MIND FULL OF COLOUR:
AN AR GAMEBOOK TO HELP INPATIENTS WITH ANOREXIA NERVOSA

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INTRODUCTION

Anorexia Nervosa (AN) is a mental disorder that causes serious damage to one's health and well-being, especially in the young (Morris and Twaddle 2007; Jassogne and Zdanowicz 2018; Resmark et al. 2019). It can have devastating effects on a person's physical, mental, and social well-being (Appolinário and Claudino 2000; Lock and Fitzpatrick 2009; Shepphird 2010; Resmark et al. 2019). It is usually considered a serious mental disorder that directly interferes with one's eating behaviour, usually manifesting itself in childhood and adolescence. It is characterised by a restriction of food intake followed by substantial weight loss and is associated with high personal and economic costs for patients, their families, and society, in general.

The greatest difficulty in its treatment is that patients don't acknowledge suffering from AN and don't comply in changing their behaviours. Typically, patients do not desire healing, and rejoice in their self-imposed restrictions regarding feeding. They have a certain distrust of medical doctors and may even perceive them as enemies who want to feed them and make them lose their will to control their own weight. This misperception can facilitate patients' evasion to treatment and their manipulation of the medical team, by simulating a recovery that does not happen (Kaplan 2002; Giordani 2006).

One of the necessary medical interventions to restore the health of patients with AN is hospital admission (Peat et al. 2009). Normally, in this intervention, the patient should eat according to a nutritional plan and lie down after feeding for as long as possible, in order to avoid compensatory behaviours that may lead to weight loss. The moments after eating (about 1 hour) are of great anxiety and discomfort for patients, being pointed out by specialists as one of critical moments during treatment, which directly affect the well-being of patients (Resmark et al. 2019).

Despite the growing use of playful instruments in health contexts, such as games and gamebooks, there are few that address the complexity of AN (Cardoso et al. 2021).

Games are recognized as a significant resource for human well-being (Ferguson 2012). The application of game design concepts in Mental Health contexts has enabled the therapeutic use of games and other ludic instruments in the treatment of psychiatric disorders such as depression, anxiety, obsessive-compulsive disorder and eating disorders (Grace 2019).

Games enable active player involvement through exploration, challenge, creativity, experimentation, competition, and cooperation. Games also improve skills such as self-regulation, problem-solving strategies, and critical thinking (Westera et al. 2008). By designing serious games, the Game Design discipline has a useful and complementary role in the clinical approach to AN, namely in augmenting clinical insight, promoting motivation for treatment, and mediating communication between health professionals and their patients (Peçaibes et al. 2018; 2020; 2021).

During our field research, we realised that a serious game, such as a gamebook mediated by some type of digital technology, could help minimise the discomfort of patients. By promoting engagement through play (Csikszentmihalyi 1990; Juul 2005; Isbister 2017), this gamebook could help patients enter a state of playfulness (Sicart 2017), and therefore avoid the aforementioned compensatory behaviours and anxious thoughts, and promote positive experiences (Isbister 2017).

The gamebook we present in this paper is one of the results of the first author's doctoral thesis. The creative process and research methodology of this thesis sought to put people at the centre of the project (Ku and Lupton 2020) to gain a deep understanding of patients' needs, and field work that included stages of passive observation of consultations and interviews with the medical team at São João University Hospital Centre[1] (Peçaibes, Cardoso, and Alvelos 2018).

This paper starts with the presentation of the gamebook's formal elements and its gameplay. Afterwards, it presents the instruments, the sample, procedures, and the results of the conducted tests, and the point of view of the medical specialist (Psychiatry) responsible for the treatment of these patients. At the end, we present the conclusions and indicate future work.

MIND FULL OF COLOUR

Mind Full of Colour is a gamebook composed of a printed book, with illustrations and poems, and a digital mobile application, featuring augmented reality (AR), depicted in Fig. 1.

[1] The University Hospital Centre of São João is a university hospital in the city of Porto, Portugal, connected to the Faculty of Medicine of the University of Porto. This hospital acts as a reference centre, being the largest hospital in the North of Portugal, and one of the largest in the country.

