SUITCEYES

1 Jan 2018 - 31 Dec 2020

Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer, Yielding Extended Sensosphere

Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces

Courtesy of LightHouse for the Blind and Visually Impaired, see http://lighthouse-sf.org

[Deliverable 7.2]

Refined Recommendations for Gamified Solutions and Social Interaction

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780814.

Dissemination level		
PU	PUBLIC, fully open, e.g. web	X
CO	CONFIDENTIAL, restricted under conditions set out in Model Grant Agreement	
CI	CLASSIFIED, information as referred to in Commission Decision 2001/844/EC.	

Deliverable Type		
R	Document, report (excluding the periodic and final reports)	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
OTHER	Software, technical diagram, etc.	

Deliverable Details	
Deliverable number	7.2
Part of WP	WP7 Gamified and Social Interaction
Lead organisation	Hochschule Offenburg (HSO)
Lead member	Oliver Korn

Revision History			
V#	**Date**	**Description / Reason of change**	**Author / Org.**
v01	10/10/2018	Structure proposal	Rúben (HSO)
v02	12/11/2018	First draft for internal review	Rúben (HSO)
v03	30/11/2018	Second draft addressing review comments submitted to HB	Rúben (HSO)
v04	17/12/2018	Final draft after PC's comments	Rúben (HSO)
v05	21/12/2018	Final draft submitted to the EU	Rúben (HSO)
	06/06/2019	Revised version submitted to EU following approval by P.O.	Rúben (HSO)

Authors	
Partner	**Name(s)**
HSO	Rúben Gouveia

Contributors		
Partner	**Contribution type**	**Name**
HSO	Lea Buchweitz	
HSO	James Gay	

Suggested Reviewers	
Partner	**Name**
UNIVLEEDS	Adriana Atkinson
HB	Nils-Krister Persson

Glossary	
Abbr./ Acronym	**Meaning**
PLEX	Playful Experience framework
SMAP	Short Measure of Adult Playfulness
CDB	Completely Deaf Blind

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Introduction

In WP7 (D7.2), we report on the results of interviews with individuals with deafblindness, in which we assess their understanding of playfulness, as well as needs and preferences towards the design of gamified solutions for developing accessible technology. Within these interviews, we explore their preferences for gamified solutions by inquiring into their memorable experiences with games, either that they use to play or still play. We inquired into their preferences for these games, as well as challenges they faced (or still face) while interacting with these games. We further inquired into particularities of these games (e.g. are they played socially? Are they used to make daily tasks more fun?). These insights were derived from in-depth interviews, conducted across five project member countries of SUITCEYES (i.e. Germany, Greece, Netherlands, Sweden and U.K.).

We leveraged on the insights gained through the interviews to identify patterns, challenges, and values that are important to individuals with deafblindness during their use of games, and how these change across different countries. These insights will be used to inform the design of our gamified device. By identifying the patterns associated to the use of games, we intend to identify elements (of gamification) to be incorporated into our own device, as well as improve our understanding of their concept of playfulness.

In the upcoming sections, we present an overview of accessible gamified interventions. We further provide a list of requirements for the design of gamified solutions for developing accessible technology.

Play, playfulness and interactive technologies

Human play and playfulness have been of interest both in research and practice over several years. According to the work of Millar [1], play can be viewed as a variety of activities, that includes a certain degree of choice, and lack of constraint from conventional ways of handling objects, materials, and ideas. Play is exploratory in nature, intrinsically motivated [2], and free of many of the constraints of objective reality [3]. Classic examples of play include children making houses with boxes or blankets, and dressing up to make-believe [4].

