Universität Basel

Fakultät für Psychologie

The Impact of Interactive Technology on Prosocial Behavior

Inauguraldissertation zur Erlangung der Würde eines Doktors der Philosophie vorgelegt der Fakultät für Psychologie der Universität Basel von

Sharon Therese Steinemann

aus Hagenbuch (ZH), Schweiz

Basel, 2019

Universität Basel

Fakultät für Psychologie

Genehmigt von der Fakultät für Psychologie auf Antrag von

Prof. Dr. Klaus Opwis (Erstgutachter)

Prof. Dr. Ester Reijnen (Zweitgutachter)

Datum des Doktoratsexamen:

DekanIn der Fakultät für Psychologie

Universität Basel

Fakultät für Psychologie

Erklärung zur wissenschaftlichen Lauterkeit

Ich erkläre hiermit, dass ich die vorliegende Arbeit ohne die Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel selbstständig verfasst habe. Zu Hilfe genommene Quellen sind als solche gekennzeichnet. Die veröffentlichten oder zur Veröffentlichung in Zeitschriften eingereichten Manuskripte wurden in Zusammenarbeit mit den Koautoren erstellt und von keinem der Beteiligten an anderer Stelle publiziert, zur Publikation eingereicht, oder einer anderen Prüfungsbehörde als der Universität Basel als Qualifikationsarbeit vorgelegt.

Es handelt sich dabei um folgende Manuskripte:

- Steinemann, S. T., Mekler, E. D., & Opwis, K. (2015). Increasing donating behavior through a game for change: The role of interactivity and appreciation. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play* (pp. 319-329). New York, NY: ACM.
- Steinemann, S. T., Iten, G. H., Opwis, K., Forde, S. F., Frasseck, L., & Mekler, E. D. (2017). Interactive narratives affecting social change. *Journal of Media Psychology, 29(1), 54-66.*
- Iten, G. H., Steinemann, S. T., & Opwis, K. (2018). Choosing to help monsters: A mixed-method examination of meaningful choices in games. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 341-354).* New York, NY: ACM.
- Steinemann, S. T., Geelan, B. J., Zaehringer, S., Mutuura, K., Wolkow, E., Frasseck, L., & Opwis, K. (submitted). Potentials and pitfalls of increasing prosocial behavior and self-efficacy over time using an online personalized platform.

Basel, 22. November 2019

Sharon Therese Steinemann

Contents

Abstract

Background. Behavior performed with the prosocial intent of helping others holds benefits not only for the recipient, but also for the prosocial actor and the community around them. Despite these pervasive benefits, there is relatively little research on how interacting with computing technology can be used to facilitate prosocial behavior. Understanding this relationship between technology usage and prosocial behavior and the psychological processes underlying this relationship is the aim of this doctoral thesis. To this goal, over the course of four manuscripts, we examined the impact of different technologies (in the form of video games, interactive narratives, and an interactive online platform) on their users' experiences and prosocial behavior.

Methods. In each manuscript we followed a similar core structure; We experimentally manipulated a form of technology to examine its effects. We collected data on psychological processes we believed to be crucial to the effect of technology on prosocial behavior. Finally, in three of the four manuscripts, we assessed prosocial behavior after interacting with the technology. Based on the individual research questions, the experimental designs were supplemented with additional methodologies, such as interviews, surveys, and longitudinal data collection.

Results. We found that interactivity in games and interactive text-based narratives can lead to increased prosocial behavior, but that this effect only occurred when interactivity lead to more meaningful experiences. We found that narrative choices can lead to meaningful experiences when they create moral dilemmas with clear consequences for oneself or others. We learned that sending reminders to track daily prosocial behavior for three weeks correlates with increases in belief in one's ability to help others in everyday contexts. The strongest predictor for using an interactive platform meant to support prosocial behavior over time was the belief in one's ability to impact change and the enjoyment of the technology itself. Enjoyment was also related to the likelihood to continue using the interactive platform. One's belief in one's ability to help others in everyday contexts did not predict prosocial behavior over time, but one's belief in one's ability to impact change did.

Conclusion. Interacting with technology is by far not a silver bullet to drastically impact prosocial behavior. However, when designed to be meaningful, interactivity can affect the way a narrative is perceived and to which extent prosocial behavior will be shown following the interaction. Interactive technology has the potential, particularly when enjoyable, to support performing prosocial actions and engagement over time. One's belief in one's abilities to perform everyday prosocial actions and one's belief in one's abilities to impact change both play roles within the relationship between technology usage and prosocial behavior. In order to correctly harness the potential of these technologies, however, the complex reality of the variability of users' everyday contexts, as well as their unique capabilities, opportunities, and motivations need to be taken into account. While some technology is more likely to lead to prosocial behavior when it is meaningful, others will be more likely be effective, particularly over time, when they are enjoyable. Future research should further examine the relationships between different forms of self-efficacy, experiences of enjoyment and meaningfulness, their relationship with sustained prosocial behavior, and how they are affected by interactive technology.

Keywords

Human-Computer Interaction • Prosocial Behavior • Interactive Technology • Experimental Studies • Mixed Method

Introduction

The world is introduced to exciting new technology every day. Some of this technology will be left by the wayside of progress and soon forgotten (Köhler, 2018). Other technology will go on to change the world (Calvo & Peters, 2014). Some technology will add unnecessary complexity and anxiety to its users' lives (Baker, Krieger, & LeRoy, 2016). Other technology will bring value and joy to its users and those around them (Roepke et al., 2015; Yang & Liu, 2017).

The goal of this doctoral thesis is to add to the understanding of how technology affects the behavior of its users. The focus here will be on prosocial behavior, that is, behavior with the intention of benefiting others (Batson & Powell, 2003). By examining prosocial behavior, we wish to understand whether technology has the potential to foster actions in its users that will lead them to support others.

Over the course of four manuscripts, my co-authors and I empirically examined the impact of different forms of technology on their users' experiences and prosocial behavior. In the following chapters, this frame will introduce, briefly, the theoretical background of concepts central to this thesis and describe the research questions at its core. Next, the four manuscripts will each be summarized. Finally, the four manuscripts will be discussed, their findings positioned in the greater research context, and implications drawn, both for future studies and practical applications.

Theoretical Background

Prosocial Behavior

Prosocial behavior is behavior performed with the intention of benefiting others (Batson & Powell, 2003). Examples of prosocial behaviors include volunteering, donating, or spontaneously helping a friend or stranger in need (Schwartz & Bilsky, 1990). Prosocial behavior has been found to not only benefit the receiver, but also the benefactor, by increasing wellbeing in those acting prosocially (Ko, Margolis, Revord, & Lyubomirsky, 2019; Layous, Nelson, Kurtz, & Lyubomirsky, 2017; Nelson, Layous, Cole, & Lyubomirsky, 2016; Snippe et al., 2018; Weinstein & Ryan, 2010). Beyond this, prosocial behavior can lead to a greater sense of common interest and willingness to invest in the community (Chang, Lin, & Chen, 2012; Fowler & Christakis, 2010; Kerwin, Warner, Walker, & Stevens, 2015).

Predicting (Prosocial) Behavior

To understand how to affect prosocial behavior, it is worth understanding how behavior overall tends to be predicted. Numerous theoretical frameworks exist for understanding and predicting behavior (Ajzen, 2005; Bandura, 1997; Fogg, 2009; Li, Xu, Chen, & Menassa, 2019; Michie, Atkins, & West, 2014). Most frameworks, however, agree that a specific behavior (e.g., helping a child with math homework) is more likely to occur when three central conditions are given: When participants possess the motivation, capability, and opportunity to exhibit the behavior. In the following these conditions will be described in more detail.

Motivation. Firstly, a person is more likely to behave a certain way when they are motivated to act (Bandura, 1997; Fogg, 2009; Li et al., 2019; Michie et al., 2014). A person can be motivated in different

ways (Ryan & Deci, 2000). On the one hand, they could be motivated, because they enjoy performing the action itself (e.g., they enjoy explaining math problems to others). On the other hand they could be motivated because they believe that performing the action will be rewarding in the short or long term (e.g., they will be paid to help, helping will look good on their resume, helping will make them feel good about themselves, or helping will relieve feelings of sadness caused by watching the child struggling alone). The meaningfulness of the behavior, that is, how closely related to personal values and goals a behavior is seen to be (van Tilburg & Igou, 2013), plays a crucial part in motivating, in particular, prosocial behavior (Andersen et al., 2005; Apter, Spirn, Sveback, & Apter, 1997; Ellithorpe, Ewoldsen, & Oliver, 2015).

Capability. The second condition conducive to behavior is capability, or perhaps more importantly, perceived capability (Ajzen, 2005; Bandura, 1997; Li et al., 2019; Michie et al., 2014). In other words, a person is more likely to show a behavior when they are capable, or crucially, believe they are capable of acting. The belief in one's capability to successfully perform an action is also known as *self-efficacy* (Bandura, 1997). Self-efficacy can develop in a number of ways, such as watching others succeed at an action (e.g., watching someone else successfully help a child with math homework) or being told that one is capable of performing an action (e.g., being told that since one is so good at math one will be good at teaching math to others). However, the most effective way of developing self-efficacy is by knowing that one has in the past successfully performed this or a closely related behavior before, that is, had so-called *mastery experiences* (e.g., one has in the past helped someone understand complicated concepts). Ideally, self-efficacy is measured as specifically as possible (Bandura, 2006). In the context of prosocial behavior one such measure is one's belief in one's ability to impact change to current states of injustice or suffering (White, MacDonnell, & Ellard, 2012). So far, however, no scale exists to measure the self-efficacy for performing prosocial behavior in everyday contexts, such as giving directions to a lost stranger when one is late for work or taking the time to comfort a sad friend when one is feeling tired after a long day. Therefore the preliminary development of a scale to measure self-efficacy in the context of everyday helping behavior was included in this thesis.

Opportunity. Thirdly, a person is more likely to show a behavior when they have and, crucially, are aware of, the opportunity to act (Fogg, 2009; Li et al., 2019; Michie et al., 2014). Even when motivation and capability are given a person cannot act if their attention is not brought to focus on a certain behavior being an option (e.g., by realizing that one has a few hours to spare or being aware that the child needs or wants help with their homework).

As we will see in the following chapters, interactive technology has the potential to be used to increase all three of these preconditions for behavior.

Measuring Prosocial Behavior

As in all empirical research on latent constructs, a central question lies in the correct form of measurement. Prosocial behavior has been examined in a number of ways in the past, a few that are central to this thesis will be described in the following sections.

Intention to Help. In particular in media psychology, it is popular to measure prosocial behavior over the proxy of reported intention to help (Cohen, 2014; Lin & Wu, 2019; Peng, Lee, & Heeter, 2010). This is done with the argument that intention to act and action are closely related (Sheeran, 2002). However, as the above sections suggest, factors such as divergent motivations, lacking capabilities, or opportunities can be powerful detractors from behavior, even when the best of intentions are given. This does not mean that intention to help cannot be a valuable indicator for the effectiveness of a stimulus. As a predictor of behavior, however, intention may be most useful when examined in the context of a multifactoral approach.

Donations. An in many ways elegant measure of prosocial behavior is the use of money donations. Here, an easily quantifiable behavior can be observed as to the extent to which people choose to benefit others instead of themselves. Commonly, study participants are given, or promised, a certain sum of money (or, in some cases, the chance to win this sum). Then, the percentage is measured that participants choose to not keep for themselves but give to a predefined charity (e.g., for school renovations or mosquito nets) or another participant (Freeman, Aquino, & McFerran, 2009; Iten, Bopp, Steiner, Opwis, & Mekler, 2018; Lee & Hsieh, 2013; Tsvetkova & Macy, 2014; Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007). Often, small amounts of one to five US dollars are enough to observe differences between experimental conditions (Iten et al., 2018; Lee & Hsieh, 2013; Twenge et al., 2007).

The limitation of donation as a measure is, however, that it will not always necessarily perfectly align with the definition of prosocial behavior, that is, behavior performed with the intention to benefit others (Batson & Powell, 2003). For instance, someone might donate, not with the intention of benefiting others, but in order to receive something more desirable in return. Or, one might choose not to donate because one does not believe the donation would actually benefit others (e.g, if one believes all the money will be used for advertisements or the salaries of rich executives). As with intention to help, donations are a valuable measure, most optimally used in tandem with other measures aimed at understanding the reasons behind the observed behavior.

Self-Reported Everyday Prosocial Behavior. As prosocial behavior is defined through the intent behind the behavior, to ensure that the behavior measured can indeed be defined as prosocial, one can simply specifically ask participants to report everyday behavior, which they themselves consider to be prosocial. This has been done by asking participants to retrospectively report on the past day (Raposa, Laws, & Ansell, 2016; Weinstein & Ryan, 2010) or hours (Snippe et al., 2018). Everyday prosocial behavior could also be examined using the measure common in other behavioral studies of experience sampling (Larson & Csikszentmihalyi, 2014); although to our knowledge experience sampling has not been used to measure prosocial behavior thus far.

With self-reported everyday prosocial behavior, however, the issue arises of how to quantify this behavior. One could, as Weinstein and Ryan (2010) did, use a dichotomous measure of whether or not prosocial behavior was shown on any given day. One can also count reported actions as done by Raposa et al. (2016). Alternatively, one could assigned specific actions more weight, due to the difficulty, time invested, or the level of beneficent intent behind the behavior (Snippe et al., 2018). Any

one of these approaches is, however, likely to miss some of the nuance present in the actual behavior. While, therefore, this measure may give one of the most accurate pictures in terms of understanding when and under which circumstances prosocial behavior is shown, quantified comparisons may become tricky; an insight, which we had the opportunity to develop over the course of the work on this thesis.

Further measures of prosocial behavior. While the above sections give an overview of some of the most common measures of prosocial behavior, many others exist. These include measuring sharing behavior of prosocial messages (Cohen, 2014), lab tasks using a confederate asking for help (Greitemeyer & Osswald, 2010; Twenge et al., 2007), using questionnaires to measure prosociality (Gentile et al., 2009), or, recently, by analyzing CCTV footage of bystander behavior in actual public conflicts (Philpot, Liebst, Levine, Bernasco, & Lindegaard, 2019).
In this thesis, prosocial behavior was measured using donations in Manuscripts 1 and 2 and self-reported everyday prosocial behavior in Manuscript 4. In Manuscript 1, willingness to help was additionally measured as an intentional variable in order to allow comparisons to previous findings in media psychology research (Cohen, 2014; Peng et al., 2010).

Interactive Technology

Interactive technologies are defined in this thesis as computing systems, which allow modification by the user (Fogg, 2002; Steuer, 1992). Compared to their non-interactive counterparts, interactive technologies can turn passive consumers of information into active participants (Thomas & Roda, 2006). For example, non-interactive technology could include the use of health videos to provide information which, however, to a specific person in a specific situation, might not necessarily be useful. In contrast, interactive technologies, such as health applications, may allow the user to input information and change settings, thereby creating an optimal, personalized experience, highly relevant to their current wants and needs.
Interactive technology has the potential to affect its users through different mechanisms. In his work on the persuasive potential of technology, Fogg (2002) conceptualized these mechanisms in the form of the *functional triad*. The functional triad defines three functionalities, media, tools, and social actors, through which technology can impact its users.