Fig. 1 - Mind Full of Colour: gamebook cover

The gamebook is printed and has the format of a colouring book (A4). On each page, there is an illustration to be painted by the player (book's right side) and only the first sentence of a poem (especially created for the illustration) accompanied by a QR Code (left side). The game's contents were co-created by a multidisciplinary team from Design and Mental Health (Fig. 2).

Fig. 2 - Mind Full of Colour: poem and illustrations.

The app has the function of promoting patients' involvement with the game environment. The application's architecture provides a hybrid experience that begins in the mobile application. Afterwards, players perform an activity in the analogue gamebook, and, after a certain time, they must return to the app to see the result of their actions in AR (Fig. 3).

Fig. 3 - Mind Full of Colour: digital application.

The player's experience embeds the following actions (Fig. 4):

1. Player decides in the app which illustration to paint on the gamebook;
2. Player paints the gamebook for 1 hour to unlock the AR poem part;
3. 24 hours later the app unlocks the illustration's AR;
4. The padlock in the painted illustration turns into a star;
5. The star goes to the player's ranking.

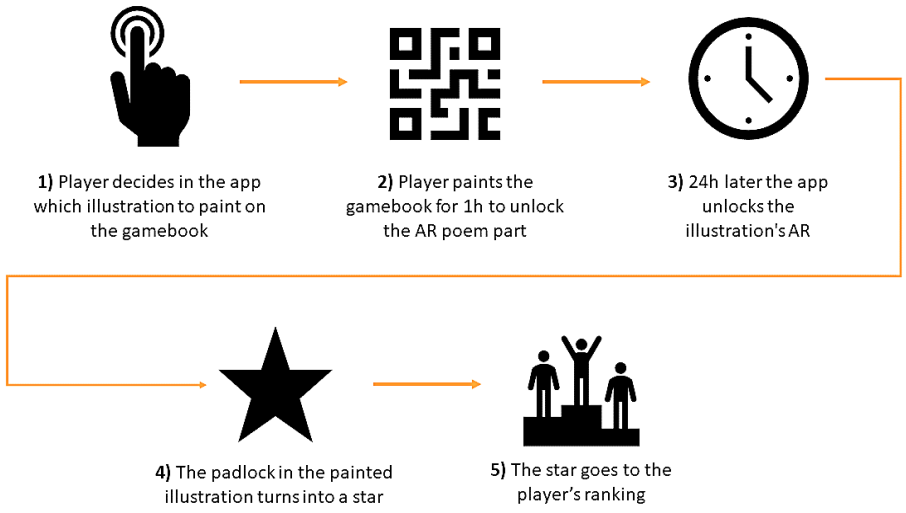

Fig. 4 - Gameplay sequence.

TESTS & RESULTS

A functional prototype of this gamebook was tested by inpatients and evaluated by a specialist in psychiatry from São João University Hospital Centre. Tests were conducted at the inpatient ward of the Psychiatry Service under the supervision of hospital staff. Two patients undergoing treatment used the gamebook for 4 consecutive days.

As for inclusion criteria, the individuals that make up the sample were selected by the health professionals who work in the hospital's Psychiatry Service; they are patients diagnosed with AN in treatment at the hospital. As for exclusion criteria, patients diagnosed with mental retardation and/or comorbid schizophrenia, and patients who present signs or symptoms of intoxication, due to the use of any substance that influences their cognition, were excluded.

The tests aimed to understand the point of view of patients and specialists regarding the gameplay and usability of the gamebook, and also if it fulfils its serious objective, which is to promote the involvement of patients in hospitalisation in a calm activity after feeding in order to avoid compensatory behaviours that lead calorie burning and therefore to weight loss.