Through play, individuals engage with both the human and physical environment, and it is the characteristics of these interactions that lead a viewer to describe one as playful [5]. While play is an observable behavior, playfulness is seen as an individual attribute, which enables people to transform a situation or an environment in a way to allow for enjoyment or entertainment [6]. According to Barnett [7], playfulness is defined as ‘‘the predisposition to frame (or reframe) a situation in such a way as to provide oneself (and possibly others) with amusement, humor, and/or entertainment. Individuals who have such a heightened predisposition are typically funny, humorous, spontaneous, unpredictable, impulsive, active, energetic, adventurous, sociable, outgoing, cheerful, and happy, and are likely to manifest playful behavior by joking, teasing, clowning, and acting silly’’ (p. 955).

Within early childhood years, play provides the means for children to practice and master a repertoire of skills needed for later childhood and adult life [8]. The development of cognitive, language, motor, and social skills have all been linked to play [9], and playfulness [5]. In addition, there is an essence of just playing for the sake of play that is perceived as equally important to typical development [4]. Play affords contextually relevant instructional opportunities for acquiring, maintaining, and generalizing cognitive and motor skills and is considered as an activity that can have reinforcing properties for social skills ([10],[9]).

Playfulness in individuals with disabilities

Individuals with disabilities are at a distinct disadvantage when it comes to play [10]. Mobility problems make it difficult, if not impossible, to play archetypical games like hide and seek; visual impairments impede a child’s ability to find and investigate toys; cognitive disabilities limit the development of make-believe [11]. In fact, any disability (physical, cognitive, or sensory) poses a barrier to spontaneous engagement in play and playful activities [4]. Overall, individuals with disabilities play less frequently [12], and their play is more often passive and sedentary [13]. Additionally, their play is more often solitary, and social interaction is frequently delayed or distorted [14].

These barriers may be greater for individuals with deaf-blindness [15]. The dual sensory impairment of deaf-blindness necessitates unique ways of communicating, ambulating, and interacting [16]. Both for young persons and adults with deaf-blindness, play may be particularly salient for maintaining a balance in their lives [17] because many do not work or work in unstimulating or routinely jobs, given the high unemployment and underemployment rates [18]. While there are therapy and/or

educational programs designed to remediate skill deficits, these programs are rarely play-focused, or even playful in nature [15]. They may contain moments of play, but the overall emphasis is on skill development. Play and playful interactions become lost in the shuffle. For instance, in Lieberman's study [19], the recreational and leisure practices of 51 adults with deaf-blindness were analyzed. Their study found that over 60% were unsatisfied with their current practices, levels of play and play opportunities – a concern also shared by the parents [18].

Playful experiences with interactive technologies

Over the last decade, a focus has been placed on the design of positive experiences with interactive products. Researchers have argued that product design should move beyond improving efficiency and efficacy, towards evoking moments of pleasure, and enjoyment [20]. Within this scope, playful experiences have been seen as critical for the emergence of inherently positive interactions [10]. One of the main purposes of playful experience research is to understand what aspects constitute the enjoyment of using a product, what kinds of experiences the product can elicit, and how to design something that elicits an enjoyable, pleasurable experience.

Games have commonly been used as a starting point towards designing playful user experience aspects. Games are structured activities with the sole purpose of creating enjoyable experiences. People play games not so much for the game itself as for the experience that the game creates: an exciting adrenaline rush, a vicarious adventure, a mental challenge; and the structure games provide for time, such as a moment of solitude or the company of friends.

Understanding playful experiences of individuals with deafblindness

Our goal is to derive participants' concept of playfulness by inquiring into their experiences with games. Participants will be asked to describe a memorable experience with a game - both those engaged with, and without technology, and asked to describe

(a) what they enjoyed about this game;

(b) the goal of playing the game;

(c) the frequency in which they engage in the game;

(d) the challenges encountered while (or even preventing from) engaging with the game;

(e) the social characteristics of the game (i.e. is it played socially?).

Questions for Participants

The list of questions below is intended as a guide for the interviewer during the semi-structured interview. An initial set of questions will be used to gain a general understanding of participants' experiences with games (see section A and B).

Table 2. Questionnaire with general and follow-up questions. Questions partially addressed in WP2 (Leeds) have been marked with an asterisk (*).