Technology as Media. Technology can function as a unique source for experiences, by allowing the simulation of reality in a virtual, safe, and controlled environment. Technology in this function is defined as *media* (Fogg, 2002). In media, interactivity adds the potential for the audience to hold not only a passive role, but to actively explore and manipulate their media experience (Elson, Breuer, Ivory, & Quandt, 2014; Green & Jenkins, 2014). Examples of interactive media include virtual reality or video games. Through interacting with media, users can experience cause-and-effect scenarios, such as when a statistics simulation allows the user to play around with the connection between sample size and distribution (Iten, 2015) or when players of the video game *Portal* can solve puzzles and learn how to manipulate increasingly deadly obstacles by experimenting with their character's inter-spatial portal-creating device. Media can also simulate environments, such as in *Richie's Plank Experience*, a

virtual reality simulation in which one can face one's fear of heights by taking an elevator up a skyscraper and daring to walk out onto a narrow plank high above a virtual city. Interactive media, however, does not have to offer high-resolution, revolutionary graphics to create unique experiences. Text-based interactive narratives, such as *Depression Quest*, pull the audience in by putting them in the role of the main character and making them responsible for the course and outcome of the narrative. Examining the types of experiences that media has to offer its audience, researchers originally focused particularly on the potential for enjoyment (Mitgutsch & Alvarado, 2012; Oliver & Bartsch, 2010). However, research in the past decades has diversified to demonstrate the intense and complex palette of emotions that media can evoke in its audience (Bopp, Mekler, & Opwis, 2015, 2016; Oliver & Bartsch, 2010; Oliver et al., 2015). A particular experience, which will become central to this thesis, is that of *appreciation* (Oliver & Bartsch, 2010). Appreciation is understood in part in contrast to the concept of enjoyment, which describes fun and entertaining experiences (Oliver & Bartsch, 2010). As argued by Oliver and Bartsch (2010), who first developed the concept within media psychology, even when media may not necessarily be enjoyed, it may still be considered valuable and personally meaningful and therefore appreciated. Appreciation, therefore, describes experiences that are meaningful, emotionally moving, and thought-provoking, such as watching the movie *Schindler's List* or *Hotel Rwanda* (Oliver & Bartsch, 2010). While appreciation was first explored in the context of non-interactive media, such as movies or text-based narratives (Lewis, Tamborini, & Weber, 2014; Oliver & Bartsch, 2010), research in recent years has highlighted the way that interactive media, such as video games, can as well elicit not only experiences of enjoyment, but also appreciation (Bopp, Opwis, & Mekler, 2018; Green & Jenkins, 2014; Oliver et al., 2015). Moreover, their ability to allow players to explore virtual worlds, make narrative choices, and experience the resulting outcomes, allows interactive media to create engaging experiences that may well extend even beyond the capability of non-interactive media (Elson et al., 2014; Fogg, 2002; Green & Jenkins, 2014).

Technology as Tools. Technology also allows for the enhancement of capabilities, through its ability to measure, identify, and offer up context-specific information matched to a users current needs. Interactive technologies in this function are defined as *tools* (Fogg, 2002). The previous example of a personalized health application falls into this category of interactive technology, as does a learning system, such as the language learning platform *Duolingo* that provides lessons at the level at which a person will most profit. Tools can track and measure various behaviors, making it easier for users to self-monitor behavior such as steps taken, time spent on their phone, or hours spent continually seated without standing breaks (Hermsen, Frost, Renes, & Kerkhof, 2016). Fast, easily interpretable feedback and context-specific support given by the tool, can allow users to understand and change behavioral patterns effectively (Hermsen et al., 2016; Stawarz, Cox, & Blandford, 2015). Centrally, personalization is a particularly impactful form of user-tool interaction (Spohr et al., 2015). Building on understanding of user-specific information, such as their capabilities, opportunities, and motivations (Michie, Van Stralen, & West, 2011), applications can allow tailored experiences, for example preparing the health regimen most likely to allow the user to succeed.

Technology as Social Actors. Finally, technology can build relationships with its users. Technologies in this function are defined as *social actors* (Fogg, 2002). Examples include the attachment people might develop to their cleaning robot or characters in games, such as the murderous artificial intelligence in *Portal*. The latter example highlights an important point to be made about the functional triad, which is that one form of technology, e.g., a game, can include more than one form of functionality, such as when a game simulates an environment (media functionality), lets the player track game statistics (tool functionality), and allows the player to develop a friendships over time with compelling virtual characters (social actor functionality).
In this thesis, the focus will be primarily on technology as media (Manuscripts 1, 2, and 3) and technology as tools (Manuscript 4), but the overlapping nature that these functions can have is demonstrated by the fact that within the examination of media, particularly in in Manuscript 3, technology as a social actor plays a crucial role in understanding the effect that media experiences can have on their users.

Understanding the Relationship between Interactive Technology and Prosocial Behavior

Considering the benefits of prosocial behavior (Layous et al., 2017; Nelson et al., 2016; Weinstein & Ryan, 2010) and the wide variety of other exciting research that has sprung up out of fields focused on the impact of technology on its users, it is surprising that examining how and why interactive technology could support prosocial behavior has received relatively little attention. However, there is an abundance of related research originating from various disciplines, which has paved the way to giving us a rich foundation on which research on the impact of interactive technology on prosocial behavior can be built.

Prosocial Behavior and Interactive Media. *Games for change*, also known as social impact games, serious games for change or persuasive games, are games that have been developed with the primary goal not of being fun, but to animate players to support the social change the game is advocating, for example by donating money or sharing the game with others (R. S. Jacobs, 2018; Neys & Jansz, 2010; Ritterfeld, Cody, & Vorderer, 2009). Examples of games for change include *Darfur is Dying*, a game in which one plays as a refugee in a militia-controlled area facing the danger involved in simple tasks such as getting clean water for one's family. Another example is *Spent*, where the player is confronted with the heart-wrenching financial choices facing someone living at the edge of destitution. In *My Cotton Picking Life*, child labor in Uzbekistan is highlighted through forcing the player to simulate the slow and bleak work involved in picking cotton. While the design and functionality of games for change can vary greatly, from complex virtual realities to simple text-based interactive narratives, they have in common that they force the player to make choices they would not usually have to face. So far, no research has focused on the behavioral impact of games for change beyond that of sharing the game with friends online (Cohen, 2014). Different studies have however examined effects on attitudes (R. S. Jacobs, 2018; Ruggiero, 2015; Soekarjo & van Oostendorp, 2015), knowledge-gain (Kampf & Stolero, 2015), and willingness to help (Peng et al., 2010). Ruggiero (2015) and Peng et al. (2010) compared games for change to non-interactive media, finding that, compared to non-interactive media,

games for change can lead to longer-lasting attitude change (Ruggiero, 2015) and greater willingness to help (Peng et al., 2010). These studies demonstrate encouraging potential for effects of games for change, making the experimental examination of behavioral effects a promising next step.
Using a game for change, the first research question of this thesis therefore examines the impact of media interactivity on prosocial behavior by measuring the percentage participants donated to charity.

> ***RQ 1:*** *In media such as games for change, what is the impact of interactivity on prosocial behavior?*

Interactive media has been found to affect audiences in a variety of ways, including by creating emotionally challenges experiences (Bopp et al., 2018) and invoking feelings of appreciation (Bopp et al., 2018; Oliver et al., 2015). There is, however, a lack of understanding as to how these experiences elicited by interactive media compare to those evoked by noninteractive media, in particular as to how these experiences then ultimately relate to differences in effects on prosocial behavior (Green & Jenkins, 2014). To understand, therefore, which underlying psychological processes are indeed particularly affected by interactive media and in turn predict prosocial behavior, was the aim of the second research question of this thesis.

> ***RQ 2:*** *Which underlying psychological processes can help explain the relationship between media interactivity and prosocial behavior?*

In the search to identify what makes media interactivity effective, it became apparent over the course of the work on this thesis that meaningful narrative choices would play a central role.
Meaningful choices have so far not been directly empirically examined in the context of interactive media. There have, however, been several recent empirical studies either on choices more generally in games (Krcmar & Cingel, 2016) or on meaningful experiences overall (Oliver et al., 2015; Rogers, Woolley, Sherrick, Bowman, & Oliver, 2017), as well as different theoretical texts on the topic of meaningful choices in interactive media (Bogost, 2007; Nay & Zagal, 2017; Schrier, 2010; Vikaros & Degand, 2010).
To empirically examine which choice characteristics would be crucial to the experience of meaningful choices and how this in turn would affect the overall meaningfulness of the media experience was the focus of the third research question.

> ***RQ 3:*** *What choice characteristics are responsible for the experience of meaningful choices and how does this affect the appreciation of the media experience?*

Prosocial Behavior and Interactive Tools. In recent years, there has been a plethora of research on the use of interactive technologies, such as mobile applications and wearable trackers for behavior change. In particular health-related behavior, such as healthy eating (Pollak et al., 2010), physical activity (Direito, Jiang, Whittaker, & Maddison, 2015; Geelan et al., 2016), and smoking cessation (Iacoviello et al., 2017; Ubhi, Michie, Kotz, Wong, & West, 2015) have been the focus of such research. However, in the context of prosocial behavior, so far no equivalent tools have been researched, or

indeed seemingly even developed. Rather, efforts to use interactive technology for prosocial behavior change have seemingly focused almost exclusively on the use of interactive media to induce attitudinal and motivational change (R. R. Jacobs, 2017). Calling back to what we know about the roots of behavior and behavior change laying in more than just motivation (Ajzen, 2005; Michie et al., 2011), this appears to leave idle the potential of technology to affect not only motivation, but capability and opportunity as well. For this, interactive tools may be particularly valuable. Understanding, therefore, the effects of popular features of interactive tools, such as gamified versions of self-tracking (Stawarz et al., 2015) and task personalization (Kickmeier-Rust, Marte, Linek, Lalonde, & Albert, 2008; Ricci, Rokach, & Shapira, 2015) on prosocial behavior are of great interest, as is the question of using such technology to support sustainable prosocial behavior change over time (Hermsen et al., 2016; Koivisto & Hamari, 2019; Orji & Moffatt, 2018; Street, Lacey, & Langdon, 2017). Considering the importance of self-efficacy for behavior change, understanding the role that interactive tools can play in facilitating not only prosocial behavior, but related constructs of self-efficacy, is as well central to the fourth and final research question of this thesis.

> ***RQ 4:*** *How does using an interactive tool and the use of a personalized platform compared to self-tracking affect prosocial behavior and self-efficacy over time?*

Aim of this Thesis

This thesis aims to answer these four overarching research questions. Four experiments, a qualitative survey, a scale construction pilot study, and a series of qualitative interviews were conducted in order to examine these research questions. The results of these studies are presented in the form of four manuscripts. Manuscript 1 and 2 both examine the first and second research questions. Manuscript 3 investigated the third research question, while Manuscript 4 focused on the fourth and final research question. All four manuscripts are summarized in the following chapters.

Summary of Manuscript 1: Increasing Donating Behavior Through a Game for Change - The Role of Interactivity and Appreciation

Aim of the study and contribution. Games for change represent a new and interesting approach for humanitarian aid organizations to engage potential supporters. While these games have peaked interest both of organizations and in academic circles, research on their effectiveness has been scarce. Particularly research on the impact of games for change on actual behavior, such as donating behavior, had been lacking prior to this study, with past and most contemporary research focusing on intentions to help rather than behavior. The planned contribution of this study was therefore twofold: Firstly, to systematically examine the difference between using a multimodal interactive game and text-based and non-interactive media presenting the same narrative. And secondly, to measure the impact in terms of behavior by examining donations after experiencing the game.

Methods. A 2x3 experimental design was used to examine systematically the effects of interactivity (narrative choice vs no narrative choice) and presentation mode (animated picture vs static picture with text vs text). The dependent variable was prosocial behavior, instrumentalized through the percentage participants were willing to donate out of an unexpected 1 US dollar bonus, which they received immediately after their media experience. To understand how the game might impact behavior, data was collected on appreciation and enjoyment of the experience, willingness to help, and role-taking with the main character in the narrative. Additionally, empathic concern and humanitarian involvement as well as knowledge of the conflict in Darfur were measured. The stimuli were based on the game for change *Darfur is Dying* and consisted of a narrative about the struggles facing a young Darfurian girl living in a refugee camp. The narrative was presented in one of the six experimental conditions: (1) interactive game, (2) noninteractive gameplay video, (3) noninteractive and (3) interactive text-with-pictures and (5) noninteractive and (6) interactive text. Two hundred and fourty-three participants were randomly assigned to one of the media conditions. Participants then filled out the presented questionnaires and indicated which percentage of the bonus they wished to donate.

Results. Results examining the effects of interactivity and presentation mode showed that interactivity lead to a higher percentage donated (p = .036, η_p^2 = .019), while both presentation mode (p = .77) and the interaction between interactivity and presentation mode (p = .53) did not. Of the additionally measured variables, only appreciation was both related to an increase in percentage donated (p<.001, r = .25) and affected by interactivity (p = .015, η_p^2 = .026). A mediation analysis found that appreciation fully mediated the relationship between interactivity and percentage donated (see Figure 1).

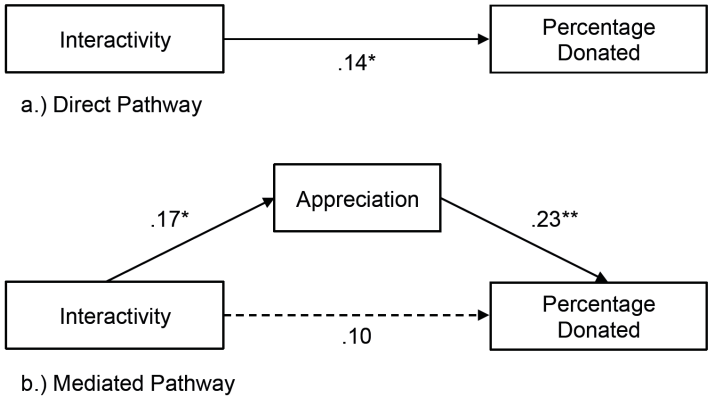

Figure 1. The relationship between interactivity and percentage donated, fully mediated by appreciation. *p < .05 ** p < .01

Discussion and Conclusion. The findings indicated that games for change can have a greater impact on prosocial behavior than traditional forms of media such as text or video and that this effect is due to interactivity. At the same time the lack of impact of presentation mode suggests that the multimodality of the game was inconsequential for this effect, at least under the conditions of this study. Thereby, the interactive text had a comparable impact on prosocial behavior to that of the multimodal game. The impact of the game for change was measured using a behavioral variable, allowing implications not only concerning the effect of these games on reported willingness to help, but also on the behavioral

outcome of monetary donations. Appreciation as a central audience response was examined for the first time in the context of games for change, highlighting the importance of appreciation as a mediating factor between the potential of interactive media and increased prosocial behavior.