The instruments used for collecting data were:

1) *Observation Grid*.
   Usage: This was filled in by the researcher during the test session.
   Description: This grid had as references the following works: ethnographic observation (Spradley 1980), manual for the observation of collective serious games (Daré, Hassenforder, and Dray 2020) and game elements (Macklin and Sharp 2016). This grid has fields dedicated to the description of: a) *non-verbal elements* – description of the participants' behaviours during the game session, such as: actions of interest and disinterest, use/appropriation of the game, agency, non-verbal emotions of fun, immersion, satisfaction, stress or confusion; b) *game elements for non-verbal behaviours* – game elements that provoked the non-verbal behaviours observed in point a); c) *verbal elements* – speech manifestations that may (or may not) support behaviours such as: understanding (or not) the game content, verbalised emotions of safety, involvement, interest and disinterest; d) *game elements for verbal behaviours* - game elements that provoked the verbal behaviours observed in point c).
   Relevance: This instrument allowed us to record players' behaviours during the game session and take notice of what were the game elements that triggered such behaviours. This type of record helped us to understand which game elements were important (or not) to the experience.
2) *PANAS – Positive Affect and Negative Affect Scale*.
   Usage: Patients were asked to state with this scale how they felt during the gaming session they had just performed.
   Description: This instrument has 10 positive affects (e.g. interested, excited, inspired) and 10 negative affects (e.g. distressed, sad, afraid). The patient has the possibility to rate each on a 5-point scale, in which 5 corresponds to extremely and 1 to very little (Watson, Clark, and Tellegen 1988).
   Relevance: Player's self-assessments with this scale allowed us to

understand how they felt during the session and whether the game was an instrument that stimulated positive or negative affective states. The players' point of view on their own affective states complements that of the researcher's.

3) *Semi-Structured Interview.*
   Usage: The point of view of the psychiatrist responsible for the patients was collected through an individual semi-structured interview, which later undergo a content analysis (Dresch, Pacheco, and Antunes 2014). The interview with the specialist responsible for the treatment of the patients who undergo the tests lasted approximately 40 minutes and was carried out after the end of both sessions with the patients.
   Description: The content of the interview guide is based on the quality assessment criteria for serious games (Caserman et al. 2020), interactive digital narrative game experience (Roth and Koenitz 2016), on the script of questions for evaluating games created by Daré et al. (2020) and the therapeutic goals of games for Anorexia Nervosa from the doctoral research that aim to assist: in treatment adherence; in gaining insight into your illness; in supporting emotional management; as a therapeutic, individual and group tool; as a facilitator of the relationship and communication between patients, families and health professionals.
   Relevance: This semi-structured interview was used in order to capture perceptions, needs and difficulties of the interviewee in order to help us understand the usefulness and potential of the gamebook in the context of the treatment of Anorexia Nervosa in the hospital environment.

As for procedures, tests with patients were performed as follows:

1) The test session was performed individually, with only the presence of the patient and the researcher, with approximately 1 hour on each of the 4 consecutive days.
2) The session began shortly after the patient's lunch hour had ended.
3) The patient is invited by the researcher and guided by the health professional to go to a reserved consultation room for the test.
4) The researcher presents the objectives of the test, shows the gamebook and app to the patient, and teaches him/her the rules and how to play.
5) The gamebook is offered to the patient and the app is on the researcher's smartphone.
6) The patient chooses an illustration from the gamebook to paint with the researcher's coloured pencils and starts the app's timer.
7) The patient paints the gamebook for 1h and at the end of the session s/he can access the app to see the augmented reality of the poem of the chosen illustration.
8) During this time, the researcher makes notes on the observation grid dedicated to that day.
9) The next day, the patient's first action is to access the app to view the augmented reality of the illustration painted the day before.
10) The patient then chooses a new illustration to paint and starts the timer.
11) At the end of the fourth day of testing, the patient is asked to complete the PANAS.

Both patients had a mean age of 19 years, the first patient (P1) was in her 5th hospitalisation and had a more restless and aggressive behaviour. P1 has not completed

high school and lives with her family in a small town in Portugal. The second patient (P2) had a calmer and more melancholic behaviour and was in her 2nd hospitalisation. P2 is in the second semester of the university but is undecided whether to continue in this course. She lives with her family in an urban city in the centre of the country. On the first day of the tests, both were very excited and anxious, but when they understood the rules of the game and saw the gamebook and the app, they became more interested and calmer.