General experiences with games

A. Games engaged without use of technology

- Which games do you enjoy playing?
- Could you describe one of your most favorite games? (*)
- What do you enjoy so much about this particular game? (*)
- For how long have you been playing this game?
- Are there any games that you used to play but cannot anymore for some reason? (please describe)

B. Games engaged through technology

- Do you play any game(s) through the use of technology? (please describe) (*)
- What do you enjoy about this game? (*)
- For how long have you been playing this game?
- What are some of the challenges/negative aspects experienced when playing this particular game? (*)
- How do you deal with these particular challenges?
- Does it provide any form of points and "rewards"? What did you find motivating about these rewards?

Study

Participants

We conducted semi-structured interviews with 28 individuals with deafblindness, each lasting 30 to 50 minutes (21 male, 7 female, mean age = 53).

All participants were totally blind, yet, varied in their degree of hearing loss. Ten were completely deaf and blind; the remaining had either slight (n=7) or moderate (n=8) hearing loss. Of the fifteen participants with either slight or moderate hearing loss, nine used hearing aids. Two of the completely deaf and blind participants had additional mild cognitive impairments.

All participants had acquired deafblindness during their life. Most (n=14) were born with vision and hearing, and gradually lost both senses during their adulthood (n=12) or infancy (n=2). Seven were born entirely blind and six were born completely deaf. Six participants were diagnosed with Usher Syndrome at birth (two with Type I, three with Type II).

The participants were recruited across five different European countries: Greece (n=12), Germany (n=7), Netherlands (n=4), England (n=3) and Sweden (n=2). They were recruited through local organizations for people with deafblindness.

Method

All interviews were conducted face-to-face, at the local organizations. Advanced preparations were necessary for communication, such as interpreters. Only few participants could communicate without intermediaries (e.g. participants in Germany, Sweden and the Netherlands). Family members and caregivers of the interviewed individuals with deafblindness acted as intermediaries when interpretation of Tactile Sign Language or tactile alphabets was necessary. In these instances, family members or caregivers played the role of interpreters who translated the questions and answers.

All participants signed a letter of consent. Its content was translated, when needed, by the interpreter or translator. We encouraged the participants to ask any question and emphasized the opportunity to stop participation at any time. Before starting the recruiting process in each country, the study underwent ethical approval by the respective authorities.

Results

Why Did Participants Stop Playing Games?

Nearly all participants (26 of 28, 93%), stated that they had played at least one game during their life. However, more than half (17 of 28, 61%) said that they no longer played any games. Games were abandoned for primarily two, intertwining reasons: due to overwhelming experiences, or a general lack of interest in games.

Games as Overwhelming Experiences

Almost all participants (25 of 28, 89%) expressed that they were no longer able to fully experience or play games they regularly used to play. Participants described being overwhelmed with the number of tasks, and elements that needed to be identified and interpreted in order to play games – thus limiting their ability to follow gameplay. Participants stated that games mostly relied on visual and/or auditory cues, which made it difficult (if not impossible) for them to engage in gameplay. For instance, one participant, who used to play *Monopoly*, mentioned having particular difficulties in coordinating multiple, intertwined game elements during gameplay (e.g. houses, money, tokens and dice). Another, similarly, found it challenging keeping track of the multiple cards and rules while playing *Rummy*, a matching-cards game: "*there are too many tasks and cards on the table. I quickly lose track of things.*".

While some participants resorted to third-party assistive devices (e.g. magnifying glass, hearing aids) or asked for help from others (e.g. family members or caregivers) to overcome some of these difficulties, the solutions were only temporary and raised issues of their own: "*I need the magnifying function [to play card games on the computer]. When I zoom in on the game, it's so hard to find where you are with the cursor. It's better when everything is on one screen than when everything is so big.*".

