Self-Transformative effects of designing videogames and the challenge of capturing them quantitatively: a case study

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ABSTRACT

In this work we discuss the self-transformative effects that can be elicited through the practice of videogame design. We focus on the problems and limitations that we encountered in trying to quantitatively capture psychological changes in videogame designers. Our work involved two experiments, each of them observing a group of M.Sc. students in a digital games course working on small, serious videogame projects. In these experiments, we attempted to identify and track transformations that the students themselves underwent while trying to stimulate psychological changes in their players by means of gameplay. The results of our case study suggest that the research setup we designed could not rigorously measure the quantitative kinds of self-transformation we were after. Even so, our work takes some important, initial steps in the direction of understanding and exploring the practice of videogame design as offering novel possibilities and advantages in the contexts of self-transformation.

CCS CONCEPTS

• **Applied computing** → **Computer games**;

KEYWORDS

Game design, Videogame design, Serious Videogames, Self-Transformation, Implicit Attitude, Transformative Design, Reflective Design

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1 INTRODUCTION

Our work on the self-transformative effects of practicing videogame design relies on Michel Foucault's notion of 'technologies of the self', in that we understand self-transformative practices as activities that "permit individuals to effect [...] a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves [...]" [1, p. 18].

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Existing work on the socio-cultural benefits of the practice of game design (and videogame design in particular) exclusively focus on its educational advantages and possibilities [5–7]. In the surveyed literature, videogame design is systematically leveraged to actively and experientially engage with learning mathematics, logics, and computer programming [5–7]. With the objective of exploring personal and psychological transformations rather than the acquisition of specific notions and skills, we decided to base our work on literature on the reflexive effects emerging from the process of designing [11, 12] and on existing, initial inquiries into self-transformation through videogame design. According to the latter, when engaged in the interrelated processes of researching, crafting, and iterating, the designers materialize and refine not only their functional plan, but also their ethos and sensitivity [3, p. 4]. In this work, we will specifically examine Gualeni's hypothesis that when taking part in design processes that are meant to be transformative for the recipients of the designed object or activity, the designers also undergo psychological transformations that are analogous to those that they intended to elicit in the recipients of their work [4, p. 2].

The participants to the two experiments we designed were two groups of students taking the 'Videogame Development' module of a M.Sc. course. The participant-designers ranged from 21 to 28 years of age. Over a five-month period, they were tasked with developing playful, digital experiences that were designed to lessen the implicit attitudes towards sugary and fatty food items in the intended players. Both the experiments measured and tracked the implicit attitude of the participant-designers towards sugary and fatty foods as they designed and developed transformative games.

2 DESCRIPTION OF THE EXPERIMENTS

The quantitative tool we used is the Implicit-Attitude Test (IAT), a test that is frequently used in psychology research [2]. The IAT was designed to measure the strength of a person's automatic association by prompting participants to rapidly categorize a given attribute into one of two provided concepts. In our experiments, a range of food items had to be categorized in terms of "healthiness" using concepts of emotional valence. At the end of an IAT test, a so-called 'D-score' is calculated. The D-score quantifies the implicit association on a scale from -2 (indicating that the concept fully correlates with an unexpected attribute; in our case 'healthy food is bad') to +2 (denoting a full correlation of a concept with the expected attribute; in our case 'healthy food is good'). A D-score of 0 indicates that a participant showed no implicit positive or negative association with the concept he or she was presented with. Both our experiments involved questionnaires that tried to capture (at different stages of videogame development) potential changes

in the dietary habits of our participants that would not be possible to be detected with the IAT test. In the follow-up experiment, we used the Fat-Related Diet Habits Questionnaire (FRDH) [9, 14]. Participants can answer the questions in a FRDH questionnaire on a 4-point Likert scale, ranging from 'usually' to 'never', thus requiring them to estimate the frequency for a given eating habit. A final score is then calculated, ranging from 1 to 4.

In our first experiment, the students in our test group mostly developed their small, transformative videogames on an individual basis. In addition to the IAT, the participants were asked to report their own weight, which could reveal whether or not changes in dietary habits had taken place. At the end of the first cycle, we noticed that changes in weight did not seem to correspond to whether or not participants had been designing a videogame for transformative purposes. In addition to this, we concluded that self-reported weight is a measure that is highly problematic, as a self-report cannot be verified objectively and, being a delicate subject in our culture, might have been reported untruthfully.