During the tests, it was observed that offering a gamebook to patients at that critical moment, after eating, changed their emotional state, making them more curious, calm, and focused on choosing the illustration in the digital application and on painting the book to achieve the objective proposed by the game. P1 expresses that: "*This looks good!*" and P2: "*I really enjoyed everything!*", when they saw the gamebook and app for the first time.

When players managed to unlock the AR part of the illustration they painted the day before, their reactions of enchantment and joy boosted by their interaction with the digital application, and the printed illustrations were decisive to enhance their engagement, favouring their permanence in the game. P1 said "*That's Cool! He moves!*" when she saw AR in the illustration of a boy. P2: "*This is really beautiful! I didn't imagine the illustration could get any cooler than it already is!".*

The poems and illustrations were perceived by the patients as positive messages that contributed to improving their emotional state, which is disturbed due to the resumption of feeding in the recommended amounts. P1 "*I like this poem... I miss my family*." and P2: *"I think that in the hospital this game helps us not to think about what we eat… this moment is very difficult*". P1 didn't want to keep the gamebook, but P2 kept the gamebook and took it home when she left the hospital (Fig. 5).

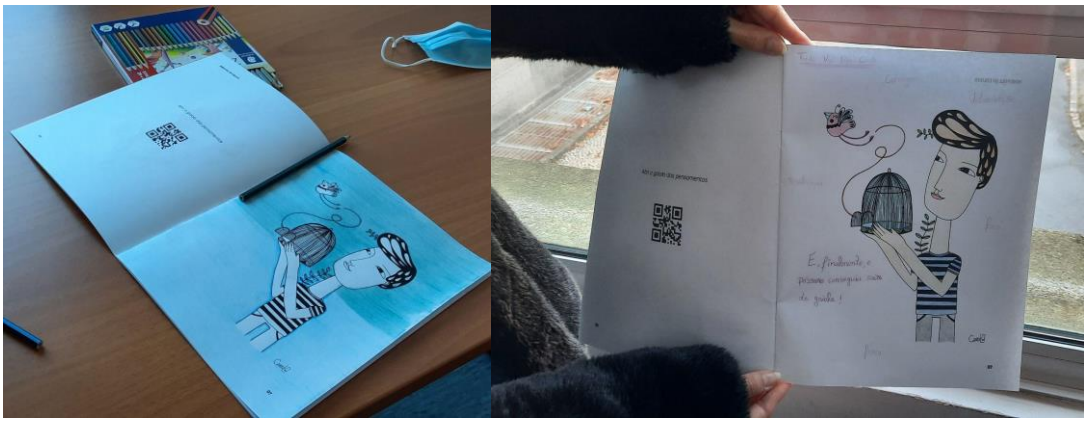

Fig. 5 - P1's (left) and P2's (right) painted gamebooks.

During their experience with the gamebook, patients felt extremely interested, active, enthusiastic, determined and pleasantly surprised (PANAS high scores) and not at all disturbed, nervous, and irritated (PANAS low scores),[2] see Table 1. This contributes to the fact that the use of the gamebook after meals is favourable to enhance positive

[2] Positive Affect Score: Total scores can range from 10 to 50, with higher scores representing higher levels of positive affect. Negative Affect Score: Total scores can range from 10 to 50, with lower scores representing lower levels of negative affect (Watson, Clark, and Tellegen 1988).

emotional states in patients, minimising the negative emotional states that normally occur in this period of time.

Table 1 - PANAS results.

POSITIVE AFFECTS	**P1**	**P2**	**NEGATIVE AFFECTS**	**P1**	**P2**
Interested	5	4	Distressed	1	2
Excited	4	2	Upset	1	1
Strong	4	3	Guilty	1	1
Enthusiastic	5	2	Sacred	1	1
Proud	4	4	Hostile	1	1
Alert	5	4	Irritable	1	1
Inspired	4	5	Ashamed	1	1
Determined	5	3	Nervous	1	1
Pleasantly Surprised	5	4	Remorse	1	1
Active	5	3	Disgust	1	1
High Scores	**46**	**34**	**Low Scores**	**10**	**11**

The specialist stated that the gamebook can be used in the hospital as a tool to support patients after eating. However, the clinic also mentioned that it can also be used before eating since there can be anxiety attacks during this moment and the gamebook can be a good strategy in such a context. She emphasises that the use of the gamebook within the hospital can promote moments in which patients can benefit from the plastic expression and the incentive (engagement) that the game provides.