The aforementioned difficulties impacted the participants' ability to understand how a game was progressing. Games, for most participants, had become "black boxes", which provided little (if any) cues besides visual and auditory ones. This had clear implications for the participants' abilities to play games with others (i.e. social games): three participants believed to be misled or even cheated by other players: "*I used to play games with my granddaughter, but she would always cheat.*" .

Other participants stated to avoid playing socially as they feel they would slow down gameplay for others, and cause inconvenience: "*[…] but obviously if you can't see what's actually going on in their world, you're either very, very slow or pathetic and therefore not a particularly good person to be playing against*".

Lack of Interest in Games

While a number of participants mentioned abandoning games due to difficulties of engaging in gameplay, others were simply not interested in playing them: *"I'm not a games person. In fact, I used to hate board games when it was Christmas."*

Interestingly, some participants described losing interest in certain games when growing from child to adulthood. While for some this seemed a natural transition (i.e. games were no longer adequate for adults), for others, these memories of games were the only ones they had: One participant, for instance, who became totally blind during childhood, described having little knowledge of games,

besides of the ones he used to play when he was a child (i.e. when he could still see). Games, for this participant, were activities only appropriate for children.

Some participants explained that they abandoned playing games because of being bored when games involved turn-taking, as they had difficulties in realizing what other players were doing, and understanding the time it would take for them to play again: "*If you can see, it's easy: it's your turn, it's your turn, now it's my turn again. But when four deafblind players play together, it takes at least 10 minutes until it's my turn again. And 10 minutes I just sit around and ask myself: When will it be my turn again? Many get bored and leave.*"

What Did Participants Enjoy About Games?

Participants mentioned three main aspects they enjoyed about playing their favorite games: social interaction, winning and level of challenge.

Social Interactions

For nearly all participants, the social aspect of games was a central motivation in their use. Twenty participants (of 28, 70%) mentioned they enjoyed a sense of connection with their families and friends while playing games: *"Sitting around the table with friends and playing Poker."* ; *"I like to play with my family."*; *"Sometimes I play with my nieces."*. Games were frequently seen as a way to mediate social interactions – and even reconnect with people.

Winning as Main Motivation

For some participants, playing socially was all about competition. Five participants (of 28, 20%) described enjoying the competitive aspect of playing socially. Their main purpose was to win and some even got irritated when losing *"Winning is important for me."*; *"Of course, playing for money has always been an enormous motivation."*; *"When I lose, I sometimes get mad."*

Challenging One's Abilities

Participants also frequently mentioned enjoying the challenges associated with games. For some, games are a way of boosting their competence and challenging what they think they can do: *"[I like] solving puzzles which seem to be impossible […] I feel like I'm learning new words and stuff at the same time."*

However, it needs to be noted that these ambitious statements sometimes refer to the past, when the participants' visual impairment was less severe. After a long time of complete blindness, many participants highlighted that they now prefer games with lower cognitive demand: *"I don't like fast or complex games, anymore."*; *"I used to love playing chess. But now I can't remember [the rules]."*; *"Challenge? No, I prefer easy games."*.

What Do Participants Miss About Games?

In this section we describe some of the game aspects missed by participants. When participants are forced to abandon favorite games, mainly the aspects of social interaction, challenge and fun are missed.

Social Interactions

As outlined in the previous section, one of the most appreciated aspects about games is the social interaction with others. Games, therefore, were missed as a way to engage socially.

For example, two participants admitted having a hard time to accept they are no longer able to play with their children. Both stopped playing video games with their children after turning completely blind: *"So obviously when you've got kids and they're on the gaming systems, you want to be part of their world. [… You feel] they're going off into a world that you have no way of accessing."*; *"Unfortunately, now – which does hurt sometimes because I used to play with them [his children] –I just can't see it. My youngest, he still struggles to understand it because one minute, daddy was playing with him, and the next one, I can't anymore."*. Another participant indicated to be sad when playing a game on the computer, because her husband could not join her anymore due to his complete blindness: *"My husband sometimes complains when I play, because we used to play together, but now he cannot see anymore."*.

