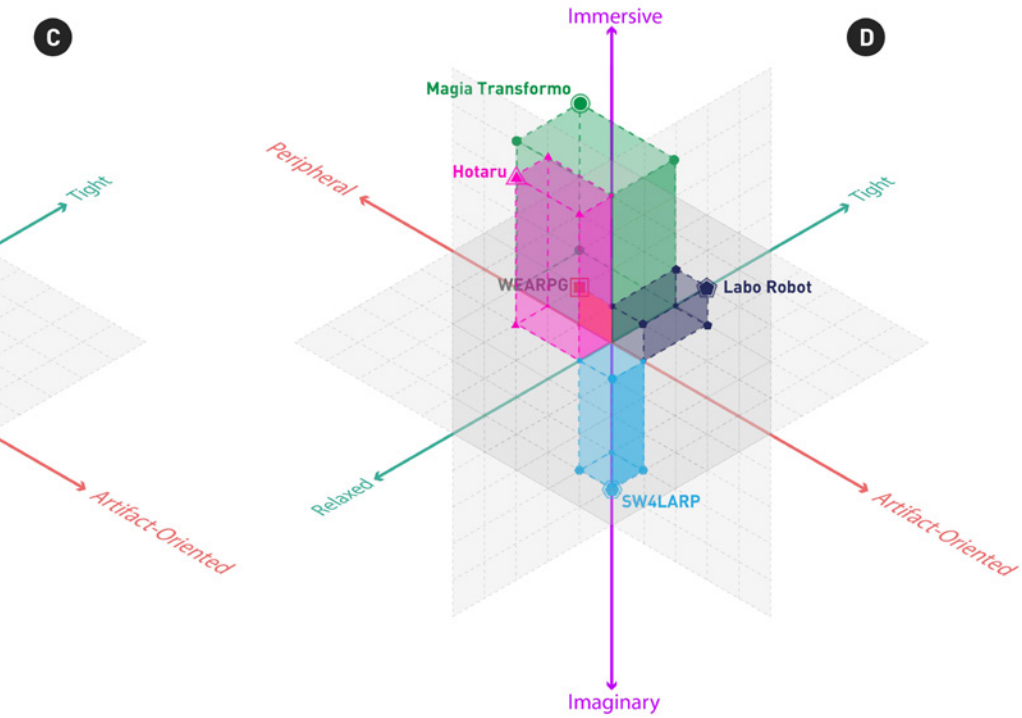
## A Design Framework for Playful Wearables

Deployment of wearables for games has attracted the interest of designers and researchers both in academia and industry. However, few of these projects treat wearables as an integral part of the gameplay, often considering them as an extension of the central on-screen experience. While preliminary forays into wearable play show promise, we see a need for a rigorous design framework to illuminate the possibilities for the future of wearables for playful interaction design. Therefore, we are working on a “design framework for playful wearables” stemming from our extensive research and hands-on experience in leading four long-term game research projects incorporating wearables.

### PUBLICATION

Buruk, O. T., Isbister, K., & Tanenbaum, J. (2019). **A Design Framework for Playful Wearables.**




Our main question in this project is “How can we improve the design of wearables for gameplay, to take full advantage of this potential?” When it comes to academic research, although there are research projects that have focused on wearability and usability issues such as comfort and ease of use, or that have evaluated appropriate technologies that can be used in wearables for games, we have found no in-depth investigation that examines wearables from a designerly point of view, to help researchers and practitioners best use these devices’ capabilities to create rich and satisfying gameplay.

We expect this design framework help us to develop more grounded and concrete observations about the work that particular design decisions about the wearables was doing for players. Using the framework will also help designers to envision alternative paths and future opportunities for these experiences. This framework can be used as a critical, an experimental, extending and polishing purposes.

# WEARPG

WEARPG Elemental Gauntlet & Luck Stone

## Extracting Design Guidelines for Wearables and Movement in Tabletop Role-Playing Games via a Research Through Design Process

WEARPG is a RPG system, which relies on wearable and tangible props that provide movement-based gameplay. WEARPG is based on a tesla and steampunk hybrid fantasy world where five elements of air, water, fire, earth and electric dominates the life (download the quick-start guide here). Characters in this word can use these elements to gain powers. Each character can choose two of these elements as the primary and the secondary. Based on this setting, WEARPG is constructed on four pillars. These pillars are: (1) Movement-Based mini games (2) Elemental Gauntlet, (3) Luck Stone, (4) Game Master Console.