Summary of Manuscript 2: Interactive Narratives Affecting Social Change - A Closer Look at the Relationship Between Interactivity and Prosocial Behavior

Aim of the study and contribution. Manuscript 1 presented several novel findings on the relationship between interactivity and prosocial behavior. The aim of Manuscript 2 was to look at these relationships in more detail. This study was conducted as part of a pre-registered special issue in the *Journal of Media Psychology*, meaning that the theoretical background and methods were peer-reviewed and revised prior to data collection. As a result, the study design was complemented with yoked experimental conditions, a larger sample size than originally planned, and the use of structural equation modeling instead of multiple analyses of variance. These changes lead to robust findings that would lay the foundations for a more nuanced discussion of the effects of media interactivity on experience and behavior.

Methods. An experimental design with two conditions (interactive and noninteractive) was utilized. The stimulus materials consisted of an article entitled *How I became homeless* (Markus, 2014), which was modified so that the interactive condition contained eight multiple-choice decisions over the course of the narrative. The inclusion of the yoked design meant that each time a participant in the interactive condition finished their version of the narrative, this version was saved and given to the next participant in the noninteractive condition. The final dataset consisted of 634 participant responses. Participants were randomly assigned to one of the two experimental conditions. Participants responded to questionnaires on identification, responsibility, and appreciation - all variables expected to potentially mediate the relationship between interactivity and prosocial behavior. Additionally, empathic concern, enjoyment, and narrative engagement were included as control variables. Prosocial behavior was instrumentalized as the percentage of a 1 US dollar reward that participants chose to donate to the charity *Habitat for Humanity*.

Results. A structural equation model was estimated for the confirmatory analysis (see Figure 2). Results suggested that interactivity did not affect prosocial behavior and that responsibility alone was impacted by interactivity. Appreciation once more was positively related to prosocial behavior, as was narrative engagement. Identification and enjoyment were negatively related to percentage donated. As part of an additional, exploratory analysis, an optimized model was estimated in which the demographic variable *experienced similar circumstances* was included. In this model, the negative relationship between identification and prosocial behavior was replaced by a positive relationship between identification and experienced similar circumstances, and a negative relationship between experienced similar circumstances and percentage donated.

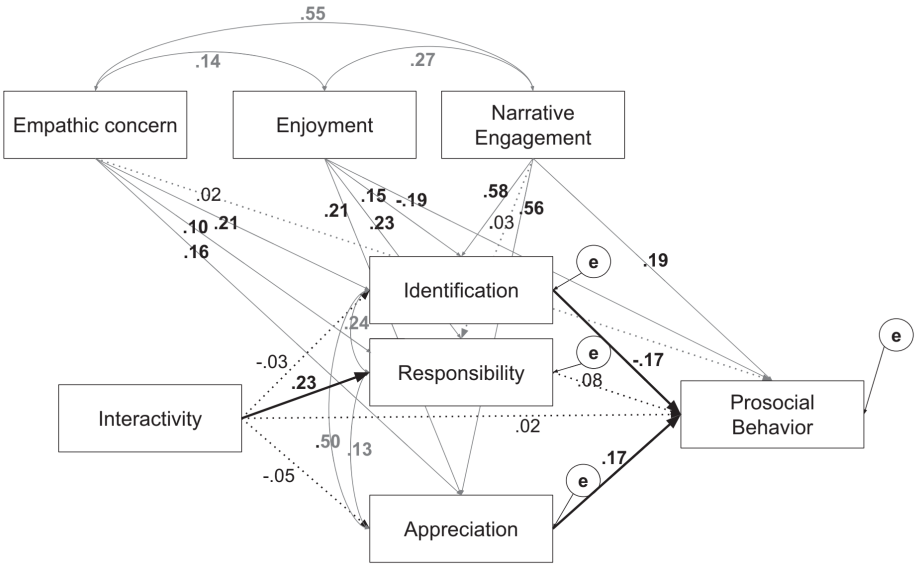

Figure 2. Structural equation model of the confirmatory analysis with bold lines indicating significant paths and dotted lines indicating insignificant paths.

Discussion and Conclusion. This study added further support for the importance of appreciation as a media experience predictive of prosocial behavior, as well as putting forth narrative engagement and enjoyment as additional variables worth examining in future studies. The results however also suggested that the effect of interactivity on prosocial behavior and appreciation found in Manuscript 1 could not be replicated under these new conditions. This indicated the importance of examining the underlying processes of these effects more closely. Of particular interest going forward was the question of the attributes which narrative choices would need to possess in order to be perceived as meaningful and whether this could create appreciation for the narrative as a whole. Exploratory analyses examined the counter-intuitive finding that the more participants identified with the character in the narrative, the less they donated. Results suggested that participants who had experienced similar circumstances to the character who became homeless both identified more with the character and donated less to Habitat for Humanity. While conclusions cannot be drawn with certainty, it is possible that participants who had experienced similar circumstances felt that they could not afford to donate or, alternatively, did not believe that donations would help people in these circumstances.

Summary of Manuscript 3: Choosing to Help Monsters - A Mixed-Method Examination of Meaningful Choices in Narrative-Rich Games and Interactive Narratives

Aim of the study and contribution. After Manuscript 1 found an effect of interactivity on appreciation and prosocial behavior and Manuscript 2 did not, the goal of Manuscript 3 was to explore a potential explanation for these conflicting results. An examination of past studies on interactivity suggested the importance of looking at the meaningfulness of choices in closer detail. Manuscript 3 consisted of two

studies. The first was a qualitative exploration of what makes in-game choices meaningful. The second study was an experimental study focused on isolating the effects of meaningfulness, choice, and their combined effect. Together, these studies formed the first empirical examination of meaningful choices in games.

Methods Study 1. In study 1, 27 participants of an online survey gave open-ended answers to questions focused on describing choices in games, which they had perceived as meaningful. In order to identify themes, the answers were analyzed using a deductive thematic analysis (Clarke, Braun, & Hayfield, 2015) on the basis of previous theoretical works on meaningful game choices and empirical work on meaningful choices in broader contexts (e.g. learning).

Results Study 1. Three overarching themes were developed. The first, *consequential choices*, described the central role consequences played for the perception of game choices as meaningful. Consequences could be intentional and immediate or unintended and delayed - or both. The combination of both intentional, immediate and unintended, delayed consequences seemed to lead to particularly meaningful experiences, such as when choosing to save one character early on lead to the death of another character later on. The second theme, *social choices*, focused on the presence of another character in almost every meaningful choice participants described. Knowing that the choice would not only impact the player themselves but another character as well, appeared to play a pivotal role in making these choices meaningful. The third and final theme, *moral choices*, described the presence of choice options with moral characteristics. Predominantly, these choices consisted of moral dilemmas. A frequent example was the choice between helping one's own group or helping a vulnerable member of a potentially hostile other group. As in this example, the three themes often occurred together, producing moral choices with consequences, in which participants had to choose between helping or harming other characters.

Methods Study 2. In study 2, a 2x2 experimental design was used to systematically examine the effects of choice and meaningfulness on appreciation. Based on the three themes developed in study 1, a narrative was developed in two variations, these variations were identical except for information related to a choice, which was included at the end of the narrative and determined the narrative outcome. In one variation the choice was designed to be highly meaningful, by making it a consequential moral dilemma with a social component. The other choice variation was designed to be less meaningful, by removing these three themes. The final data set consisted of 192 participants, randomly assigned to one of the four conditions (choice-high meaningfulness, no choice-high meaningfulness, choice-low meaningfulness, and no choice-low meaningfulness). Participants in the "choice"-conditions could choose the ending, while participants in the "no choice" conditions were assigned an outcome. Additionally, participants filled out questionnaires on care morality (control variable), appreciation (dependent variable), and enjoyment and narrative engagement (exploratory variables).

Results Study 2. ANCOVA results found a significant main effect for meaningfulness on appreciation (p = .002, η^2 = .044), but not for interactivity (p = .23) and no interaction effects (p-values between .061

and .688). Care morality was positively associated with appreciation ($p < .001$, $\eta^2 = .093$). To examine whether the effect of choice on appreciation would be different depending on the meaningfulness of the choice (see Figure 3), three contrasts were examined. The contrast *c1* examined choice vs no choice in the high meaningfulness conditions, *c2* examined choice vs no choices in the low meaningfulness conditions, and *c3* compared the choice high meaningfulness condition to the other three conditions. The results found a significant effect for *c1* ($p = .042$, Cohen's $d = 0.30$), no significant effect for *c2* ($p = .407$), and a significant effect for *c3* ($p = .03$, Cohen's $d = 0.32$). Exploratory analyses found no effects of choice or meaningfulness on either enjoyment or narrative engagement (p-values between .067 and .997). Likewise narrative outcome had no effect on appreciation in either the high meaningful or the low meaningful conditions (p-values between .339 and .976).

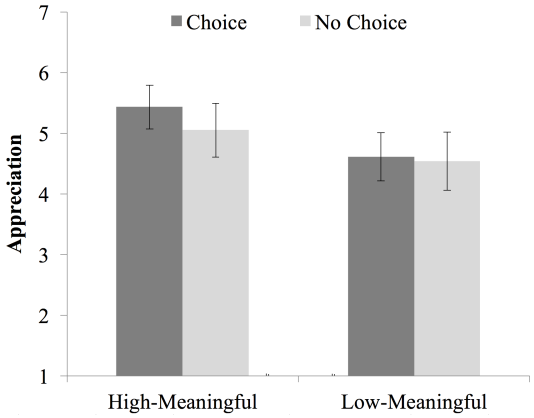

Figure 3. Mean differences in appreciation across conditions. Error bars depict the 95% confidence intervals.

Discussion and Conclusion. Study 1 developed three themes common to meaningful choices in games. These centered around the consequences the choice had, the morality or moral dilemmas posed by the choice options, and the responsibility of making a choice, which would impact another character. In study 2 these themes were used to create an experimental design which allowed the systematic manipulation of meaningfulness and choice. Results confirmed the link between the meaningfulness of choices and appreciation of the narrative. Furthermore, the findings offered an explanation for the seemingly contradictory results of Manuscript 1 and 2. While interactivity (in the form of the narrative choice) lead to higher appreciation when this choice was meaningful, this effect disappeared when the choice was not meaningful. This suggests that interactivity, as examined in Manuscript 1, 2, and 3 only affects appreciation, and potentially prosocial behavior, if the choices are meaningful.

Summary of Manuscript 4: Potentials and Pitfalls of Increasing Prosocial Behavior and Self-Efficacy over Time Using an Online Personalized Platform

Aim of the study and contribution. Manuscript 1 and 2 had focused on online donations as a measure of prosocial behavior. The goal of the fourth and final Manuscript was to explore further forms of prosocial behavior more closely connected to everyday life and to understand their predictors and relationship to the usage of interactive technology over time. Manuscripts 1, 2, and 3 had furthermore focused on interactive media. In Manuscript 4, the focus would be on understanding the impact of an interactive tool. In this context, understanding the role of self-efficacy was of particular interest for both its potential to be affected by personalization and its potential to affect behavior. Following participants over three weeks, their daily prosocial behavior was tracked, along with their levels of self-efficacy and wellbeing. Furthermore, half of the participants interacted with a platform, which gave them personalized suggestions for prosocial actions they could undertake. Platform-specific measures of enjoyment, appreciation, and usability were measured for the platform group. At the end of the three-week study, a subsample of the participants were interviewed in order to gain further, qualitative insights into their experiences. Combined, these data give a rich overview of potential processes through which interactive technology can impact daily prosocial behavior and self-efficacy.

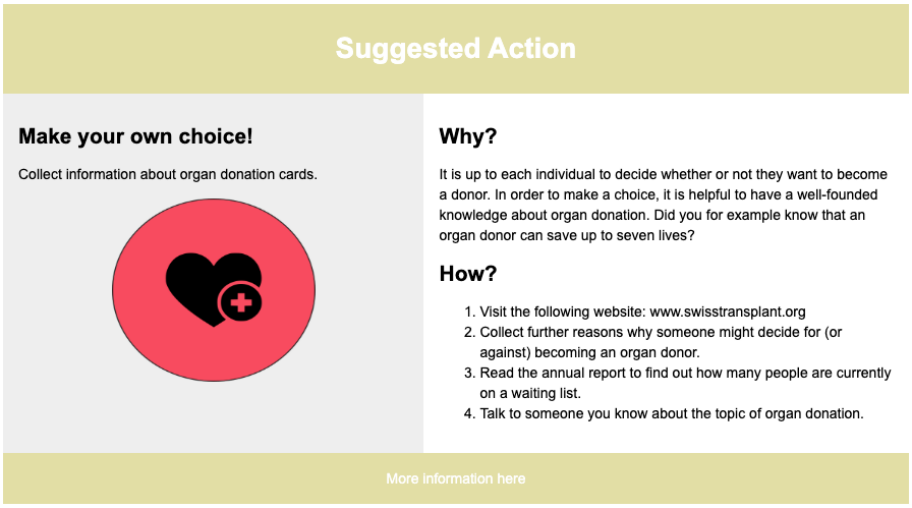

Figure 4. Example of a suggested action.

Methods. An experimental longitudinal mixed design was used. The final data set consisted of 66 participants who participated in a three-week diary study. The independent variable was platform exposure (Platform Group/Tracking-Only Group), with half of participants given access to the interactive platform (a prototype developed for this study). A prestudy questionnaire asked participants questions to understand their capabilities, opportunities, and motivations. Based on these data, the interactive platform suggested three personalized suggested actions per week to participants (see Figure 4 for an example of an action). The main dependent variables were daily prosocial behavior, suggested actions

completed, and self-efficacy. To examine the effects of self-efficacy, an adapted version of a preexisting questionnaire, change impact self-efficacy was used, as well as a questionnaire developed here in a pilot study, everyday helping self-efficacy. While change impact self-efficacy was focused more on participants' belief in their ability to have an impact, everyday helping self-efficacy was focused on participants' belief in their ability to perform everyday forms of prosocial behavior. Together, these two scales examined different aspects and impediments to everyday prosocial behavior. Self-efficacy and suggested actions completed were measured on a weekly basis, along with wellbeing, usability, enjoyment, and appreciation. Post-study interviews with eight participants focused on experiences with the platform and self-tracking and were analyzed using thematic analysis.

Results. Multilevel modeling found no impact of platform exposure on daily prosocial behavior over time (b = .08, p = .772). Change impact self-efficacy significantly predicted daily prosocial behavior across both groups (b = .02, p =.012), while everyday helping self-efficacy did not (b = .001, p = .865). Examining the platform group, change impact self-efficacy (b = .01, p = .017) and enjoyment (b = .12, p = .034) predicted suggested actions completed. Everyday helping self-efficacy (b = 2.86, p < .001) and wellbeing (b = .11, p = .016) increased over time for both groups, while change impact self-efficacy did not (b = -1.03, p = .815). For participants in the platform group, enjoying (r = 0.55, p = .005), appreciating (r = 0.66, p < .001), and finding the platform more user friendly (r = 0.51, p = .010) were correlated with a higher likelihood to continue using the platform (see Table 1). Interview results suggested that the platform could be improved upon in the future by focusing on highlighting the impact of suggested actions and avoiding actions, which were perceived as less meaningful, such as donation-based actions. The option to choose and complete actions was currently easily forgotten in the bustle of everyday life. Finally, participants sometimes experienced it as difficult to find one of the three actions, which fit their wishes in a specific moment, based on factors such as time constraints and mood.