Participants also frequently described missing seeing other players' reactions and reading the faces of team-mates when playing: *"Deafblind people lack the facial expression. You don't know if the other player is smiling or just mocking you. That's a pity. My team-mate can grin at me when I've lost, and I can't see it."*. For many games, there needs to be a sighted person who explains these details to the individuals with deafblindness *"But [when playing Monopoly] only the streets have Braille and the tiles are different. The banknotes are indistinguishable. Probably you always need a sighted person who is the bank"*.

Challenges and Fun

As indicated in the previous section, almost one third of participants expressed enjoying the challenging aspect of games. For some, this was a way of putting their abilities to test. Among those, many mentioned missing being able to play games that used to challenge them: *"I used to enjoy doing crosswords, but I just can't see them in newspapers anymore. It was a nice daily challenge. Yeah, I used to like that."*; *"I used to like playing chess. I can't play that anymore. I also liked to play Skat and Rummy."*.

Several participants also mentioned that accessible alternatives of games were simply not as fun as the original version: *"I used to like playing Ludo. But now I can't do that anymore and despite the tactile game board I don't enjoy it as much."*; *"I don't want to play these games again as a deafblind person, because they simply don't have the same value as before."*.

Recommendations on Designing Accessible Games for Individuals with Deafblindness

The qualitative analysis of the interviews with individuals with deafblindness led to important insights into their unique requirements and expectations towards games. Based on these insights, we derived a list of recommendations on designing accessible and enjoyable games for individuals with deafblindness. Below, we detail four design indications:

Games as a Way of Mediating Social Interaction

The aspect enjoyed and missed the most about games is the mediation of social interaction. Therefore, supporting and enhancing opportunities to connect with others should be a central aspect when designing accessible games for individuals with deafblindness.

Due to the dual sensory disability of individuals with deafblindness, participants seemed particularly limited in their abilities to engage socially, which was very challenging for some parents who suffer from not being able to play with their children anymore. Playing games clearly helped many participants to cope with their situation: *"when I only concentrate on the game, it keeps me busy. I feel that I get a little out of my darkness and isolation."*.

This highlights the importance of making the "inherently social aspect" [11] of games accessible again and providing opportunities to reconnect with loved ones. For instance, the participant who enjoys sitting together with his friends while playing, or another one who states that playing in general is more fun in a group: *"It's more fun to play together. It's not so much fun alone."*. One possible solution are competitive team games which require collaboration between individuals with deafblindness and seeing and/or hearing team-mates, like a shooter game for visually impaired individuals, where visually impaired individuals are the only players with guns and sighted team-mates need to tell them where to go and where an enemy is located [12].

Customizing the Levels of Challenge Present in Games

Challenges turned out to be a double-edged sword. While for some, challenges were a central mean for generating motivation and engagement with games (and even challenging their own abilities): *"They [the puzzles] go all the way from very easy to impossible, but I've managed to do some of the impossible ones […] playing difficult levels has always been an enormous motivation."*, others felt overwhelmed by challenges.

One of the core challenges in the design of games is in judging the balance between motivating, demanding tasks, and compliance with accessibility guidelines. Despite being entertained, players should also be challenged, but not unnecessarily frustrated [3, 13]. Complicating the game and task requirements easily turns from challenging to overwhelming and, therefore, can be contradictory. Hence, designers of gamified systems should consider and address the balance between both

challenging and motivating tasks, while providing accessible stimuli and in-game responses. For instance, playing an increasingly challenging game is probably not what all participants would choose to do. Games, therefore, should provide scalable levels of challenge to participants, adapting to individuals' personal preferences and abilities.