### PUBLICATION

Buruk, O. T., & Özcan, O. (2018).
**Extracting Design Guidelines for Wearables and Movement in Tabletop Role-Playing Games via a Research Through Design Process.**
In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 513). ACM. (Honorable Mention)

https://dl.acm.org/citation.cfm?id=3174087

Movement-Based mini games encapsulate seven different games which refer to basic movements in the game which are power, reflex, precision and concentration. Power games are required when the fictional character perform a physically demanding task like swinging a sword. It has two different versions. First one requires swinging the arm as strong as possible while the second one works by squeezing the Luck Stone, which is the augmented die, as hard as possible. Reflex games are to be played in situations where the pace is essential. Dodging from an attack or catching something thrown can be the examples. First reflex game is about moving the Elemental Gauntlet in the right timing just after a haptic feedback. Other one requires grabbing the Luck Stone as soon as it turns into the players' main element color. Precision moves were designed for situations like shooting an arrow or lock picking where hefty hands are essential. First version of precision games is aiming by using the LEDs on Elemental Gauntlet, while the other is rotating the hand really slow to find the right spot. The last game type, Concentration game, is for where focus is needed. Examples can be casting a spell or focusing on something for remembering it. This type has only one game and it requires rolling the Luck Stone in hands in a certain speed and maintaining that speed. Each game has 5 difficulty levels from easiest to hardest. GM decides which difficulty level will be played depending on the character skills and condition (injured, crimpled etc.)

Elemental Gauntlet (EG) is the arm-worn device. It is comprised of three modules which are Interface Module, Processor Module, and two Haptic Modules. It accounts for automatization of calculations and character creation. With EG, one can perform the elemental ritual by attaching elemental stones to device to define their character properties. Moreover, it also measures the motion and facilitate the movement-based play. It is also the main interface which leads players during mini-games and shows information such as mana level. GM also can use it by lighting it in different colors or sending haptic feedback.

Luck Stone (LS) is an assistive device for randomization. We introduce the LS into the game which has a role in some of the mini games and in the randomization. Still, different from a conventional die, LS has a dynamic chance adjustment system. Your success in the movement-based mini games affect the outcome of the LS. For instance, if a player is successful at playing a power game, then the Luck Stone will have more green (standing for "success") sides.

# Immersive Industry Day

In May 2018 we organized a free half-day seminar event titles the “Immersive Industry Day”, with the main goal of disseminating information from the project to a broad range of Finnish companies working within the fields of virtual and augmented reality.

The event gathered a large amount of interest, and the seminar tickets were sold out in a matter of days. The final tally of attendees was approximately 55. In conjuntion with the event, Kaapelitehdas organised a free “Kaapeli Walks” tour for a smaller group of attendees.

The event included an industry overview by Tuukka Takala from the Finnish Virtual Reality Association, followed by two presentations on research from within the project, by researchers Timo Nummenmaa & Mila Bujić. We recruited four very interesting speakers from the finnish VR & AR industry.

Emmi Jouslehto, the CEO of AR startup Arilyn, discussed how AR technologies can be leveraged to create engaging brand experiences & brand storytelling.

Nora Kajantie, producer at YLE, presented two of YLEs test projects within immersive journalism, and how VR technology can enable the next step in the evolution of journalism.

Jussi Kajala, the COO of educational AR startup 3DBear, talked about how a combination of AR technologies can enable constructing engaging 3D worlds for an edtech perspective, helping engage and enhance learning in classroom environments.

Finally, Raine Heikkinen, marketing and sales manager from Kaapelitehdas, discussed how these new technologies can be used in developing new service concepts and experimental designs that are tied to spatial experiences, such that are present at the large spaces of Kaapelitehdas and Suvilahti.