Discussion and Conclusion. Quantitative results indicated that the platform and its personalized action suggestions in their current form did not increase self-efficacy or prosocial behavior over time. However, results support a close relationship between change impact self-efficacy and both forms of prosocial behavior measured (i.e., daily prosocial behavior and suggested actions completed), as well as between enjoyment and suggested actions completed. Associations over time suggested that daily prosocial behavior tracking was related to increases in both everyday helping self-efficacy and wellbeing. Qualitative results highlight the importance of designing for integration into the complexities of users' everyday lives, ensuring the tool will be remembered and that actions are perceived as meaningful and can be chosen according to current context-specific resources and states.

General Discussion

Over the course of these four manuscripts, four overarching research questions were examined. The aim was to improve our understanding of the impact of interactive technology on prosocial behavior; an area that so far has received relatively little attention.

Table 1
Bivariate Pearson Correlation Coefficients.

	Completed suggested actions	Change impact self-efficacy	Everyday helping self-efficacy	Enjoyment of platform	Appreciation of platform	Usability of platform	Likelihood to Continue	General self-efficacy	Wellbeing	Time
Daily prosocial behavior	.01	**.29*** **	**.15***	.15	.20	.02	-.20	.12	**.17***	**-.20****
Completed suggested actions		**16***	.02	**.25***	.18	.12	.05	.06	-.004	.06
Change impact self-efficacy			**.53*** **	**.39*** **	**.33****	**.33****	.19	**.39*** **	**.38*** **	-.01
Everyday helping self-efficacy				**.49*** **	**.37*** **	**.38*** **	.39	**.47*** **	**.42****	**.16***
Enjoyment of platform					**.78*** **	**.49*** **	**.55****	**.26***	**.45*** **	-.14
Appreciation of platform						**.30****	**.66*** **	.14	**.22***	-.10
Usability of platform							**.51***	**.40*** **	**.27*** **	-.05
Likelihood to Continue								**.42***	.15	-
General self-efficacy									**.47*** **	.10
Wellbeing										**.13***

Note: $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Examining the effect of media interactivity on prosocial behavior, in Manuscript 1 we found media interactivity to lead to an increase in donations. This expands past findings on the effectiveness of games for change from attitude change (R. S. Jacobs, 2018; Ruggiero, 2015; Soekarjo & van Oostendorp, 2015), willingness to help (Peng et al., 2010), and sharing with friends (Cohen, 2014) to include effects on donating behavior.

In Manuscript 2, however, we found no such interactivity effect on donating behavior. Underlying psychological processes examined suggest an explanation for these conflicting results. In Manuscript 1, interactivity increased appreciation, as well as prosocial behavior. This supports past research on the potential of interactive media to lead to experiences that are meaningful, moving, and thought-provoking (Bopp et al., 2015, 2018). Mediation analysis found appreciation, alone of the examined psychological processes, to fully mediate the relationship between interactivity and prosocial behavior. In Manuscript 2 as well, appreciation was related to prosocial behavior. This connects to past research that prosocial behavior is related to experiencing meaningfulness (Andersen et al., 2005; Apter et al., 1997; Ellithorpe et al., 2015). The interactive narrative choices in Manuscript 2 however failed to affect appreciation. Manuscript 3 therefore sought to understand under which circumstances narrative choices would increase appreciation. Qualitative results suggested that narrative choices that had moral, social, and consequential elements would be perceived as meaningful choices. This fits well with past research which had suggested that these elements could be relevant for the experience of meaningful choices (Krcmar & Cingel, 2016; Nay & Zagal, 2017; Oliver et al., 2015; Rogers et al., 2017; Schrier, 2010; Vikaros & Degand, 2010). In a quantitative examination, these three elements were experimentally manipulated to be included or excluded across levels of interactivity. Results showed that the interactive narrative only then lead to greater appreciation than the non-interactive

narrative when the interactive narrative included these three elements. This suggests that interactivity will only lead to increases in appreciation when choices are experienced as meaningful. Taken together with results from Manuscripts 1 and 2, this in turn suggests that only when choices are meaningful, will interactivity affect prosocial behavior.

In Manuscript 4, we wished to explore how prosocial behavior and self-efficacy would be affected over time by the use of an interactive tool. Exposure to an interactive platform with personalized action suggestions affected neither prosocial behavior, nor self-efficacy to a greater degree than self-tracking daily prosocial behavior. This, despite the potential of personalization to increase self-efficacy through the facilitation of mastery experiences (Bandura, 1997; Michie et al., 2014). In both groups, however, self-tracking was related to increases in both everyday helping self-efficacy and wellbeing, but not in change impact self-efficacy. These findings support the popularity of self-tracking in current behavior change apps (Stawarz et al., 2015). Both forms of prosocial behavior examined (i.e., daily prosocial behavior and suggested actions completed) were predicted by change impact self-efficacy. This is in line with self-efficacy theory (Bandura, 1997). However, everyday helping self-efficacy predicted neither form of prosocial behavior. This suggests the importance of examining different forms of self-efficacy in the context of behavioral predictions, highlighting in this case the importance particularly of supporting belief in one's ability to affect change in order to increase prosocial behavior.

Considering the low engagement observed with the personalized action suggestions, qualitative results gave insights into potential improvement opportunities for the interactive tool. These results highlighted the importance of understanding the impact of the suggested actions, being reminded to check in with the tool, and to have actions be tailored not only to a user's general capabilities, opportunities, and motivations, but to allow users to choose actions based on context-specific resources, such as mood and time available in any specific moment. Finally, results pointed to the importance of designing for sustained enjoyment over time, as this was related to both higher numbers of suggested actions completed and a greater likelihood to continue using the tool in the future. This is in line with past research that has stressed the importance of enjoyment for sustained engagement over time (Hamari, Koivisto, & Sarsa, 2014; Roth, Vermeulen, Vorderer, & Klimmt, 2012; Tannenbaum, 2013). Crucially however, this research highlights that this is also the case for tools in the context of prosocial behavior, which could be assumed to be driven purely through prosocial motivation. These findings point out that here too, enjoyment of the prosocial interactive tools is important.

Implications

Interactive media can increase prosocial behavior by creating more meaningful experiences.

Creating meaningful interactivity in media is not as simple as adding an arbitrary choice to a narrative. In order to create a meaningful experience with the narrative, the choices themselves must be meaningful. Moral dilemmas and consequences for oneself and others are ways in which choices can be made meaningful, increasing appreciation for the narrative as a whole. Appreciation across the studies of Manuscripts 1 and 2 was related to increased prosocial behavior. This implies that through media interactivity, audience members can connect in a more personally meaningful way with the

narrative, ultimately leading them to donate larger amounts than the audiences of non-interactive media.

Interestingly, appreciation of the interactive tool in Manuscript 4 predicted neither suggested actions completed nor daily prosocial behavior. It is possible that the effect of appreciation is only short-term. This would be supported by past research by Ellithorpe et al. (2015), who found effects of video-induced meaningfulness on prosocial behavior to last only for the task immediately after the induction. At the same time, however, meaningfulness is also related to more thoughtful processing and lingering in memory (Iacovides & Cox, 2015; Oliver & Bartsch, 2010). It is also possible that media is uniquely capable of creating meaningful experiences in a way that interactive tools cannot, even when focused on prosocial behavior. This would be supported by the relatively low appreciation values in Manuscript 4, especially compared to high appreciation values in the media-focused Manuscripts 1, 2, and 3. However, participants in Manuscript 4 likely to continue using the platform reported significantly higher appreciation than other participants, suggesting that for interactive tools as well, appreciation may be of relevance after all, at least for interested subgroups. Further research is needed to provide additional insights and clarity by focusing on appreciation across forms of technology and different time spans.

For sustainable engagement over time, interactive tools for prosocial behavior need to be designed for enjoyment. In Manuscript 4, enjoyment of the interactive tool was related to increases in suggested actions completed and likelihood to continue using the platform in the future. This highlights the importance of enjoyment for sustainable engagement with technology (Hamari et al., 2014; O'Brien & Toms, 2008). Of the four Manuscripts, Manuscript 4 alone examined effects over time. In neither Manuscript 1 or 2 did media enjoyment relate to prosocial behavior. While the lack of longitudinal data in these studies make definitive conclusions impossible, it is likely that these differences are not due to differences between interactive tools and media, but due to differences between effects in single interactions, as examined in Manuscripts 1 and 2, and recurring interactions over time, as examined in Manuscript 4. While appreciation is crucial in the moments immediately following the interaction in order to move participants to donate, it is enjoyment over time that most likely leads participants to decide to return and engage repeatedly over time. Further research is needed on the differing effects of enjoyment and appreciation over time and whether these effects occur differently in interactive tools compared to interactive media.

Change impact self-efficacy predicts prosocial behavior over time, while everyday helping self-efficacy does not. Change impact self-efficacy predicted both suggested actions completed and daily prosocial behavior, while everyday helping self-efficacy predicted neither. This offers an interesting insight into the processes behind prosocial behavior. These findings suggest that simply increasing perceived capability of daily actions is not enough to change daily prosocial behavior. Different studies examining prosocial behavior have highlighted the importance of believing that action will truly affect change (Bekkers & Wiepking, 2011; White et al., 2012). This touches on another potential way in which interactive technology may be able to impact prosocial behavior. While Manuscripts 1, 2, and 3 did not examine self-efficacy, it is possible that interactive media, such as

games for change, may have their own ways of affecting self-efficacy. Potentially, choosing the steps a character in need must take in a narrative can help audience members identify ways in which people in similar situation in real life could be helped. Seeing the dangers present in simple tasks such as getting water for one's family when one lives in an insecure location could highlight how providing safe access to water could make a significant difference in people's lives. Experiencing the heart-wrenching choices someone at the edge of destitution must make or the bleakness of cotton picking could spur the audience on to support programs that help in precisely such moments. If audience members agonized over choices themselves, this could give rise to an understanding of the difference that help in just such a situation would make. Future research examining the effect of media interactivity on change impact self-efficacy in particular could be of great interest to both scholars and practitioners alike.

Personalization necessitates a nuanced understanding of contextual capabilities, opportunities, and motivation. Despite its personalization, participants showed relatively low engagement with the interactive platform used in Manuscript 4. Qualitative results highlighted the importance of a more nuanced understanding of participants' capabilities, opportunities, and motivations in the various contexts in which they might wish to interact with the platform. This highlights the importance of user-centered design to inform nuanced understandings of ways in which interactions will unfold and the necessity of iterative improvement of features throughout the process of the creation of new technology (Norman, 2002).

Mixed method examinations provide rich insights into new areas of research The studies in this thesis were conducted using a wide variety of data collection and analyses methods. In Manuscript 1 mediation analysis shed light on the relationships between interactivity, appreciation, and prosocial behavior. In Manuscript 2 structural equation modeling explored further interconnected psychological processes between media interactivity and prosocial behavior. In Manuscript 3 and 4 mixed methods were used to explore findings with both qualitative and quantitative data. In Manuscript 4 longitudinal data was examined using multilevel modeling. While each method comes with its own advantages, disadvantages, and challenges, the flexibility to choose between methods allows for the choice of method ideally suited to explore a specific research question. The combination of methods, as done in Manuscripts 3 and 4, allow for rich insights that could not be gathered with one method alone. In its own way, developments of interactive technologies, including tools such as the programming language *R* and the online communities and resources that have grown up around analysis tools, are themselves facilitating the research focused on understanding interactive technology.

Limitations

The studies presented offer implications for practical applications and future research. However, important limitations need to be addressed. For one, interactivity was examined in specific forms, namely narrative choices, meaning that findings cannot be extrapolated to other forms of interactivity, such as time-sensitive combat gameplay in video or virtual reality games. It is possible that such interactivity may lead to different effects on enjoyment and appreciation and ultimately behavior through processes such as immersion and arousal (Kors, Ferri, Van Der Spek, Ketel, & Schouten,

2016; Rieger, Frischlich, Wulf, Bente, & Kneer, 2015). Another limitation was the exploration of interactive tools using a self-developed prototype. It is very well possible that further iterations of this tool or future tools will find effects of interactivity on prosocial behavior, particularly after longer engagement periods than the examined three weeks. Finally, the measure of prosocial behavior used in Manuscripts 1 and 2 was donating behavior. While donating is a well-established prosocial activity, results from Manuscript 4 stress the differences to participants between donating and other forms of prosocial behavior where one's impact becomes more immediately apparent. Future research on interactive media, particularly on games for change, should therefore attempt to use varied measures of prosocial behavior to explore effects.

Conclusion

The world is introduced to new technology every day. This technology has the potential to either benefit or harm us. By understanding the psychological processes involved, effectively designed interactive technology has the potential to help us help ourselves and others. The research presented in this thesis suggests that interactive technology can communicate meaningfulness beyond the capabilities of noninteractive technology. It can facilitate new behavior and support wellbeing. The importance of psychological processes such as increased appreciation for interactive media and the enjoyment of interactive tools highlight the importance of carefully thought-out and well-designed technology. The nuanced relationship between interactive technology, different forms of self-efficacy, and prosocial behavior highlight the importance of the development of a better understanding of the relationships between these concepts. Above all, however, this research highlights the potential for research to inform the design of interactive technology for prosocial behavior. Theoretical backgrounds allowed for informed explorations. Experimental designs allowed for causal inferences to be drawn. Statistical analyses such as structural equation and multilevel modeling allowed for nuanced examinations of data. Qualitative analyses and mixed method approaches allowed for rich first glimpses into research areas with little empirical work. I hope this thesis will provide both knowledge foundations and inspiration for future research into this exciting and important field of study.

References

Ajzen, I. (2005). *Attitudes, personality and behaviour* (2nd ed.). Berkshire, England: Open University Press.

Andersen, M. H., Mathisen, L., Øyen, O., Wahl, A. K., Hanestad, B. R., & Fosse, E. (2005). Living donors' experiences 1 wk after donating a kidney. *Clinical transplantation*, *19*(1), 90–96.

Apter, M. J., Spirn, N., Sveback, S., & Apter, M. (1997). Motives for donating blood. In S. Svebak & M. J. Apter (Eds.), *Stress and health: A reversal theory perspective* (pp. 145–156). Washington, DC: Taylor & Francis.

Baker, Z. G., Krieger, H., & LeRoy, A. S. (2016). Fear of missing out: Relationships with depression, mindfulness, and physical symptoms. *Translational Issues in Psychological Science*, *2*(3), 275.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY, US: W. H. Freeman & Company.

Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-efficacy beliefs of adolescents*, *5*(1), 307–337.

Batson, C. D., & Powell, A. A. (2003). Altruism and prosocial behavior. In T. Millon, M. J. Lerner, & I. B. Weiner (Eds.), *Handbook of Psychology, Personality and Social Psychology, Vol. 5* (pp. 463–484). Hoboken, New Jersey: John Wiley & Sons.

Bekkers, R., & Wiepking, P. (2011). A literature review of empirical studies of philanthropy: Eight mechanisms that drive charitable giving. *Nonprofit and voluntary sector quarterly*, *40*(5), 924–973.

Bogost, I. (2007). *Persuasive games: The expressive power of videogames*. MIT Press.