Games with Clear and Comprehensible Rules and Simple Responses

A requirement, crucial for clear rules and in-game responses is to transform all stimuli relevant to gameplay and relying on visual or auditory cues into perceivable modalities for deafblind users, e.g. tactile stimuli: *"There are some games for blind people, but none specifically intended for deafblind people."* ; *"We converted "Connect Four". We put signs for both colors on the discs with a hot glue gun."*. Stimuli not relevant for gameplay might be removed completely to simplify the game mechanics and avoid overstraining, as stated by one participant, who quickly loses overview when too many stimuli are present. However, it is important to keep in mind that excluding too many stimuli might make the game less fun to play, as stated by another two participants, who perceive the accessible version of a favorite game as less appealing.

To support clear and comprehensible game mechanics we also recommend creating short play sessions. The attention span of individuals with deafblindness is often shortened: *"Yes, I think that [playing a game] requires a lot of concentration and it's very exhausting."*. At the same time, understanding the game state followed by providing in-game responses takes time: *"But playing with deafblind people always takes a very long time."*. Thus, compact play sessions are beneficial for an enjoyable game experience. This avoids overloading individuals with deafblindness and meets the preference of many of these players, who play primarily in shorter time periods: *"I normally just play for fun, for 20 minutes or so, while waiting."*

Providing all information relevant to gameplay in a way that produces accessible stimuli and structures the game into short units requires simple and clear mechanics. If the game mechanics are complex, too much information needs to be conveyed. If users need to understand and respond to it in a short time, this results in stress. While a certain level of challenge is required for a good gaming experience, real stress reduces fun, which in turn spoils the whole game experience.

As deafblindness is often accompanied by additional cognitive impairments [7], the need for providing clear, easy and comprehensible game mechanics and in-game responses is increased even more.

Games Should Provide Continuous Access to Game-Related Information

Many participants mentioned having difficulties in assessing how a game is progressing. Games are "black boxes", which provided little (if any) cues besides visual and auditory ones. For example, one participant admitted getting bored and leaving the game while waiting for his turn: *"A big problem is a lack of flow of information. […] Then you simply play in turn and it's your turn again, but you don't even know how the other players played."*.

This highlights the need of providing continuous access to the current state of game (e.g. moves of other players) to individuals with deafblindness. The opportunity to access information about the

game state does not only keep deafblind players entertained while waiting for their turn, it also makes the game more interesting and fun (e.g., conveying facial expressions and moods of players) and can enhance social interaction (e.g., mocking others).

Conclusions and future actions

The results from the interviews which have been conducted have highlighted some design suggestions for gamified technology for individuals with deafblindness, which will further be used to derive scenarios and games for gamified solutions.

In D7.3, we leverage on the insights from this deliverable, as well as the recommendations derived from previous literature (i.e. D7.1) to create a number of gamified experiences for the SUITCEYES project.

References

[1] S. Millar, *The psychology of play*. Oxford, England: Penguin Books, 1968.

[2] J. F. Christie and E. P. Johnsen, “The Role of Play in Social-Intellectual Development,” *Rev. Educ. Res.*, vol. 53, no. 1, pp. 93–115, Mar. 1983.

[3] A. L. Robinson, “Play: The arena for acquisition of rules for competent behavior,” *Am. J. Occup. Ther.*, vol. 31, no. 4, pp. 248–253, 1977.

[4] S. J. Lane and S. Mistrett, “Let’s Play! Assistive Technology Interventions for Play,” *Young Except. Child.*, vol. 5, no. 2, pp. 19–27, 2002.

[5] P. Berger, F. Bitsch, H. Bröhl, and I. Falkenberg, “Play and playfulness in psychiatry: a selective review,” *Int. J. Play*, vol. 7, no. 2, pp. 210–225, May 2018.

[6] R. T. Proyer, “Development and initial assessment of a short measure for adult playfulness: The SMAP,” *Personal. Individ. Differ.*, vol. 53, no. 8, pp. 989–994, Dec. 2012.

[7] L. A. Barnett, “The nature of playfulness in young adults,” *Personal. Individ. Differ.*, vol. 43, no. 4, pp. 949–958, Sep. 2007.