Since patients are alone at the hospital, the gamebook helped them reflect on their relationships, being seen as an useful instrument for them to express issues regarding affection and other issues related with their families. This is directly related to the content of the gamebook – illustrations and poems related to family, friends, and the person himself. These contents allowed patients to express themselves through painting and/or writing something with a particular illustration in mind. The specialist is a psychiatrist with extensive experience in the treatment of eating disorders, namely AN, and saw these paintings and writings as important data for health professionals to assess in the course of their patients' treatment. She mentioned that doctors can use this information about their patients' decision-making in the course of their treatment – e.g., why do patients choose a particular illustration to paint, or why do they not choose a specific one –, because, with that in mind, they may be able to ascertain different emotional aspects of those patients, which is usually a difficult thing to assess. The gamebook's rules give the patient freedom of choice and decision-making. It is known that decision-making is a factor directly impacted by AN, causing emotional ambivalence. Thus, patients' resistance to colouring some illustrations or the decision to paint a particular illustration

may reveal reasons for their difficulty in facing what the drawing or poem triggered in their memories. This is important data that becomes accessible to health professionals and that they usually do not have access to.

The interviewed specialist also highlighted that the hybrid format (printed gamebook with a digital application) is very consistent with the common age group of these patients. AN has the highest mortality rate among mental disorders and is among the top 10 causes of disability in young women (Attia and Walsh 2007; Bulik et al. 2007). The young population are considered digital natives (Prensky 2001) and, thus, games and technology are relevant tools for accessing information, for learning and even favouring engagement (Peçaibes et al. 2020). In this sense, the interviewee found it important that the gamebook offers an analog and digital experience with the potential to consistently involve patients with the activity and, consequently, favour access to the benefits of emotional control that the gamebook offers players.

CONCLUSIONS & FUTURE WORK

We may conclude that this gamebook can help inpatients with AN minimising discomfort, and promoting engagement through play, and that it can be a tool to support their treatment helping patients enter a state of playfulness and therefore avoiding compensatory behaviours and anxious thoughts. By means of the aforementioned evaluation, we can conclude that this gamebook:

a) Assists in one of the most critical moments of patients' treatment, being a facilitator for their engagement, minimising their discomfort and facilitating their compliance to treatment;
b) The involvement that the game offers through the playful experience helps in the emotional management of the patient. When patients are immersed in a calm and engaging activity, this directly affects their anxiety and can be a supporting agent in their emotional regulation after feeding;
c) The gamebook's content helps in the plastic expression of patients, which helps them externalise emotions, feelings, and thoughts about their interpersonal relationships, regarding family and others.
d) The gamebook was perceived as a useful instrument for psychotherapy, as it provides therapists with access to patients' motivations and insight on their decision-making. The gamebook rules give patients the power to choose a particular illustration to paint (or not paint). This implicit proposal in decision-making the game makes contributes to the psychologist's work, as the gamebook gives access to the therapist to investigate why a given patient did or did not choose a specific illustration, and with that in mind, the therapist can assess different emotional aspects of these patients.

For the future we intend to:

1) Conclude the development of this gamebook: For the tests we developed a prototype with only 4 illustrations and 4 poems. Our intention is to create a gamebook with 30 illustrations and 30 poems, as this number is related to the average number of days a patient with Anorexia Nervosa is hospitalised for treatment.
2) Finalise the app's implementation, with the full version of the gamebook, for individual players, including 30 illustrations and 30 poems.

3) Carry out new tests with the aforementioned complete version of the gamebook to verify if the patients' interest in the game is maintained during the 30 days of game sessions.
4) Create a new feature for the game book to be used by a group of patients, as mentioned by the interviewed specialist. For this, we intend to co-create this feature of the gamebook with health professionals who work in the São João University Hospital Centre - Psychiatric Service.
5) At the end, we intend to create a collection of books, because patients who have already used this game will be able to have access to new books, as a result of new hospitalizations. In addition, not all themes will appeal to all types of people, and by having other types of gamebooks, we may have different options for different types of patients and even different types of moods.