In our second experiment, participants were asked to develop videogames in teams of three members each. Based on lessons learned from the first experiment cycle of our study, we discontinued the self-report of individual weight was as a way to reveal food-related transformations. We also increased the frequency of the IAT, with students taking it on a monthly basis rather than only at the beginning and at the end of the experiment. As outlined above, the participants to the second experiment also took FRDH questionnaires, which were also administered on a monthly frequency. In addition to our group of designers, we also involved four Master's students from the cognitive science department to act as a control group with the objective to assess the potential impacts of factors unrelated to the design process. We also managed to gather quantitative data from individual interviews with each participant. The outcomes of the interviews will be discussed in the conclusive sections of this poster, as we do not consider these outcomes to be formally part of our quantitative approach. That said, those results offered the possibility to develop a richer and better-informed discussion about the meaning of the quantitative analyses we performed as well as the methodological and logistical shortcomings we encountered.

3 RESULTS

In our first experiment, we found that the median of IAT test results increased from 0.64 before the design process to 0.92 after the design process. To recall, in our IAT setup a positive value indicates an implicit association for healthy food being positive. The control group, consisting of two students in the class who designed videogames that were not about dietary habits, showed a decrease in the same time-frame, going from 1.22 to 1.13 (see Fig. 1). With a BF_{-0}=3.9 (based on a Bayesian Paired Samples T-Test [10]), meaning that it is close to four times more likely that an increase of IAT test results would occur in everyone who designs a videogame for improving dietary habits than that the measured increase is coincidental, we can notice some evidence for the assumption that the implicit association strengthened through the design process. We, of course, need to remind the reader that there are many other parameters that we could not control and that might have been responsible

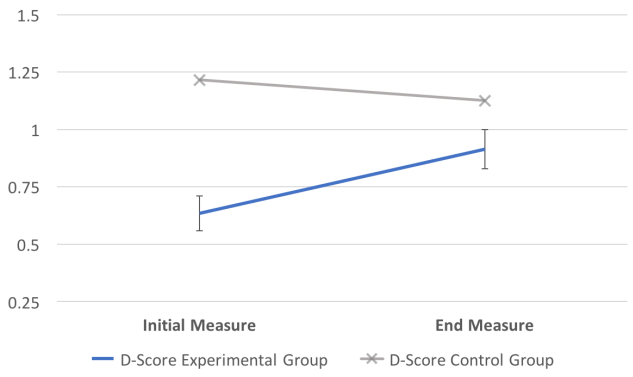

Figure 1: Chart showing the median of IAT D-scores before and after the design process. Higher values indicate a higher association of healthy food being good. Vertical bars show the deviation from the median across participants. Median scores of the control group are indicated with a grey X symbol.

for this increase. Nevertheless, it indicates that Gualeni's hypothesis deserved further scrutiny and research, which motivated our second research experiment.

In our second experiment, we ran IAT tests on our participants on a monthly basis throughout the design process, and included the FRDH questionnaire to capture potential changes in their dietary habits. The median results of the IAT went from 0.91 before the design process, to 0.7 at the end of the experiment. This means that overall participants had weakened their implicit association for healthy food being good - or, considering unhealthy food as less bad than they did at the beginning of the experiment. A similar trend can be observed for the control group, which went from 1.07 to 0.97 in the same time-frame. With a BF_{-0}=0.2, there is statistical evidence to conclude that in this second experiment the practice of designing a videogame did not positively impact the implicit association of the participants. While D-score of the IAT show increases in month two and four (see Fig. 2, neither month results in a Bayes Factor over 1, which would suggest an improvement to be just as likely as no improvement. Consequently, we have to conclude that, even with fluctuations throughout the design process, we did not find evidence for a strengthening of the association of healthy food being positive. The results of the FRDH questionnaire (see Fig. 3) are consistent with these observations, as the score produced by the questionnaire went from a median of 2.6 before the design process to 3.2 at the end. To recall, the score ranges from 1 to 4, with 4 indicating a high involvement of fat in the dietary habits of a participant. With a BF_{+0}=0.2 when comparing measures before and after the design process, we again have to conclude that a hypothesized lowering of the score (thus reduced intake of fat) did not occur, instead suggesting that an increase in score is five times more likely (5 being the inverse of 0.2). Particularly interesting, here, is comparing the score at the beginning and the second month, which has a BF_{+0}=2.4. This means that the measured decrease in questionnaire scores (shown as an upwards tendency in the figure) is potentially meaningful, given that it is more than twice