Bopp, J. A., Mekler, E. D., & Opwis, K. (2015). "It Was Sad But Still Good": Gratifications of emotionally moving game experiences. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 1193–1198). New York, NY: ACM.

Bopp, J. A., Mekler, E. D., & Opwis, K. (2016). Negative emotion, positive experience?: Emotionally moving moments in digital games. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 2996–3006). New York, NY.

Bopp, J. A., Opwis, K., & Mekler, E. D. (2018). “An Odd Kind of Pleasure”: Differentiating emotional challenge in digital games. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 1-12). New York, NY: ACM.

Calvo, R. A., & Peters, D. (2014). *Positive computing: technology for wellbeing and human potential*. Cambridge, Massachusetts: MIT Press.

Chang, Y.-P., Lin, Y.-C., & Chen, L. H. (2012). Pay it forward: Gratitude in social networks. *Journal of Happiness Studies*, *13*(5), 761–781.

Clarke, V., Braun, V., & Hayfield, N. (2015). Qualitative psychology: A practical guide to research methods. In A. Smith Jonathan (Ed.), (p. pp. 222-248). Sage.

Cohen, E. L. (2014). What makes good games go viral? The role of technology use, efficacy, emotion and enjoyment in players’ decision to share a prosocial digital game. *Computers in Human Behavior*, *33*, 321–329.

Direito, A., Jiang, Y., Whittaker, R., & Maddison, R. (2015). Apps for improving fitness and increasing physical activity among young people: the AIMFIT pragmatic randomized controlled trial. *Journal of Medical Internet Research*, *17*(8), 1-13.

Ellithorpe, M. E., Ewoldsen, D. R., & Oliver, M. B. (2015). Elevation (sometimes) increases altruism: Choice and number of outcomes in elevating media effects. *Psychology of Popular Media Culture*, *4*(3), 236-250.

Elson, M., Breuer, J., Ivory, J. D., & Quandt, T. (2014). More than stories with buttons: Narrative, mechanics, and context as determinants of player experience in digital games. *Journal of Communication*, *64*(3), 521–542.

Fogg, B. J. (2002). *Persuasive technology: Using computers to change what we think and do*. San Francisco, CA: Morgan Kaufmann.

Fogg, B. J. (2009). A behavior model for persuasive design. In *Proceedings of the 4th International Conference on Persuasive Technology* (p. 1-7). New York, NY: ACM.

Fowler, J. H., & Christakis, N. A. (2010). Cooperative behavior cascades in human social networks. *Proceedings of the National Academy of Sciences*, *107*(12), 5334–5338.

Freeman, D., Aquino, K., & McFerran, B. (2009). Overcoming beneficiary race as an impediment to charitable donations: Social dominance orientation, the experience of moral elevation, and donation behavior. *Personality and Social Psychology Bulletin*, *35*(1), 72-84.

Geelan, B., Zulkifly, A., Smith, A., Cauchi-Saunders, A., de Salas, K., & Lewis, I. (2016). Augmented exergaming: Increasing exercise duration in novices. In *Proceedings of the 28th Australian Conference on*

Computer-Human Interaction (pp. 542–551). New York, NY: ACM.

Gentile, D. A., Anderson, C. A., Yukawa, S., Ihori, N., Saleem, M., Ming, L. K., ... others (2009). The effects of prosocial video games on prosocial behaviors: International evidence from correlational, longitudinal, and experimental studies. *Personality and Social Psychology Bulletin*, *35*(6), 752–763.

Green, M. C., & Jenkins, K. M. (2014). Interactive narratives: Processes and outcomes in user-directed stories. *Journal of Communication*, *64*(3), 479–500.

Greitemeyer, T., & Osswald, S. (2010). Effects of prosocial video games on prosocial behavior. *Journal of Personality and Social Psychology*, *98*(2), 211–221.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? - A literature review of empirical studies on gamification. In *2014 47th Hawaii International Conference on System Sciences* (p. 3025-3034).

Hermsen, S., Frost, J., Renes, R. J., & Kerkhof, P. (2016). Using feedback through digital technology to disrupt and change habitual behavior: A critical review of current literature. *Computers in Human Behavior*, *57*, 61–74.

Iacovides, I., & Cox, A. L. (2015). Moving beyond fun: Evaluating serious experience in digital games. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 2245–2254). New York, NY: ACM.

Iacoviello, B. M., Steinerman, J. R., Klein, D. B., Silver, T. L., Berger, A. G., Luo, S. X., & Schork, N. J. (2017). Clickotine, a personalized smartphone app for smoking cessation: initial evaluation. *JMIR mHealth and uHealth*, *5*(4), 1-15.

Iten, G. H. (2015). *Impact of visual simulations in statistics: The role of interactive visualizations in improving statistical knowledge*. Wiesbaden, Germany: Springer.

Iten, G. H., Bopp, J. A., Steiner, C., Opwis, K., & Mekler, E. D. (2018). Does a prosocial decision in video games lead to increased prosocial real-life behavior? The impact of reward and reasoning. *Computers in Human Behavior*, *89*, 163 - 172.

Jacobs, R. R. (2017). *Playing to win over: Validating persuasive games*. Erasmus University Rotterdam.

Jacobs, R. S. (2018). Play to win over: Effects of persuasive games. *Psychology of Popular Media Culture*, *7*(3), 231.

Kampf, R., & Stolero, N. (2015). Computerized simulation of the Israeli-Palestinian conflict, knowledge gap, and news media use. *Information, Communication & Society*, *18*(6), 644–658.

Kerwin, S., Warner, S., Walker, M., & Stevens, J. (2015). Exploring sense of community among small-scale sport event volunteers. *European Sport Management Quarterly*, *15*(1), 77-92.

Kickmeier-Rust, M. D., Marte, B., Linek, S., Lalonde, T., & Albert, D. (2008). The effects of individualized feedback in digital educational games. In *Proceedings of the 2nd European Conference on Games Based Learning* (pp. 227–236). Academic Publishing Limited.

Ko, K., Margolis, S., Revord, J., & Lyubomirsky, S. (2019). Comparing the effects of performing and recalling acts of kindness. *The Journal of Positive Psychology*, 1–9.

Köhler, H. (2018). Learning from a failed project–challenges of implementing 'green' technology in a real world setting. *Scottish Geographical Journal*, *134*(3-4), 158–171.

Koivisto, J., & Hamari, J. (2019). Gamification of physical activity: A systematic literature review of comparison studies. In *GamiFIN Conference* (pp. 106–117).

Kors, M. J., Ferri, G., Van Der Spek, E. D., Ketel, C., & Schouten, B. A. (2016). A breathtaking journey. On the design of an empathy-arousing mixed-reality game. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play* (pp. 91–104). New York, NY: ACM.

Krcmar, M., & Cingel, D. P. (2016). Moral foundations theory and moral reasoning in video game play: using real-life morality in a game context. *Journal of Broadcasting & Electronic Media*, *60*(1), 87–103.

Larson, R., & Csikszentmihalyi, M. (2014). The experience sampling method. In M. Csikszentmihalyi (Ed.), *Flow and the foundations of positive psychology* (p. 21-34). Berlin, Germany: Springer, Dortrecht.

Layous, K., Nelson, S. K., Kurtz, J. L., & Lyubomirsky, S. (2017). What triggers prosocial effort? A positive feedback loop between positive activities, kindness, and well-being. *The Journal of Positive Psychology*, *12*(4), 385-398.

Lee, Y.-H., & Hsieh, G. (2013). Does slacktivism hurt activism?: The effects of moral balancing and consistency in online activism. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (p. 811-820). New York, NY: ACM.

Lewis, R. J., Tamborini, R., & Weber, R. (2014). Testing a dual-process model of media enjoyment and appreciation. *Journal of Communication*, *64*(3), 397–416.

Li, D., Xu, X., Chen, C. F., & Menassa, C. (2019). Understanding energy-saving behaviors in the American workplace: A unified theory of motivation, opportunity, and ability. *Energy Research & Social Science*, *51*, 198-209.

Lin, J.-H. T., & Wu, D.-Y. (2019). Newsgames for the greater good: The effects of graphic realism and geographic proximity on knowledge acquisition and willingness to help. *Journalism & Mass Communication Quarterly*.

Michie, S., Atkins, L., & West, R. (2014). *The behaviour change wheel. A guide to designing interventions*. Great Britain: Silverback Publishing.

Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 42.

Mitgutsch, K., & Alvarado, N. (2012). Purposeful by design?: A serious game design assessment framework. In *Proceedings of the International Conference on the Foundations of Digital Games* (p. 121-128). New York, NY: ACM.

Nay, J. L., & Zagal, J. P. (2017). Meaning without consequence: Virtue ethics and inconsequential choices in games. In *Proceedings of the 12th International Conference on the Foundations of Digital Games* (p. 1-8). New York, NY: ACM.

Nelson, S. K., Layous, K., Cole, S. W., & Lyubomirsky, S. (2016). Do unto others or treat yourself? The effects of prosocial and self-focused behavior on psychological flourishing. *Emotion*, *16*(6), 850-861.

Neys, J., & Jansz, J. (2010). Political internet games: Engaging an audience. *European Journal of Communication*, *25*(3), 227–241.

Norman, D. A. (2002). *The design of everyday things*. New York, NY: Basic Books.

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American society for Information Science and Technology*, *59*(6), 938–955.

Oliver, M. B., & Bartsch, A. (2010). Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication Research*, *36*(1), 53–81.

Oliver, M. B., Bowman, N. D., Woolley, J. K., Rogers, R., Sherrick, B. I., & Chung, M.-Y. (2015). Video games as meaningful entertainment experiences. *Psychology of Popular Media Culture*, 1–16.

Orji, R., & Moffatt, K. (2018). Persuasive technology for health and wellness: State-of-the-art and emerging trends. *Health Informatics Journal*, *24*(1), 66–91.

Peng, W., Lee, M., & Heeter, C. (2010). The effects of a serious game on role-taking and willingness to help.

Journal of Communication, *60*(4), 723–742.

Philpot, R., Liebst, L. S., Levine, M., Bernasco, W., & Lindegaard, M. R. (2019). Would i be helped? cross-national cctv footage shows that intervention is the norm in public conflicts. *American Psychologist*. (Advance online publication.)

Pollak, J., Gay, G., Byrne, S., Wagner, E., Retelny, D., & Humphreys, L. (2010). It's time to eat! Using mobile games to promote healthy eating. *IEEE Pervasive Computing*, *9*(3), 21-27.

Raposa, E. B., Laws, H. B., & Ansell, E. B. (2016). Prosocial behavior mitigates the negative effects of stress in everyday life. *Clinical Psychological Science*, *4*(4), 691–698.

Ricci, F., Rokach, L., & Shapira, B. (2015). Recommender systems: introduction and challenges. In *Recommender systems handbook* (pp. 1–34). Springer.

Rieger, D., Frischlich, L., Wulf, T., Bente, G., & Kneer, J. (2015). Eating ghosts: The underlying mechanisms of mood repair via interactive and noninteractive media. *Psychology of Popular Media Culture*, *4*(2), 138.

Ritterfeld, U., Cody, M., & Vorderer, P. (2009). *Serious games: Mechanisms and effects*. New York & London: Routledge.

Roepke, A. M., Jaffee, S. R., Riffle, O. M., McGonigal, J., Broome, R., & Maxwell, B. (2015). Randomized controlled trial of superbetter, a smartphone-based/internet-based self-help tool to reduce depressive symptoms. *Games for Health Journal*, *4*(3), 235-246.

Rogers, R., Woolley, J., Sherrick, B., Bowman, N. D., & Oliver, M. B. (2017). Fun versus meaningful video game experiences: A qualitative analysis of user responses. *The Computer Games Journal*, *6*(1-2), 63–79.

Roth, C., Vermeulen, I., Vorderer, P., & Klimmt, C. (2012). Exploring replay value: shifts and continuities in user experiences between first and second exposure to an interactive story. *Cyberpsychology, Behavior, and Social Networking*, *15*(7), 378–381.

Ruggiero, D. (2015). The effect of a persuasive social impact game on affective learning and attitude. *Computers in Human Behavior*, *45*, 213–221.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54-67.

Schrier, K. (2010). *Ethics and game design: Teaching values through play: Teaching values through play*. New York, NY: IGI Global.

Schwartz, S. H., & Bilsky, W. (1990). Toward a theory of the universal content and structure of values: Extensions and cross-cultural replications. *Journal of Personality and Social Psychology*, *58*(5), 878-891.

Sheeran, P. (2002). Intention—behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, *12*(1), 1-36.

Snippe, E., Jeronimus, B. F., aan het Rot, M., Bos, E. H., de Jonge, P., & Wichers, M. (2018). The reciprocity of prosocial behavior and positive affect in daily life. *Journal of personality*, *86*(2), 139–146.

Soekarjo, M., & van Oostendorp, H. (2015). Measuring effectiveness of persuasive games using an informative control condition. *International Journal of Serious Games*, *2*(2), 37-56.

Spohr, S. A., Nandy, R., Gandhiraj, D., Vemulapalli, A., Anne, S., & Walters, S. T. (2015). Efficacy of sms text message interventions for smoking cessation: a meta-analysis. *Journal of Substance Abuse Treatment*, *56*, 1–10.

Stawarz, K., Cox, A. L., & Blandford, A. (2015). Beyond self-tracking and reminders: Designing smartphone apps that support habit formation. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (p. 2653-2662). New York, NY: ACM.

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, *42*(2), 73-93.

Street, T. D., Lacey, S. J., & Langdon, R. R. (2017). Gaming your way to health: A systematic review of exergaming programs to increase health and exercise behaviors in adults. *Games for Health Journal*, *6*(3), 136-146.

Tannenbaum, P. H. (2013). "Play it again, Sam": Repeated exposure to television programs. In B. J. Zillmann D. (Ed.), *Selective Exposure to Communication* (p. 225-242). New York & London: Routledge.

Thomas, J., & Roda, C. (2006). Various views on digital interactivity. In *Encyclopedia of Human Computer Interaction* (p. 686-691). New York, NY: IGI Global.

Tsvetkova, M., & Macy, M. W. (2014, 02). The social contagion of generosity. *PLOS ONE*, *9*, 1-9.

Twenge, J. M., Baumeister, R. F., DeWall, C. N., Ciarocco, N. J., & Bartels, J. M. (2007). Social exclusion decreases prosocial behavior. *Journal of personality and social psychology*, *92*(1), 56.

Ubhi, H. K., Michie, S., Kotz, D., Wong, W. C., & West, R. (2015). A mobile app to aid smoking cessation: Preliminary evaluation of smokefree28. *Journal of Medical Internet Research*, *17*(1).

van Tilburg, W. A., & Igou, E. R. (2013). On the meaningfulness of behavior: An expectancy x value approach. *Motivation and Emotion*, *37*(3), 373–388.

Vikaros, L., & Degand, D. (2010). Moral development through social narratives and game design. *Ethics and game design: Teaching values through play*, 197–216.

Weinstein, N., & Ryan, R. M. (2010). When helping helps: Autonomous motivation for prosocial behavior and its influence on well-being for the helper and recipient. *Journal of Personality and Social Psychology*, *98*(2), 222-244.