# IMMERSIVE INDUSTRY DAY

| | |
|---|---|
| 12.30 – 13.00 | **Registration** |
| 13.00 – 13.20 | **Max Sjöblom** (TUT)<br>*Welcoming words*<br>**Olli Sinerma** (FIVR)<br>*State of VR in Finland* |
| 13.20 – 13.40 | **Timo Nummenmaa** (TUT)<br>*AR & Spaces* |
| 13.40 – 14.00 | **Mila Bujić** (TUT)<br>*VR immersive experiments* |
| 14.00 – 14.30 | **Emmi Jouslehto** (Arilyn)<br>*AR & brand storytelling* |
| 14.30 – 15.00 | Coffee break |
| 15.00 – 15.30 | **Raine Heikkinen** (Kaapelitehdas)<br>*AR & service design* |
| 15.30 – 16.00 | **Jussi Kajala** (3DBear)<br>*Finnish edtech + AR = success?* |
| 16.00 – 16.30 | **Nora Kajantie** (Yle)<br>*Immersive journalism* |
| 16.30 | Seminar ending |

IMMERSIVE

Gamification Group

gamification.group

# LIFT Helsinki

In October 2018, Kaapelitehdas in conjuntion with YLE, organised the media, arts & culture event LIFT. As a partner of Kaapelitehdas within the Immersive project, we were given a chance to participate as speakers during the event.

At the event, researchers Timo Nummenmaa & Max Sjöblom presented the Space Pace method for creating low-cost fast augmented reality 360 degree video experiences, as well as talking about how new technologies such as virtual reality shape the media consumption of individuals. These talks were based on research conducted within the Immersive project.

Aside from merely talking about the research, we also set up a demo of Space Pace method in the Kaapelitehdas C Gallery, so that guests could experience it for themselves using their smartphones. The demo was left in the C Gallery for the remainder of 2018, as an avenue for collecting feedback on the method. In order to communicate to visitors about the demo and method findings, we set up a booth in the exhibition area for the Thursday of LIFT.

Gamification Group

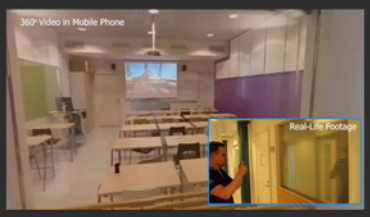
# SPACE PACE

## METHOD FOR CREATING AUGMENTED REALITY TOURS BASED ON 360 VIDEOS

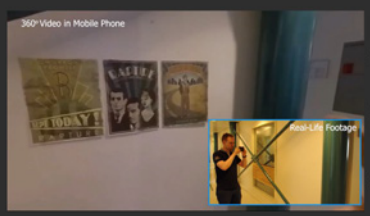
Space Pace is a video shooting method for creating augmented-reality like experiences. It does not rely on heavy technological requirements but can be implemented by anyone with a consumer level camera capable of making 360-video recordings, in a variety of locations with low cost and modest technological prowess. Principle application areas are for example museum and city tours, wayfinding applications and crafted narrative experiences. Space Pace is promising as a new way to experience locations and the method can be employed by a wide variety of actors to create services with clear added value.



In a Space Pace tour, guide is an essential part of the experience. Because, this virtual guide in the video will lead the user around the place. Therefore, it is important the the user is in the correct location and follows the guide in the right pace. The guide can stop or slow down for giving information and start walking or get faster after the information phase. In this moments, it is important to give commands such as "follow me" or express that we are in a phase of information giving. The guide should be expressive in talking and body language to make it easier for users to follow.




With space pace experience, users can be enabled to see the areas which are/should normally be closed. An example can be an artists atelier whose door is closed time to time. On the left, there is a photo of an user who can see the inside of a classroom which has closed blinds at that time of the day. By incorporating Space Pace tour video in an environment, its depth can be increased and locations behind close doors can be rendered visible to visitor at all times.




Although having augmented content is one of the strong points of Space Pace experience, in some cases the initial need can only be having a guide in the scene. However, we observed that having content in the video that does not exist in the real world makes the experience more interesting and increases the surprise effect. It can also be confusing for some users, which should be taken into account in the design of the experience. In this example, we added some posters to video which are not present in the real world that are visible to users only through the mobile phone.

# Publications

## Publications WP1

Alha, K., Koskinen, E., Paavilainen, J., & Hamari, J. (2019). Why Do People Play Location-Based Augmented Reality Games: A Study on Pokémon GO. *Computers in Human Behavior*.

Hamari, J., Hassan, L., & Dias, A. (2018). Gamification, quantified-self or social networking? Matching users' goals with motivational technology. *User Modelling and User-Adapted Interaction, 28(1)*, 35-74.

Hamari, J., Malik, A., Koski, J., & Johri, A. (2018). Uses and gratifications in Pokémon Go: Why do people play mobile location-based augmented reality games? *International Journal of Human-Computer Interaction*.

Högberg, J., Wästlund, E., & Hamari, J. (2019). Gameful Experience Questionnaire (GAMEFULQUEST): An instrument for measuring the perceived gamefulness of system use. *User Modelling and User-Adapted Interaction*.