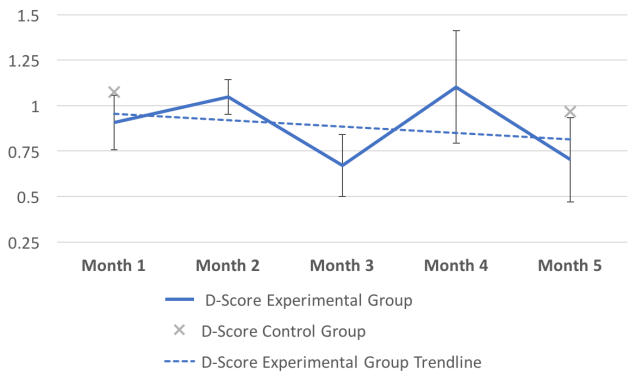

Figure 2: Chart showing the median of IAT D-scores for each month of the experiment. IAT-D scores generally range from -2.0 to 2.0. Higher values indicate a higher association of healthy food being good. Vertical bars show the deviation from the median. Median scores of the control group are indicated for Month 1 and 5 with an X symbol.

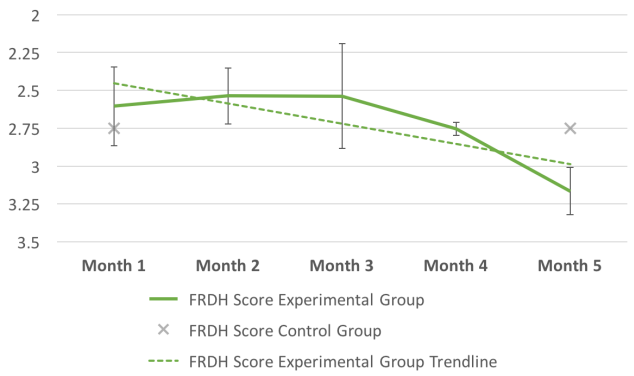

Figure 3: Chart showing the median of FRDH Questionnaire scores for each month of the experiment. Scores range from 1 (healthy habits) to 4 (unhealthy). Vertical bars show the deviation from the median. Scores of the control group are shown for Month 1 and 5 with an X symbol. Y-axis inverted for clarity (lower in the graph means less healthy eating).

as likely due to an actual decrease rather than natural variation in measures. While this is far from conclusive evidence, it could indicate that the beginning of the development process - which involve tasks such as gathering information, developing concepts, and working or early prototypes - has a higher chance of triggering transformations than the later phases of videogame development, which are customarily characterized by production tasks that more repetitive and less exploratory.

3.1 Outcomes of the interviews at the end of the second experiment

The following sections of our text thematically cluster and discuss themes and concerns that emerged in the interviews that took place at the end of the second experiment cycle.

(1) **Problems With the Educational Setting:** Both the experiments that comprise our case study were run in coordination with the videogame development module taught at our University. That specific module also overlapped with other classes in the same Master's course. Stress ensuing from having to study and produce deliverables for other modules likely influenced any potential transformation that might or might not have emerged.
(2) **Eating Healthy on a Student's Budget:** This specific limitation was mentioned in the interviews as an obstacle to adopting healthier eating habits, as unhealthy food items were indicated by our participants as being cheaper than the healthier, low fat alternatives.
(3) **Disconnection by Design:** Our interviewees reflected on their understanding of the healthy and unhealthy food items in their videogames, and reported relating to them simply and functionally as 'game components'. This functional disconnection was discussed by our participants as a potential obstacle to the self-transformative effects that those videogames could have had.
(4) **Lack of Engagement With the Audience:** Given the limited development period, the participants reported that they lacked contact and engagement with their intended players. Therefore, the design of those small, transformative videogames happened in a way that was not directly informed by the interactive preferences and the cognitive needs of their intended players.