White, K., MacDonnell, R., & Ellard, J. H. (2012). Belief in a just world: Consumer intentions and behaviors toward ethical products. *Journal of Marketing*, *76*(1), 103–118.

Yang, C.-c., & Liu, D. (2017). Motives matter: Motives for playing Pokémon Go and implications for well-being. *Cyberpsychology, Behavior, and Social Networking*, *20*(1), 52–57.

Acknowledgements

I am sincerely grateful to many people for the various roles that they have played in contributing to this thesis and in supporting me throughout the journey to its completion. Without their help this thesis would not have been possible:

- Klaus Opwis, my thesis supervisor. Thank you for giving me the opportunity to write this thesis and for your encouragement, trust, guidance, and support throughout the last four years.
- My co-authors, Glena Iten, Benjamin Geelan, Lars Frasseck, Elisa Mekler, Kamalatharsi Mutuura, Seamus Forde, Stephan Zaehringer, and Ewgenji Wolkow. Thank you for lending your skills, time, energy, and enthusiasm to these projects. I hope you are as proud of the outcomes as I am.
- Silvia Heinz, Javier Bargas, Alexandre Tuch, and Chri Hübscher. Thank you for introducing me to Human-Computer Interaction, your mentorship, and infectious passion for this unique and awesome field.
- My interns and research assistants throughout the years, Pranvera Islami, David Mühlebach, Pietro Caroni, Seamus Forde, Nicole Müller, Laura Quintana, Sebastian Perrig, Ewgenij Wolkow, Kamalatharsi Mutuura, Stephan Zähringer, Damian Paro, Thierry Perrig, and Nicolas Scharowski. Working with you guys has lead to some of the most rewarding, educational, and inspiring experiences of my PhD.
- The students and team members of the MMI Basel research group. You made this process both fun and meaningful.
- My friends and family. For keeping me sane and making me laugh. A special thanks to Glena Iten, Mirjam Seckler, and Judy Steinemann for their very helpful notes and comments on the final thesis draft.
- My husband, Ben. For being crazy with me. And for reading early drafts when I didn't dare show anyone else. Your honesty and encouragement means the world to me and helped coax me across the finish line. Thank you.

Appendix

1. Steinemann, S. T., Mekler, E. D., & Opwis, K. (2015). Increasing donating behavior through a game for change: The role of interactivity and appreciation. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play* (pp. 319-329). New York, NY: ACM.

2. Steinemann, S. T., Iten, G. H., Opwis, K., Forde, S. F., Frasseck, L., & Mekler, E. D. (2017). Interactive narratives affecting social change. *Journal of Media Psychology 29*(1), 54-66.

3. Iten, G. H., Steinemann, S. T., & Opwis, K. (2018). Choosing to help monsters: A mixed-method examination of meaningful choices in games. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p.341-354). New York, NY: ACM.

4. Steinemann, S. T., Geelan, B. J., Zaehringer, S., Mutuura, K., Wolkow, E., Frasseck, L., & Opwis, K. (submitted). Potentials and pitfalls of increasing prosocial behavior and self-efficacy over time using an online personalized platform.

Increasing Donating Behavior Through a Game for Change: The Role of Interactivity and Appreciation

Sharon T. Steinemann, Elisa D. Mekler, Klaus Opwis
University of Basel, Department of Psychology, Center for Cognitive Psychology & Methodology
Missionsstrasse 62a, 4055 Basel, Switzerland
sharon.steinemann@unibas.ch, elisa.mekler@unibas.ch, klaus.opwis@unibas.ch

ABSTRACT

Games for change have attracted the interest of humanitarian aid organizations and researchers alike. However, their effectiveness to promote behavior such as donating remains unclear. Furthermore, little is known about how key game properties interactivity and presentation mode impact the effectiveness of these games, or how player attitudes and experiences relate to the interplay between game properties and donating behavior. In this study, experimental conditions were systematically varied in their interactivity and presentation mode. Thereby, 234 participants played, watched, or read through one of six variations of the narrative of the game *Darfur is Dying*. Following this, they were asked to choose the percentage of an unexpected bonus to donate to a charity. While interactivity increased donating by an average of 12%, presentation mode had no significant impact on the percentage donated. Thus, between presentation mode and interactivity, interactivity was found to be the more impactful game property. Moreover, appreciation fully mediated the relationship between interactivity and donating, hinting at its relevance for the evaluation of the effectiveness of games for change.

Author Keywords

Games for change, persuasive games, appreciation, donating

ACM Classification Keywords

J.4 Social and Behavioral Sciences:: Sociology, Psychology; K.8.0 Personal Computing Games

INTRODUCTION

For organizations focused on humanitarian aid, the rise of new media and technology brings with it the potential for creating new ways to make the world a better place. Most such organizations depend on reaching the public and persuading individuals to help [39]. Working on a limited budget, finding ways to do this in a way that is both efficient and effective is pivotal [42]. An interesting option, which in recent years has caught the attention of both humanitarian aid organizations and researchers alike, are games for change [7, 35].

CHI PLAY 2015, October 03 - 07, 2015, London, United Kingdom.

ACM 978-1-4503-3466-2/15/10...$15.00.
DOI: http://dx.doi.org/10.1145/2793107.2793125

Games for change, also known as social impact games or serious games for social change, are digital games with the purpose of not only entertaining, but reaching players and ideally animating them to support the social change the game is advocating [31, 36]. *Darfur is Dying* for example confronts players with the fear and constant lack of security facing Darfurian refugees, by forcing the player to attempt to bring water back to their camp, while avoiding the patrolling Janjaweed militia. Meanwhile, *Spent* illustrates how quickly poverty can spiral into homelessness by having players try to survive on a minimal income, while being faced with choices such as deciding whether to get an expensive treatment for a dental infection for half their monthly income or to buy numbing cream and try to ignore the pain. The appearance of games for change can vary greatly, from high-quality video games, to simple cartoon-like animation, to text-based gameplay [22]. The vast majority of these games however have in common that no matter how simple the design, they force players to face challenges and make difficult choices they would not have to in their regular life. This aspect of interactivity also sets these games apart from other forms of media conveying similar messages.

While interest in various types of serious games has been on the rise in recent years, little is known about the effectiveness of these games in achieving the goals for which they were designed [26, 44]. Especially in the context of games for change, effectiveness can be hard to discern, as their purpose may not be clearly defined or it may be difficult to distill their success down to measurable values [21, 28, 36]. However, as argued by Iacovides and Cox [21], despite these added difficulties it is especially vital to evaluate the experience invoked by games that go beyond fun, to understand whether they are effective facilitators of social change.

Related to the question of the overall effectiveness of games for change is the examination of how individual game properties, such as interactivity or presentation mode, contribute to this effect, as understanding the specific impact of individual game properties can help organizations create impactful games efficiently, by focusing on the most effective properties. Although still a very sparse field of research, the few studies that have aimed to evaluate the effectiveness of games for change have found support for their impact on a number of factors such as player attitudes or knowledge gain [34] and some have even found effects on attitudes weeks later [20, 38].

However, so far very few studies have examined the impact of games for change on behavior-related variables. The only

studies that have to our knowledge touched on behavior did this by asking participants about their willingness to show a certain behavior or via self-reports, for example by asking how willing participants would be to donate money [34] or asking them a week after the study, whether they had shared the game with a friend [12]. So far to our knowledge no studies have explored the impact of games for change on directly measurable behavior.

The goal of the current study is first and foremost to examine the effectiveness of a game for change on impacting behavior, specifically donating. In particular, we wish to understand how two specific game properties contribute to the effectiveness of these games by analyzing the impact of systematically changing presentation mode or adding and removing interactivity, while keeping the information content itself constant. Beyond that, we also wish to gain insight into how role-taking, willingness to help, enjoyment, and appreciation are affected by playing a game for change and how they relate to donating. Examined together, these questions should help us improve our understanding of how games for change can impact player attitudes, experience, and behavior and thereby further understand these games' value as a tool for meaningful social change.

RELATED WORK

A key game property, both for games as a whole and for games for change in particular, is interactivity [36]. Klimmt and Vorderer [23] defined interactivity in the context of digital games as the game property that gives the player the ability to interact with and influence the story told in the game. Previous research in the context of games for change, other serious games, and in the broader field of game research, has identified the interactivity of a game as a factor, which contributes to different attitudinal and motivational changes, as well as to knowledge gain.

Peng, Lee, and Heeter [34] for example had participants either play Darfur is Dying, watch a recording of the gameplay (but not play the game themselves), or read a text describing the same events as were played out in the game. They found that, compared to the other two conditions, playing the game led to significantly higher role-taking with the character and willingness to help people, who, like their character, were affected by the crisis in Darfur. Similarly, Ruggiero [38] found that playing Spent led to participants improving their attitude towards homelessness more than a control group and more than a group that read an article about homelessness. The effects were weaker three weeks later, but had decreased less for the game group than for the control or reading group. Ritterfeld et al. [37] also compared an interactive serious game, in this case for education, with the noninteractive recorded gameplay and found a significant effect for interactivity on knowledge gain in the game's subject of the human digestive system. Further, while not exclusively focusing on interactivity, a meta-analysis of games for education by Wouters et al. [44] found games to be more effective at encouraging learning and retention than conventional, mainly non-interactive instructional methods. An explanation for this finding could be the ability of interactive games to allow players to experience and manipulate the game's material and outcome in ways other instructional methods cannot [19]. While this effect may be especially relevant in the context of games for learning, this aspect, of seeing the consequences of certain actions and the therewith connected learning experience, may well also hold importance for the creation of new or adapted attitudes and thereby also be of significant importance for games for change. In the wider game context, interactivity has also been examined, as Lin [24] compared an interactive violent video game with the noninteractive recorded gameplay and a noninteractive corresponding scene in a movie, on which the game was based. Lin found interactivity to have a significant short-term effect on both aggressive affect and cognition. Once again however, the impact on behavioral measures remains unclear.

Another important property of games is their presentation mode and their ability to incorporate different forms of sensory input, such as visualizations and audio tracks [36]. This combination of different sensory perceptions in one presentation mode is referred to as multimodality [4]. Past research has shown that the use of multimodality can impact the way information is processed. For example, using multiple modalities, distributed over separate sensory channels in parallel, as by supplementing a lecture with descriptive images, can improve information processing [26, 40]. However, relaying two pieces of information simultaneously over the same channel can lead to inferior processing [4]. Simply changing the presentation mode can also have consequences on attitudes, as for example presenting a political debate either in a single-screen view or a split-screen view can significantly impact the way viewers process the debate issues and evaluate candidates [10]. Findings on the impact of presentation mode and modality in the context of serious games have been mixed. For example, Ritterfeld et al. [37] found that using combined images and sound instead of text in a game for education significantly increased knowledge gain and interest in learning. Conversely, Peng et al. [34] found no significant difference between the recording of the cartoon-like animation supplemented by sound in the game Darfur is Dying and a text telling the same story regarding their impact on role-taking and willingness to help.

While several studies have examined the effects of interactivity and presentation mode and some, such as Peng et al. [34], have even included them in the same design, the effect of interactivity has to our knowledge never been systematically examined across different presentation modes. Peng et al. [34] for instance did not include an interactive equivalent of the text, meaning that any findings on the effectiveness of the interactive game could not be completely attributed to interactivity, as it might have been an effect of the interaction between interactivity and the presentation mode of the game.

Aim of this study

In this study, our goal was to firstly examine the individual effects of interactivity and presentation mode on a measurable behavioral variable, namely donating, considering the importance of donations for humanitarian aid [39]. The effects of interactivity and presentation mode were examined by com-

paring interactive and noninteractive versions of three different presentation modes. As research on games for change has so far lacked examination of the impact of game properties on behavior, it will be interesting to see whether the link found between interactivity and willingness to donate [34], can also be found between interactivity and donating behavior. As attitudes are generally connected to corresponding behavior [1, 18], we hypothesize that as with willingness to donate:

H1: Interactivity will lead to increased donations.

As findings on the effectiveness of presentation mode in the context of serious games have been mixed [34, 37], no specific hypotheses will be proposed regarding its impact. As the study design will however allow a systematic examination of the impact of presentation mode, as with interactivity, results regarding the effectiveness of presentation mode will nevertheless be of interest.

Of further interest is the question of how subjective player ratings are impacted by interactivity and presentation mode and how they relate to donating. This will allow the findings of this study to be compared to previous research examining subjective ratings. In the following sections we will therefore focus on four factors shown to be of importance in recent serious game and media research.

Role-Taking and Willingness to Help

Empathy has long been associated with prosocial behavior [17]. Role-taking refers to a specific form of empathy whereby a person temporarily imagines themselves as another person and takes on their perspective [14]. In the context of media, role-taking is closely related to identification, which effectively describes role-taking specifically with a mediated character, such as a character in a book, movie, or game [13, 34].

In their study, Peng et al. [34] argued that due to the game's interactivity, playing as a character in a game could lead to an increase in role-taking with that character more than noninteractive forms of media could. In line with this expectation, they found that interactivity led to an increase in role-taking. Similar results are expected for this study:

H2: Interactivity will lead to more role-taking.

Furthermore, Peng et al. [34] also found that an increase in role-taking led to an increase in self-reported willingness to help a cause that would benefit people like the character they had just played. It remains to be seen how role-taking and willingness to help translate into donating behavior, however, considering the well-established links between empathy and prosocial behavior [17] as well as research linking attitudes with related behavior [1, 18], we hypothesize that:

H3: Role-taking will be positively correlated with donating behavior.

H4: Willingness to help will be positively correlated with donating behavior.

Peng et al. [34] did not find an impact of presentation mode on role-taking or on willingness to help. As their design however did not allow for a clear distinction between the impacts of interactivity and presentation mode, it is possible that isolating the effects of presentation mode may yield different findings.

Enjoyment and Appreciation

A key aspect of games, which should not be neglected, is their capacity to be entertaining and enjoyable [27]. Of special interest in the context of games for change is the concept of eudaimonic entertainment [33]. This describes entertainment, which leads to gratification not necessarily by being fun, but by being thought-provoking and meaningful [6, 25]. Examples of media that are in this way appreciated, but not necessarily enjoyed, are films such as Schindler's List, which may not be considered fun, but is widely appreciated for its ability to make the audience think [33]. It is important to bear in mind that media can be simultaneously appreciated and enjoyed [33]. Accordingly, while the game may be appreciated for its message, the gameplay may still be enjoyable. Specifically, the interactivity of a game has in the past been linked to enjoyment [23]. We therefore assume that:

H5: Interactivity will lead to more enjoyment.

Appreciation has been linked to the degree to which media is moving and thought-provoking [5, 6, 33]. A recent study by Bopp et al. [8] found games to be an effective medium for inspiring both strong emotions and reflective thoughts. Interestingly, players often especially appreciated game situations where both positive and negative emotions were elicited, such as when the player won, but only after having made a sacrifice. This may be especially relevant for games for change, such as Darfur is Dying, where the player is likely to be confronted with negative emotions when contemplating the humanitarian crisis the game is illustrating. While the resulting game experience may not necessarily be fun, this does not have to make it a bad experience or one that game designers should avoid designing for. As Marsh and Costello [25] have argued, other forms of media such as literature or film are often acclaimed for their ability to portray suffering and adversity and that limiting their storytelling to be only positive or fun would be considered a serious restriction. Marsh and Costello advocate that there is no reason why games should not similarly aim to be moving and thought-provoking. Considering the above-mentioned research by Bopp et al. [8] and other recent findings on the ability of games to promote affective learning [38] and stronger affective reactions [24], it could be postulated that games may even be uniquely qualified to facilitate moving experiences. As a game property, interactivity in particular has been associated with stronger cognitive and affective reactions [24]. We therefore hypothesize that:

H6: Interactivity will lead to more appreciation.