Koivisto, J., Malik, A., Gurkan B., Hamari, J. (2019). Getting healthy by catching them all: A study on the relationship between player orientations and health benefits in an augmented reality game. In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

Morschheuser B., Riar, M., Hamari, J., & Maedche, A. (2017). How games induce cooperation? A study on the relationship between game features and we-intentions in an augmented reality game. *Computers in Human Behavior*, 77, 169-183.

Morschheuser, B., Hamari, J., & Maedche, A. (2019). Cooperation or Competition - When do people contribute more? A field experiment on gamification of crowdsourcing. *International Journal of Human-Computers Studies*.

Xi, N., & Hamari, J. (2019). The relationship between gamification, brand engagement and brand equity. In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

Hassan, L., Hamari, J., & Dias, A. (2019). How motivational feedback increases user's benefits and continued use: A study on gamification, quantified-self and social networking. International Journal of Information Management 46, 151-162.

## Publications WP2

Buruk, O. T., & Özcan, O. (2018, April). Extracting Design Guidelines for Wearables and Movement in Tabletop Role-Playing Games via a Research Through Design Process. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 513). ACM.

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Hassan, L., Morschheuser, B., Alexan, N., & Hamari, J. (2018). First-Hand Experience of Why Gamification Projects Fail and What Could be Done About it. In *Proceedings of the 2nd International GamiFIN conference*, Pori. Finland, May 21-23, 2018.

Kankainen V., Arjoranta J., Nummenmaa T. (2018). Games as Blends: Understanding Hybrid Games. *Journal of Virtual Reality and Broadcasting*.

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Martinez R., Tong M., Diago L., Nummenmaa T., Nummenmaa J. (2018). Fuzzy Simulation of Human Behaviour in the Health-e-living System. In: *Uncertainty Management with Fuzzy and Rough Sets: Recent Advances and Applications. Studies in Fuzziness and Soft Computing*. Springer, Cham.

Sabuncuoğlu, A., Erkaya, M., Buruk, O. T., & Göksun, T. (2018, June). Code notes: designing a low-cost tangible coding tool for/with children. In *Proceedings of the 17th ACM Conference on Interaction Design and Children* (pp. 644-649). ACM.

Warmelink, H., Koivisto, J., Mayer, I., Vesa, M., & Hamari, J. (2018). Gamification of the work floor: A literature review of gamifying production and logistics operations. *Journal of Business Research*.

Warmelink, H., Koivisto, J., Mayer, I., Vesa, M., & Hamari, J. (2018). Gamification of the work floor: A literature review of gamifying production and logistics operations. In *Proceedings of the 50th Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 4-7, 2018.

## Publications WP3

Järvelä, S., Salminen, M., Ruonala, A., Timonen, J., Mannermaa, K., Jacucci, G, Ravaja, N. (2019). DYNECOM: Augmenting Empathy in VR with Dyadic Synchrony Neurofeedback. In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

Salminen, M., Järvelä, S., Ruonala, A., Timonen, J., Mannermaa, K., Ravaja, N., & Jacucci, G. (2018). Bio-adaptive Social VR to Evoke Affective Interdependence: DYNECOM. In *23rd International Conference on Intelligent User Interfaces* (pp. 73-77). ACM.

## Publications WPX


Salminen, M., & Ravaja, N. Empathizing with the end user: A psychophysiological study of ideation. *Creativity Research Journal*.

Hamari, J., Koivisto, J., & Parvinen, P. (2019). Introduction to Gamification Minitrack. In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

Hassan, L., & Hamari, J. (2019). Gamification of E-Participation: A Literature Review. In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

Jylhä, H., & Hamari, J. (forthcoming). An icon that everyone wants to click on: The relationship between consumer perceptions and app icon successfulness.

Koivisto, J., & Hamari, J. (2019). The rise of motivational information systems: A review of gamification literature. *International Journal of Information Management*.

Morschheuser, B., & Hamari, J. (2018). The gamification of work: Lessons from crowdsourcing. *Journal of Management Inquiry*.

Parvinen, P., Hamari, J., & Pöyry, E. (2018). Introduction to the Minitrack on Mixed, Augmented and Virtual Reality. In *Proceedings of the 51th Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 3-6, 2018.