4 DISCUSSION ON THE STUDY'S LIMITATIONS AND ON THE KNOWLEDGE GAINED

In the design phases of this case study, we considered that running an experiment on a group of students who were taking a videogame development class would be desirable in terms of our research goals. We imagined that observing a group of people of roughly the same age, educational background, and technical capabilities in videogame design would conveniently remove several external factors that could have influenced our results. The same could be said about them working in the same setting, with similar intensity, on videogame development projects that were comparable in terms of themes and scope. However, gathering research data from something produced during an academic module invited several external factors from which we could not isolate our participants. Among those factors is the additional stress of being graded for their design efforts and, as already mentioned, the concomitant pressure exerted by the other modules in the same course, not to mention the financial limitations that often characterizes the lives of students. Another drawback to this case study that we consider crucial and crucially dependent on the educational context was its duration: each design cycle had to run for five months (that is from January to the beginning of June, as that is the time allotted for the videogame development module at our University). That period spanned over three seasons. Medical research established that a number of factors (including the lesser intake of vitamin D, the increased levels of melatonin, the diminished amount of physical activity, et cetera) statistically determine the tendency of human

beings to change dietary habits and customarily gain weight over the cold months of the year [8, 13]. Physiological seasonal changes, thus, also influenced our results with effects that we cannot measure precisely or neatly separate from other factors, contributing to making our outcomes even less reliable.

A possible solution to these problems could have been to avoid combining the experiment with the complications that inevitably arise from participating in an academic module. Instead, we could have run a shorter, more focused experiment, possibly in a controlled environment and in relative isolation. A dedicated game jam (normally lasting 48 hours) or a slightly longer game design retreat could constitute a less problematic alternative. This solution appears to address many of the difficulties related to stress, duration, and money-related dietary habits, but it also introduces new logistical as well as methodological problems. The most obvious among those would be identifying and tracking psychological effects that could manifest themselves in the span of a few days, instead of weeks or months (as it was the case for dietary habits and food-related attitudes). This, in turn, limits the potential spectrum of topics and types of transformations that we could hope to explore with quantitative methods.

We further note that while a few of our participants had no prior experience in videogame development, others had extensive expertise in the field. In all likelihood, this difference played a role in the levels of stress that the different participants experienced throughout of the experiment. We can consider this as an influential factor in our results on the basis that, stress is recognized as playing a significant role in the establishing and shifting of dietary habits [15]. Our recommendation in this case is to try to enlist designers with a comparable level of experience and psychological investment in game design as a practice.

We also deem it important to address the fact that the videogames that our participants developed in each experiment cycle were not tested on players in terms of their transformative effects. Despite being potentially problematic, this lack of data does not impinge on our case study, as what we are trying to argue is that the transformations that take place in the practice of game design are similar, but not qualitatively or quantitatively identical, to the transformations that the designers expected to elicit in the players.

5 CONCLUSIONS

In this conclusion we want to emphasize the point that videogame design is not the same as general videogame development, as the latter includes - among other activities - asset and sound creation, animating, scripting, and iterative testing. Although videogame designers tend to take on multiple roles, especially in small independent teams, they are most heavily involved in the creative and formative aspects of the videogame development process. As such, they tend to have a more pivotal role and the most influence on game development at the start of the process. In small student teams, the specific role of videogame designer, a figure that is solely concerned with crafting the metaphors and affordances to transform the audience, is often not a possibility. As suggested in our speculative explanation of the results, there was a slight improvement of implicit attitudes and fat-related dietary habits in the early phases of the videogame development process, when the students were concerned with developing their concepts and researching the subject matter. In that respect, we consider it to be is fully possible that the positive changes we observed in the results of the first experiment could emerge due to the setup where every student had to design and conceptualize their individual videogame, rather than working in a team where only a few participants were involved in research and conceptualization tasks. This phase in particular should be explored further in future work.

Based on our experience so far, we consider the IAT a potentially useful tool to reveal changes that the participants' themselves are not aware of, though it might not be the most suitable tool for every research 'theme' and in every scenario. In general, we believe this to be the case, at least on the short-term: researchers pursuing a quantitative approach to detect and track self-transformation ensuing from the practice of (video)game design should also consider planning follow-up tests to assess the longevity of these changes.

Qualitative data, such as more elaborate interviews and diary entries, could in these cases provide a deeper and more granular understanding of transformative practices to be explored through quantitative means. Even with inconclusive and perhaps problematic results in relation to Gualeni's original hypothesis, we believe that this work takes some important, initial steps in the direction of understanding and exploring the practice of videogame design as offering novel possibilities and advantages in the contexts of self-transformation.

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