Lastly, moving media, distinguished by the presence of both positive and negative emotions, has been associated with an increased likelihood of participants performing prosocial behavior, such as sharing an informational video with others to spread awareness around skin cancer prevention [30]. Additionally, past research has highlighted the importance of meaningfulness for people engaging in prosocial behavior,

such as donating blood [2, 3]. Considering this, we propose that:

H7: Appreciation will be positively correlated with donating behavior.

It is yet to be seen how presentation mode affects enjoyment and appreciation or how enjoyment impacts donating behavior. Finally, it will be interesting to explore whether any of these subjective ratings for player attitudes and experiences will be able to mediate the effect of interactivity and presentation mode on donating behavior.

METHOD

The experiment had a 2x3-between-subject design. The independent variables were interactivity with two levels (interactive, noninteractive) and presentation mode with three levels (text, text with pictures, (recorded) gameplay). The primary dependent variable was percentage donated. Further dependent variables were role-taking, willingness to help, enjoyment, and appreciation. To control for confounding effects, the covariables empathic concern, general involvement with international humanitarian affaires, and previous knowledge of the crisis in Darfur were also included.

Participants

Participants were recruited on the crowdsourcing platform Crowdflower. Participants were only allowed to participate once, any repeated participations were excluded from the dataset (73 participants). We also excluded participants who did not complete the survey (19 participants) or had technical difficulties, which led to them being unable to experience the experimental condition they were assigned to (3 participants). We also excluded participants who were unable to correctly answer an open-ended question about what had happened in the experimental condition (6 participants) or obviously had randomly answered multiple choice questions (8 participants). As only the game condition included the option of winning, we excluded participants, who indicated they had won (5 participants), to keep the outcome consistent across conditions.

After data cleanup, a sample of 234 participants (121 female) remained: 29 in the gameplay condition, 31 in the interactive text with pictures condition, 43 in the interactive text condition, 40 in the noninteractive recorded gameplay condition, 39 in the noninteractive text with pictures condition, and 52 in the text condition. The mean age was 38 with a range from 16 to 79. After conducting a pilot study, we realized that good English skills were essential for understanding the questionnaires and the text conditions. Therefore for the main study we restricted recruitment to countries with English as an official language. Despite this constraint, participants came from a fairly broad range of nationalities; 35% identifying as American, 23% as British, 22% as Canadian, and the remaining 20% identifying as from one of 28 other nationalities. 49% were full-time employed, 19% were unemployed, 13% were part-time employed, 8% were students, and the remaining 11% identified as either stay-at-home parents, self-employed, retired, or preferred not to say. Participants received $1 for their participation, which they were assigned after entering a code on Crowdflower that they were awarded at the end of the study.

Materials

Stimuli

We partially replicated the design of Peng et al. [34], using the same two presentation modes as they had. These were the interactive web-based video game Darfur is Dying, which has been previously used in research on games for change (e.g., [12, 31, 34]), a recorded gameplay video of Darfur is Dying, and a text, recounting the narrative of the game. While there were several characters available, we asked participants – similar to Peng et al. [34], – to play as the little girl Poni, for the sake of consistency across the other conditions, which only offered the option of playing as Poni. Likewise, we excluded participants,who won (i.e., successfully brought water back to their camp without getting caught) to keep the outcome consistent across conditions.

We furthermore supplemented Peng et al.'s study design with an additional three conditions. The first was an interactive version of the text adapted from Peng et al. ([34], p. 741). This interactive text was a simple form of interactive fiction or text adventure, which allowed the reader to make choices as to how the story would progress. The interactive text condition was created by modifying the noninteractive text in Twine, a software, which allows the creation of hypertext-based interactive stories. Where the noninteractive text condition described the decisions Poni made when running across the landscape to get to the well, the interactive text condition let the participants choose in which direction Poni should run. The player would make their choice by clicking on their preferred answer and were then taken to a new page in the browser with a text reflecting their choice (see also Figure 1).

To keep the experience consistent with the noninteractive text, the interactive text told the same story, independently of the choices the player made, although the players did not know this. While the player would choose a direction in which to run and the next page would give feedback about the direction they ran in (e.g., "Poni runs east, away from the oncoming jeep"), the rest of the text would be the same for each option. The only exception was if participants chose an option that took them towards the jeep, in which case they were captured immediately. If they did not run towards the jeep, players went through eight pages, on seven of which they were given a section of the story and had to choose which way to run. To keep the story consistent across conditions, the final choice always lead to Poni being captured on the eighth page.

While interactive fiction may be visually very different to a video game such as Darfur is Dying, it can nonetheless be defined as a form of game [29]. Considering the substantial visual difference between an interactive text and a video game, a third presentation mode of a text with pictures using screenshots from the game (see Figure 1) was included, to allow a more nuanced examination of the impact of different forms of presentation mode. The three presentation modes also varied in their use of modality, as the gameplay offered visual information, as well as auditory information (e.g., Poni's footsteps, motor sounds of nearby militia jeeps),

Poni runs east, away from the oncoming jeep. She successfully avoids the Jeep. Perhaps there will not be any more patrols, she thinks, but that familiar whine is heard in the distance to the north once again. Now she is in a bad position, as she has gone further away from the rocks and has no place to hide.

What should Poni do?

Run north, towards the well
Run east, away from the well
Run south, towards camp
Run west, towards the well

Figure 1. A section of the interactive text with pictures condition. The image is a screenshot of *Darfur is Dying* taken by the first author.

making it multimodal. Meanwhile, the text offered information only through written language as a single modality and the text with pictures offered information through written language and images, meaning that two pieces of information had to be transferred over the same processing channel.

Measures

To measure donating behavior, participants were given a $1 bonus in addition to the $1 that they were already receiving as compensation for taking part in the study. While $1 may not seem to be a large amount, several studies have previously employed this or similar amounts (e.g., [9, 16, 41]). Participants had to choose which percentage of this $1 they wanted to have paid to them and which percentage should be donated for them to the charity Save Darfur. Using a dropdown menu, participants selected the amount to be donated in 10-percent increments between 0% and 100%.

Cohen's identification scale [13] was used to measure role-taking, with the name of the character of the game, Poni, inserted in the item statements (Cronbach's α = .90). Participants were asked to use a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) to rate six statements, such as "I was able to understand the events in a manner similar to that in which Poni understood them" or "When Poni failed, I was sad; when Poni succeeded I felt joy".

While role-taking is a measure for the empathy felt towards a specific individual, or in this case character, it is reasonable to assume that a person's general tendency towards empathy may also impact prosocial behavior such as donating. To control for this potentially confounding factor, the Empathic Concern subscale developed by Davis [15] was utilized (Cronbach's α = .86). Participants rated seven statements, such as "When I see someone taken advantage of, I feel kind of protective towards them" on a 7-point Likert scale from 1 (does not describe me well) to 7 (describes me very well).

Besides empathic concern, it is also plausible that a person with an interest in following news about humanitarian issues or someone with previous knowledge of the crisis in Darfur would be more likely to donate money to this cause. To measure general involvement with international humanitarian affaires, participants were asked the same four questions used in Peng et al. [34], such as "I pay attention to news about human rights", on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree, Cronbach's α = .92). To measure previous knowledge of the crisis in Darfur, one item was used similar to Peng et al., asking whether the participant had heard of the crisis in Darfur.

Four dependent variables focusing on willingness to help were measured using the same four questions used by Peng et al. [34]. The participants were asked to rate how likely on a 7-point Likert scale from 1 (very unlikely) to 7 (very likely) it was that they would (a) donate money to help fund crucial awareness and advocacy programs needed to end the crisis in Darfur; (b) sign a petition to build the political pressure needed to end the crisis in Darfur; (c) discuss the situation in Darfur with their friends or family; and (d) forward the link of the game/video/text/interactive text to their friends to disseminate the message about Darfur. It is important to note that, as in Peng et al. [34], these four questions were not used as a scale measuring one variable, but as four separate variables measuring four separate forms of willingness to help.

Enjoyment and appreciation were measured using the scale developed by Oliver and Bartsch [33], which consists of three items each for enjoyment (Cronbach's α = .90) and appreciation (Cronbach's α = .87). To accommodate the different media used in this study, statements were slightly modified depending on the condition. For example, a statement for appreciation in the game condition was formulated as "I found this game to be very meaningful", while in the recorded gameplay condition it was written as "I found this video to be very meaningful" (7-point Likert scale, 1 = strongly disagree, 7 = strongly agree).

Procedure

Participants began the online survey after following a link from Crowdflower. After being informed about the rough procedure and length of the study, participants filled out questionnaires for empathic concern, as well as general involvement with international humanitarian affaires, and knowledge of the humanitarian crisis in Darfur. Next, participants were randomly assigned to one of the six experimental conditions, each of which told Poni's story through a different form of presentation mode (text, text with pictures or (recorded) gameplay) in either an interactive or noninteractive version. Participants completed the various experimental conditions (e.g., playing the game) in between five and seven minutes.

Immediately after the experimental condition, participants filled out questionnaires for role-taking, willingness to help, appreciation, and enjoyment. Then, participants were told that they would be receiving a bonus of $1, in addition to the $1 they were already receiving for participating in the study. They were then given the choice to keep the entire bonus for themselves or to donate up to 100 percent to a charity called Save Darfur. Optionally, they could click on a link to find out more about Save Darfur before making their decision. After choosing the amount to donate, participants were asked

Table 1. Descriptive statistics for all dependent variables for all conditions.

	Non-interactive			Interactive		
	Text	Text with Pictures	Recorded Gameplay	Text	Text with Pictures	Gameplay
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Percentage donated	49.42 (41.46)	52.56 (41.15)	50.75 (41.16)	65.12 (35.48)	55.16 (41.38)	66.55 (43.12)
Role-taking	5.11 (1.25)	5.12 (1.36)	4.85 (1.26)	5.75 (1.08)	5.07 (.99)	4.80 (1.27)
Enjoyment	2.73 (1.44)	2.64 (1.29)	2.65 (1.25)	3.93 (1.92)	4.15 (1.73)	3.77 (1.54)
Appreciation	5.31 (1.41)	5.05 (1.58)	4.92 (1.51)	5.90 (1.13)	5.40 (1.24)	5.39 (1.33)
Willingness to help	4.45 (1.62)	4.29 (1.64)	4.47 (1.51)	4.95 (1.62)	4.56 (1.51)	4.47 (1.49)
Empathic concern	3.39 (.62)	3.02 (.86)	3.13 (.63)	3.40 (.79)	3.32 (.77)	3.43 (.75)
Humanitarian involvement	4.88 (1.48)	4.72 (1.47)	4.89 (.97)	5.42 (1.20)	4.94 (1.25)	4.98 (1.35)

to briefly recount what had happened in the story they had read, watched, or played through. This was followed by some quality-check questions to ensure all media in their condition had been presented correctly (e.g., for the text with pictures condition: "In the story you just read, did you see pictures illustrating the story?"). Finally, participants answered demographic questions and three validation questions about the content of the study, which when answered correctly gave them two codes, which when entered on Crowdflower, led to them receiving their compensation and the chosen bonus.

RESULTS

An alpha level of .05 was used for all statistical tests. Across all conditions participants donated an average 56% of their bonus, this amounted to a total of $131 that we consequently paid to Save Darfur. The average percentage donated in each condition is shown in Table 1.

Percentage donated

To examine the effects of interactivity and presentation mode on percentage donated, the data were analyzed using a two-way analysis of variance (ANOVA) for unrelated samples. There was a significant main effect for interactivity ($F(1, 228) = 4.427$, $p = .036$, $\eta_p^2 = .019$). Percentage donated was significantly higher in the interactive conditions ($M = 62.52$, $SD = 39.45$) than in the noninteractive conditions ($M = 50.76$, $SD = 40.98$), supporting H1. Neither the main effect for presentation mode ($p = .77$), nor the interaction effect ($p = .53$) were significant.

Next, analyses were performed to examine whether empathic concern, humanitarian involvement, or knowledge of the crisis in Darfur might be confounding the effects of interactivity and presentation mode on percentage donated. The results indicated that empathic concern was not significantly correlated with percentage donated (see Table 2). The same analysis for humanitarian involvement similarly revealed no significant relationship between humanitarian involvement and percentage donated. To examine whether participants who had previous knowledge of the humanitarian crisis in Darfur had donated differently than those who had not, an independent t test for equal variances was conducted. Results were significant ($t(232) = 2.061$, $p = .040$), indicating that participants who had known about the crisis in Darfur donated significantly more ($M = 62.35$, $SD = 39.73$), than those who had not ($M = 51.32$, $SD = 40.82$). A t test was conducted to examine whether the interactive and the noninteractive conditions differed in their previous knowledge of Darfur. The difference between the groups was however not significant ($p = .812$).

Role-taking and willingness to help

An analysis of the impact of interactivity and presentation mode on role-taking revealed a significant main effect for presentation mode ($F(2, 228) = 5.25$, $p = .005$, $\eta_p^2 = .049$). As listed in Table 1, role-taking was highest in the text conditions, followed by the text with pictures conditions, and lowest in the (recorded) gameplay conditions. Planned contrasts further revealed that role-taking was significantly higher in the interactive text condition compared to the other five conditions, ($t(228) = 3.68$, $p < .001$). Lastly, neither the main effect for interactivity ($p = .302$), nor the interaction effect for interactivity and presentation mode ($p = .068$), on role-taking were significant. H2 was therefore not supported.

To examine the relationship between role-taking and percentage donated, the data were analyzed using Pearson's *r*. As can be seen in Table 2, role-taking was significantly positively correlated with percentage donated. Thus supporting H3. Interestingly, when the data were split by interactivity, the significant positive correlation remained for the noninteractive conditions between percentage donated and role-taking ($r(131) = .26$, $p = .003$), but disappeared for the interactive conditions ($r(103) = -.05$, $p = .607$).

To allow comparisons with the results reported by Peng et al. [34], a two-way multivariate analysis of variance (MANOVA) was conducted to examine the impact of interactivity and presentation mode on willingness to donate, willingness to sign a petition, willingness to discuss with friends and family, and willingness to forward message. Against our expectations and in contrast to the findings of Peng et al. [34], no significant effects were found for any of the four ratings (p-values between .11 and .85). For this reason and since all four items were moderately to strongly correlated ($r(234) = .56$ - $.81$, $p < .001$), we decided to collapse the four individual items into a single factor "willingness to help" for subsequent analyses (Cronbach's $\alpha = .69$).

Table 2. Pearson's Correlation for dependent variables and covariables over all conditions.