Parvinen, P., Hamari, J., & Pöyry, E. (2019). Introduction to Mixed, Augmented and Virtual Reality: Co-Designed Services and Applications Minitrack. In *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA, January 8-11, 2019.

Vesa, M., Hamari, J., Harviainen, J. T., & Warmelink, H. (2017). Computer Games and Organization Studies. *Organization Studies, 38(32)*, 273-284.

## Publications
## Theses

Bujić, M. (2018). An Experiment on Experience of Presence in Immersive Journalism. Master's thesis.

Hassan, L. (2018). Means to Gameful Ends: How Should Gamification Be Designed? Doctoral dissertation.

Koivisto, J. (2017). Gamification: A study on users, benefits and literature. Doctoral dissertation.

Morschheuser, B. (2017). The Gamification of Crowdsourcing Systems: Empirical Investigation and Design. Doctoral dissertation.

Salminen, M. (2018). Emotions and psychophysiological responses in organizational social interaction. Doctoral dissertation.

Xi, N. (2018). A study on the impact of gamified interaction on brand equity. Doctoral dissertation.

# Awards, editorial & chairing positions and positions of trust

## Awards

Juho Hamari
Prestigeous publications records award
Tampere University of Technology

Juho Hamari
Researcher of the Year
UC Pori

Juho Hamari & Max Sjöblom
Emerald Literati Award of Excellence
Emerald

Juho Hamari
Information Systems Science Scholar of the Year

## Editorial positions

Special issue – International Journal of Human-Computer Studies; Special issue – Journal of Business Research; Review Editor at journal: Frontiers in Psychology - Cognition; Associate Editor to the HCI in a Sharing Society track at ECIS 2019

## Chairing positions

Gamification Track, 52nd annual Hawaii International Conference on System Sciences HICSS, January, 2019; VR/AR/MR Track, 52nd annual Hawaii International Conference on System Sciences HICSS, January, 2019; Gamification Track, 51st annual Hawaii International Conference on System Sciences HICSS, January, 2018; VR/AR/MR Track, 51st annual Hawaii International Conference on System Sciences HICSS, January, 2018; GamiFIN 2019; GamiFIN 2018.

## Positions of trust

Chairman of Game Studies Thesis competition 2018; Computer and information science-panel, JUFO

# Outcomes

## Press appearances

**2018** Yle Radio 1; Hanken Magazine; Tekijä lehti; ABB; Tekniikan Maailma; Yle; Yle Puhe; Aamulehti; Yle Uutiset; Yle Ajankohtainen kakkonen; Tampere3 press; NordicEdu

**2017** Aamulehti; Aurora; Helsinki University website; Yle Radio Suomi Tampere; Blue Wings (Finnair magazine); Forbes; Tekniikka & Talous; Satakunnan Kansa; UC Pori News

## Keynotes

**2018** Virpa D Wellbeing Demoday; Kaapeli LIFT; Zhongnan University of Economics and Law, Wuhan, China; Anhui Polytechnic, Wuhu, China; Tax Officials of Finland; Immersive Industry Day; Länsi-Suomi - Sydkusten Osuuspankkiliitto; Alma Media networking meeting; 11th Accu-Chek Network meeting; Digi and Experience event: Games and Gamification, Aalto University; Gamify2018; The Finnish Parliament; Digital Colisseums, NTU, Singapore

**2017** IGDA Gamification Now & AI in Games; Tampere3 Health; Tekniikan päivät; Kauppakeskus puuvilla, Teknologia'17 messut; TAYS nuorisopsykiatrian poliklinikka; Tutkijoiden Yö – science popularization event; Heritage, Tourism, Hospitality Conference; Teknologiateollisuus ry

## Events

**2019** GamiFIN 2019; Gamification Track, 52nd annual Hawaii International Conference on System Sciences HICSS; VR/AR/MR Track, 52nd annual Hawaii International Conference on System Sciences HICSS

**2018** Jam Jam Festival; Immersive Industry Day; GamiFIN 2018; Sami Game Jam 2018; Three day design workshop (including public presentations); Finnish Game Jam X; Finnish Game Jam X Tampere; Gamification Track, 51st annual Hawaii International Conference on System Sciences HICSS; VR/AR/MR Track, 51st annual Hawaii International Conference on System Sciences HICSS

## Software

**2018** Max Wake Radiohead; Marker based augmented reality prototype

Gamification Group

GL! HF! ...GG!

# Immersive

This report, produced by the Immersive research project, features research outcomes related to virtual & augmented reality.