[8] P. Jean, *Play, Dreams And Imitation In Childhood*. Routledge, 2013.

[9] K. Lifter, E. J. Mason, and E. E. Barton, “Children’s Play: Where We Have Been and Where We Could Go,” *J. Early Interv.*, vol. 33, no. 4, pp. 281–297, Dec. 2011.

[10] J. R. Frey and A. P. Kaiser, “The Use of Play Expansions to Increase the Diversity and Complexity of Object Play in Young Children With Disabilities,” *Top. Early Child. Spec. Educ.*, vol. 31, no. 2, pp. 99–111, Aug. 2011.

[11] C. Kasari, Y.-C. Chang, and S. Patterson, “Pretending to Play or Playing to Pretend,” *Am. J. Play*, vol. 6, no. 1, pp. 124–135, 2013.

[12] A. K. Li, “Play and the mentally retarded child,” *Ment. Retard.*, vol. 19, no. 3, pp. 121–126, 1981.

[13] L. Florey, “An approach to play and play development,” *Am. J. Occup. Ther.*, vol. 25, no. 6, pp. 275–280, 1971.

[14] C. Missiuna and N. Pollock, “Play Deprivation in Children With Physical Disabilities: The Role of the Occupational Therapist in Preventing Secondary Disability,” *Am. J. Occup. Ther.*, vol. 45, no. 10, pp. 882–888, Oct. 1991.

[15] G. King, M. Lawm, S. King, P. Rosenbaum, M. K. Kertoy, and N. L. Young, “A Conceptual Model of the Factors Affecting the Recreation and Leisure Participation of Children with Disabilities,” *Phys. Occup. Ther. Pediatr.*, vol. 23, no. 1, pp. 63–90, Jan. 2003.

[16] J. M. McInnes, *A Guide to Planning and Support for Individuals who are Deafblind*. University of Toronto Press, 1999.

[17] T. Smith, “GUIDELINES: Practical Tips for Working and Socializing with Deaf- Blind People,” *Deaf. Cult. Community*, Jan. 2002.

[18] “Play and Recreational Habits of Youths Who Are Deaf-Blind — JVIB Abstract - American Foundation for the Blind.” [Online]. Available: https://www.afb.org/jvib/newjvibabstract.asp?articleid=jvib971203. [Accessed: 24-Oct-2018].

[19] “Self-determined Recreational and Leisure Choices of Individuals with Deaf-Blindness — JVIB Abstract - American Foundation for the Blind.” [Online]. Available: https://www.afb.org/jvib/newjvibabstract.asp?articleid=JVIB961004. [Accessed: 24-Oct-2018].

[20] M. Hassenzahl, “The Thing and I: Understanding the Relationship Between User and Product,” in *Funology 2*, M. Blythe and A. Monk, Eds. Cham: Springer International Publishing, 2018, pp. 301–313.

[21] B. Costello and E. Edmonds, “A study in play, pleasure and interaction design,” in *Proceedings of the 2007 conference on Designing pleasurable products and interfaces - DPPI ’07*, Helsinki, Finland, 2007, p. 76.

[22] H. Korhonen, M. Montola, J. Arrasvuori, and T. D. Games, *Understanding Playful User Experience*. .
[23] “Rules of Card Games: Rummy.” [Online]. Available: https://www.pagat.com/rummy/rummy.html. [Accessed: 17-Dec-2018].
[24] “Rules of Card Games: Skat.” [Online]. Available: https://www.pagat.com/schafkopf/skat.html. [Accessed: 17-Dec-2018].
[25] “Rules of Card Games: Uno variations.” [Online]. Available: https://www.pagat.com/invented/uno_vars.html. [Accessed: 17-Dec-2018].
[26] “Rules of Tile Games: Okey 101.” [Online]. Available: https://www.pagat.com/rummy/okey101.html. [Accessed: 17-Dec-2018].