REFERENCES

Appolinário, José Carlos, and Angélica M Claudino. 2000. "Transtornos Alimentares." *Revista Brasileira de Psiquiatria* 22 (suppl 2): 28–31. https://doi.org/10.1590/s1516-44462000000600008.

Attia, Evelyn, and B Timothy Walsh. 2007. "Anorexia Nervosa." *The American Journal of Psychiatry* 164 (12): 1805–10; quiz 1922. https://doi.org/10.1176/appi.ajp.2007.07071151.

Bulik, Cynthia M, Margarita C T Slof-Op't Landt, Eric F van Furth, and Patrick F Sullivan. 2007. "The Genetics of Anorexia Nervosa." *Annual Review of Nutrition* 27: 263–75. https://doi.org/10.1146/annurev.nutr.27.061406.093713.

Cardoso, Pedro, Viviane Peçaibes, Bruno Giesteira, and Liliana Correia de Castro. 2021. "Positive Play: Games for Human Potential and the Yet Unexplored Case of Anorexia Nervosa." In *Handbook of Research on Solving Modern Healthcare Challenges With Gamification*, edited by R. Alexandre Peixoto de Queirós and A. Marques, 154–85. IGI Global. https://doi.org/10.4018/978-1-7998-7472-0.ch010.

Caserman, Polona, Katrin Hoffmann, Philipp Müller, Marcel Schaub, Katharina Straßburg, Josef Wiemeyer, Regina Bruder, and Stefan Göbel. 2020. "Quality Criteria for Serious Games: Serious Part, Game Part, and Balance." *JMIR Serious Games* 8 (3): e19037. https://doi.org/10.2196/19037.

Csikszentmihalyi, Mihaly. 1990. *Flow: The Psychology of Optimal Experience*. New York, NY, US: Harper Perennial.

Daré, William's, Emeline Hassenforder, and Anne Dray. 2020. *Observation Manual for Collective Serious Games*. Montpellier, France: CIRAD; ComMod Association. https://doi.org/10.19182/agritrop/00144.

Dresch, Aline, Daniel L. Pacheco, and José A. V. Antunes. 2014. *Design Science Research: Método de Pesquisa Para Avanço Da Ciência e Tecnologia*. 1º. Porto Alegre - Brasil: Bookman.

Ferguson, Bill. 2012. "The Emergence of Games for Health." *Games for Health Journal* 1 (1): 1–2. https://doi.org/10.1089/g4h.2012.1010.

Giordani, Rubia Carla Formighieri. 2006. "A Auto-Imagem Corporal Na Anorexia Nervosa: Uma Abordagem Sociológica." *Psicologia & Sociedade* 18 (2): 81–88. https://doi.org/10.1590/S0102-71822006000200011.

Grace, Lindsay. 2019. *Doing Things with Games*. *Doing Things with Games*. https://doi.org/10.1201/9780429429880.

Isbister, Katherine. 2017. *How Games Move Us: Emotion by Design*. Series: Pl. Cambridge: MIT Press.

Jassogne, Carole, and Nicolas Zdanowicz. 2018. "Management of Adult Patients with Anorexia Nervosa: A Literature Review." *Psychiatria Danubina* 30 (Suppl 7): 533–36.

Juul, Jesper. 2005. *Half-Real: Video Games between Real Rules and Fictional Worlds*. Massachusetts: MIT Press.

Kaplan, Al S. 2002. "Psychological Treatments for Anorexia Nervosa: A Review of Published Studies and Promising New Directions" 47 (3): 235–42.

Ku, Bon, and Ellen Lupton. 2020. *Health Design Thinking - Creating Products and Services for Better Health*. Massachusetts: MIT Press.

Lock, James D, and Kathleen Kara Fitzpatrick. 2009. "Anorexia Nervosa," no. August 2007: 1–19.

Macklin, Colleen, and John Sharp. 2016. *Games, Design and Play: A Detailed Approach to Iterative Game Design*. 1st ed. Addison-Wesley Professional.

Morris, Jane, and Sara Twaddle. 2007. "Anorexia Nervosa." *British Medical Journal* 334 (7599): 894–98. https://doi.org/10.1136/bmj.39171.616840.BE.

Peat, Christine, James E Mitchell, Hans W Hoek, and Stephen A Wonderlich. 2009. "Validity and Utility of Subtyping Anorexia Nervosa." *The International Journal of Eating Disorders* 42 (7): 590–94. https://doi.org/10.1002/eat.20717.

Peçaibes, Viviane, Pedro Cardoso, and Heitor Alvelos. 2018. "Design de Jogos Para a Inovação Em Saúde: O Lúdico Como Mecanismo No Tratamento Da Anorexia Nervosa." In *UD18 Encontro De Doutoramentos Em Design*, 49–56. Aveiro - Portugal: Universidade de Aveiro. http://ud18.web.ua.pt/wp-content/uploads/2019/05/UD18_actas_VF.pdf.

Peçaibes, Viviane, Pedro Cardoso, Liliana Castro, Bruno Giesteira, Livia Lopes, and Clara Junqueira. 2021. "How Do I Feel When… A Card-Based Communication Game to Stimulate Empathy Among Family Members with Anorexia Nervosa." In *Advances in Design and Digital Communication Proceedings of the 4th International Conference on Design and Digital Communication, Digicom 2020, November 5–7, 2020, Barcelos, Portugal*, edited by Nuno Martins and Daniel Brandão, 1:418–32. Switzerland: Springer. https://doi.org/10.1007/978-3-030-61671-7_40.

Peçaibes, Viviane, Pedro Cardoso, and Bruno Giesteira. 2018. "Speculative Design for Serious Games: Towards a Matrix for the Conception of Ludic Tools in the Context of Anorexia Nervosa." In *DIGICOM International Conference on Digital Design & Communication.*, 105–16. Portugal: IPCA. https://digicom.ipca.pt/2018/docs/DIGICOM2018-proceedings.pdf.

Peçaibes, Viviane, Livia Sant'Anna, Pedro Cardoso, Liliana Castro, Bruno Giesteira, and Clara Junqueira. 2020. "Ana<b3l@>: Um Jogo Para Promover a Aprendizagem Sobre a Prevenção Da Anorexia Nervosa Na População Jovem." In *Atas Do 5º Encontro Sobre Jogos e Mobile Learning*, 302–12. Coimbra - Portugal: Centro de Estudos Interdisciplinares do Século 20 (CEIS20) Universidade de Coimbra - Coimbra. isbn:978-972-8627-96-6.

Prensky, Marc. 2001. "Digital Natives, Digital Immigrants Part 1." *On the Horizon* 9 (5): 1–6. https://doi.org/10.1108/10748120110424816.

Resmark, Gaby, Stephan Herpertz, Beate Herpertz-Dahlmann, and Almut Zeeck. 2019. "Treatment of Anorexia Nervosa—New Evidence-Based Guidelines." *Journal of Clinical Medicine* 8 (2): 153. https://doi.org/10.3390/jcm8020153.

Roth, Christian, and Hartmut Koenitz. 2016. "Evaluating the User Experience of Interactive Digital Narrative." In . https://doi.org/10.1145/2983298.2983302.

Shepphird, Sari Fine. 2010. *100 Questions and Answers about Anorexia Nervosa*. Sudbury, MA: Jones and Bartlett Publishers, LLC.

Sicart, Miguel. 2017. *Play Matters*. Massachusetts: MIT Press.

Spradley, James P. 1980. *Participant Observation*. New York: Holt, Rinehart and Winston.

Watson, David, Lee Anna Clark, and Auke Tellegen. 1988. "Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales." *Journal of Personality and Social Psychology* 54 (6): 1063–70. https://doi.org/10.1037/0022-3514.54.6.1063.

Westera, W, R J Nadolski, H G K Hummel, and I.G.J.H. Wopereis. 2008. "Serious Games for Higher Education: A Framework for Reducing Design Complexity." *Journal of Computer Assisted Learning* 24 (5): 420–32. https://doi.org/https://doi.org/10.1111/j.1365-2729.2008.00279.x.

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