	Percentage donated	Role-taking	Enjoyment	Appreciation	Willingness to help	Empathic concern
Role-taking	.15*					
Enjoyment	-.03	.29**				
Appreciation	.25**	.76**	.23**			
Willingness to help	.22**	.67**	.30**	.69**		
Empathic concern	.08	.41**	-.01	.50**	.40**	
Humanitarian involvement	.10	.42**	.12	.48**	.58**	.40**

* Significant at $p < .05$. ** Significant at $p < .01$.

To examine the relationship between willingness to help and percentage donated, the data were analyzed using Pearson's *r*. In support of H4, the results indicated positive significant correlations for willingness to help with percentage donated, as can be seen in Table 2. Just as had been the case with role-taking, when the data were split by interactivity, the significant positive correlation remained for the noninteractive conditions between percentage donated and willingness to help ($r(131) = .33$, $p < .001$), but not for the interactive conditions ($r(103) = .06$, $p = .532$).

Enjoyment and appreciation

An ANOVA was conducted to examine the impact of interactivity and presentation mode on enjoyment, revealing a significant main effect for interactivity ($F(1, 228) = 33.99$, $p < .001$, $\eta_p^2 = .13$), but no significant effects for presentation mode ($p = .860$), or the interaction between interactivity and presentation mode ($p = .779$), thereby supporting H5. To examine the relationship between enjoyment and percentage donated, the data were analyzed using Pearson's *r*. No significant correlation was found.

An analysis of the impact of interactivity and presentation mode on appreciation likewise revealed a significant main effect for interactivity ($F(1, 228) = 6.05$, $p = .015$, $\eta_p^2 = .026$), but no significant effects for presentation mode ($p = .071$), or the interaction between interactivity and presentation mode ($p = .763$), thereby supporting H6. An analysis of the relationship between appreciation and percentage donated revealed a significant positive correlation ($r(234) = .25$, $p < .001$). Thus, H7 was also supported.

Since appreciation, as the only one of the subjective player ratings, was significantly associated with both interactivity and percentage donated, a mediation analysis was performed to explore whether appreciation mediated the effect of interactivity on percentage donated. To this end, two path-models were set up, as seen in Figure 2. The first path model examined the direct effect of interactivity on percentage donated, while the second path model included appreciation as a mediator variable. As had already been found in the ANOVA, the first path model revealed a significant direct effect of interactivity on percentage donated ($\beta = .14$, b = 11.76, SE = 5.298, t = 2.20, $p = .026$). The second path model revealed significant paths from interactivity to appreciation ($\beta = .17$, b = .49, SE = .182, t = 2.71, $p = .007$) and appreciation to percentage donated ($\beta = .23$, b = 6.69, SE = 1.86, t = 3.561, $p < .001$), while the path from interactivity to percentage donated

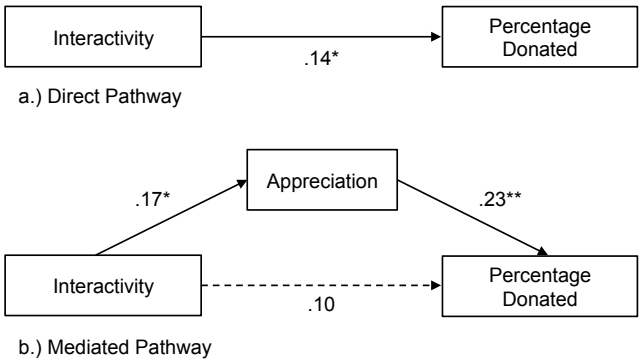

Figure 2. The relationship between interactivity and percentage donated, fully mediated by appreciation. * $p < .05$. ** $p < .01$.

was now no longer significant ($\beta = .104$, b = 8.46, SE = 5.24, t = 1.62, $p = .106$), indicating that the effect of interactivity on percentage donated is fully mediated by appreciation.

DISCUSSION

The results of the present study offer further support for the findings of previous research (e.g., [31, 34, 38]) on the effectiveness of games for change, while additionally providing insight into the individual contributions of specific game properties. Furthermore, for the first time effectiveness was examined using both a behavioral measure and ratings of player attitudes and experience, shedding light on the relationship between subjective ratings and donating behavior, as influenced by games for change.

With 63%, participants in the interactive conditions donated a significantly higher percentage of their one dollar bonus than the 51% donated by participants in the noninteractive conditions. Presentation mode on the other hand did not have a significant impact on the percentage participants chose to donate. However, presentation mode did significantly impact role-taking. Specifically, participants showed significantly higher role-taking in the interactive text condition than in the other conditions. Role-taking was also significantly correlated with willingness to help. This is in line with previous findings by Peng et al. [34].

Additionally, the interactive conditions led to significantly more enjoyment and appreciation than the noninteractive conditions, whereas presentation mode had no significant impact on either enjoyment or appreciation. While enjoyment was

not associated with a higher percentage donated, appreciation was. Furthermore, appreciation fully mediated the higher percentage donated in the interactive over the noninteractive conditions.

Due to the systematic experimental manipulation of interactivity across the three presentation modes, conclusions may now be drawn as to their direct effects on the examined dependent variables. Across all dependent variables save for willingness to help and role-taking, interactivity was the relevant game property, while presentation mode had no significant impact. This means that percentage donated, enjoyment, and appreciation were all significantly increased by making participants interact with the media they were consuming. This is in line with previous research on the importance of interactivity as a game property [19, 24, 34, 37, 38], however, this was the first study to examine the effect of interactivity while controlling for presentation mode.

In further support of the findings of Peng et al. [34], higher willingness to help correlated with a higher percentage donated, indicating that willingness to help is related to actual donating behavior. However, the correlation was fairly weak, indicating that other factors besides willingness to help may be involved in the decision to donate. While there was no significant main effect for interactivity on either willingness to help or role-taking, interactivity did have an interesting impact, in the respect that there was a significant positive correlation between role-taking and percentage donated and willingness to help and percentage donated for the noninteractive conditions, but not for the interactive conditions. At the same time, participants in the interactive conditions donated almost 12% more than in the noninteractive conditions. In other words, interactivity seemed to invoke a higher percentage donated regardless of participants' reported willingness to help or role-taking. Beyond further establishing the importance of interactivity, this further implies that role-taking and willingness to help are not the only relevant factors related to increasing percentage donated.

One of these relevant factors appears to be appreciation, which was not only increased by interactivity, but also fully mediated the relationship between interactivity and percentage donated. While the nature of the present study does not allow for any causal inferences, this may suggest that participants found a narrative that they could actively participate in more meaningful than a narrative they were passively consuming and this then possibly encouraged them to donate a larger percentage of their bonus. This is in line with previous research on the ability of games to be thought-provoking [8, 21, 25] and findings on the relationship between meaningfulness and prosocial behavior [2, 3, 30]. However, this is to our knowledge the first study to find evidence for a potential connection between game properties, appreciation, and prosocial behavior. These findings indicate the importance of including appreciation in the examination of the effectiveness of games for change, as well as highlighting its potential for encouraging prosocial behavior, such as donating.

Enjoyment was increased by interactivity, but was not directly associated with a higher percentage donated. This means that while participants clearly enjoyed the interactive conditions more than the noninteractive conditions, this did not necessarily make them donate a higher percentage. This recalls Cohen's findings [12], who found that while enjoyment increased the intention to share a game for change, it was not associated with a higher likelihood of later (self-reported) sharing. A caveat for this study however, is that while interactivity increased enjoyment, the primary goal of the game makers had most likely not been to make the narrative of Darfur is Dying enjoyable [31]. It would be interesting to examine games for change with more enjoyable narratives and explore whether for these games enjoyment might be more likely to impact behavior, as well as investigating how more enjoyable narratives impact appreciation.

Presentation mode did not have a significant impact on any of the dependent variables, except for role-taking, where the interactive text increased role-taking more than the other conditions. That role-taking would be higher for a text condition than for other, more visual conditions may point to the ability of a text to convey the character's thoughts and emotions better than the cartoon-like animation of Darfur is Dying, making it easier to identify with the character when reading the text. Furthermore these findings also indicate that the multimodality of the presentation mode does not play a significant role in increasing factors relevant to the effectiveness of games for change, such as willingness to help, enjoyment, appreciation, or donating. This sets games for change apart from games for education where multimodality had been found to significantly impact knowledge gain and interest in learning [37]. Considering research on the positive impact of multimodality on information processing [40], it is perhaps not surprising that multimodality was more effective in the context of learning.

Implications, limitations and further research

For game designers and organizations aiming to create games for change, the main takeaway from this study is that while interactivity is crucial for the effectiveness of games for change to encourage donating, presentation mode is seemingly less important. Strikingly, in this study this meant that using a simple interactive text was almost exactly as effective at motivating participants to donate, as the video game Darfur is Dying. However, an important limitation of this study is that the effectiveness of the game only refers to the behavior of players after being prompted to play the game. It is very possible that while presentation mode may not be important for increasing donating behavior, it may increase the likelihood of a player noticing or seeking out a game, as a video game may look more interesting than a text-based game. Likewise, participants were instructed to play, watch, or read through the conditions until the end. While none of the conditions took longer than seven minutes to complete, it is possible that without the context of the study, participants may have been more likely to stop playing in the text or text with pictures conditions than in the (recorded) gameplay conditions. Finally, the short play time utilized in this game means that these findings may not be generalizable to games played over a longer course of time. However, the finding that even such

a short play time could lead to significant changes in participant attitudes, experiences, and behavior, is an interesting finding in and of itself. Together, these findings suggest that while further research is necessary to understand the potential and limitations of text-based interactive fiction as games for change, this may be an area worth exploring both in future research and practical work.

Perhaps more importantly, the present study identified appreciation as a potential component of the effectiveness of games for change, as showcased by its mediating the relationship between interactivity and donating behavior. It remains to be seen what game properties other than interactivity may potentially inspire player appreciation and how this subsequently relates to various prosocial behaviors, including but not limited to donating. Iacovides and Cox [21] mention narrative, gameplay, and audio as factors that helped create a meaningful and thought-provoking experience in a game illustrating the dilemmas facing health professionals. Bartsch et al. [6] highlight the role that moving music can play in evoking appreciation for a film. Another interesting approach was highlighted in recent research by Gerling et al. [20], who utilized embodied interaction, which had participants controlling a digital game about living with disabilities by sitting in and operating a wheelchair themselves. This embodied interaction lead participants to reflect more on real-world challenges facing people with disabilities than participants controlling the same game by traditional gamepad. Considering the current findings, further research could investigate how these and other game properties impact appreciation and prosocial behavior in the context of games for change.

A further limitation is that this study only examined results for participants who lost the game. Past research has found that success and failure can lead to considerably different affective responses [32]. In sports, winning has been associated with more positive affect, while losing is more likely to lead to a negative affective response [43]. Considering past findings that media is especially appreciated when it evokes mixed emotions (e.g., [5, 8, 21]), it would be interesting to see how appreciation differs depending on whether participants win or lose at a game for change. Further research on how game outcome and the consequent emotional response impact appreciation and its connection to prosocial behavior could help improve understanding of its importance for games for change.

Having participants donate their bonus was successful in showing differences in prosocial behavior depending on the experimental condition experienced. However, while Clark [11] found that participants tend to give similar amounts of their own money in comparison to an unexpected sum of money given to them during a study, people may still take other criteria into consideration when donating their money to an organisation in a real-world setting than when donating a bonus in a study. Therefore future research should strive to examine donating behavior and other forms of prosocial behavior using more realistic measurements and settings.

Finally, an obvious limitation of this study was the use of only three modes of presentation. These represented only a very small spectrum of the presentation modes possible in the design of games. While using an animated cartoon-like gameplay may not increase appreciation, enjoyment, willingness to help, or percentage donated compared to an interactive text conveying the same information, these same variables might behave quite differently for other presentation modes, not examined in this study, such as photo-realistic graphics. Similarly, it is possible that cartoon-like presentations might not necessarily be the presentation mode best suited for the context of games for change, but might have a different impact on factors such as enjoyment or other behavioral variables in another context such as games for education or pure entertainment games. Therefore, to explore if these findings can be generalized to other presentation modes and game genres, further research is necessary.

CONCLUSION

The findings indicate that between presentation mode and interactivity, interactivity is the more important property in driving the effectiveness of games for change in increasing enjoyment, appreciation, and donating behavior. Interactive conditions also increased donating independently of role-taking or willingness to help in comparison to the noninteractive conditions. Interestingly, interactivity increased the appreciation players felt for the story being told, which in turn fully mediated the effect of interactivity on donating behavior. Role-taking was the only one of the variables studied, which was significantly affected by presentation mode. It is important however, to keep in mind that these findings do not allow inferences as to the effectiveness in winning or holding players' attention, as well as how these factors may change over a longer play time. It is also possible that other more effective presentation modes exist that were not included in this study. More research is necessary to examine how far these results can be generalized. Finally, the crucial role that appreciation played in mediating the relationship of interactivity on donating behavior, suggests the potential of appreciation as a promising addition to future research on games for change.

ACKNOWLEDGEMENTS

We would like to thank the reviewers for their very helpful comments. Special thanks also go to the members of our research department for providing valuable discussions and feedback throughout the course of this research project.

REFERENCES

1. Ajzen, I. *Attitudes, personality and behaviour*. McGraw-Hill International, 2005.
2. Andersen, M. H., Mathisen, L., Øyen, O., Wahl, A. K., Hanestad, B. R., and Fosse, E. Living donors' experiences 1 wk after donating a kidney. *Clinical transplantation 19*, 1 (2005), 90–96.
3. Apter, M. J., Spirn, N., Sveback, S., and Apter, M. Motives for donating blood. *Stress and health: A reversal theory perspective* (1997), 145–156.
4. Baddeley, A. Working memory. *Science 255*, 5044 (1992), 556–559.

5. Bartsch, A., and Hartmann, T. The role of cognitive and affective challenge in entertainment experience. *Communication Research* (2015), 0093650214565921.
6. Bartsch, A., Kalch, A., and Oliver, M. B. Moved to think: The role of emotional media experiences in stimulating reflective thoughts. *Journal of Media Psychology: Theories, Methods, and Applications 26*, 3 (2014), 125.
7. Bogost, I. *Persuasive games: The expressive power of videogames*. Mit Press, 2007.
8. Bopp, J. A., Mekler, E. D., and Opwis, K. It was sad but still good: Gratifications of emotionally moving game experiences. In *Ext. Abstracts CHI '15*, ACM (2015), 1193–1198.
9. Chatterjee, P., Rose, R. L., and Sinha, J. Why money meanings matter in decisions to donate time and money. *Marketing Letters 24*, 2 (2013), 109–118.
10. Cho, J. Disentangling media effects from debate effects: The presentation mode of televised debates and viewer decision making. *Journalism & Mass Communication Quarterly 86*, 2 (2009), 383–400.
11. Clark, J. House money effects in public good experiments. *Experimental Economics 5*, 3 (2002), 223–231.
12. Cohen, E. L. What makes good games go viral? the role of technology use, efficacy, emotion and enjoyment in players' decision to share a prosocial digital game. *Computers in Human Behavior 33* (2014), 321–329.
13. Cohen, J. Defining identification: A theoretical look at the identification of audiences with media characters. *Mass Communication & Society 4*, 3 (2001), 245–264.
14. Coutu, W. Role-playing vs. role-taking: An appeal for clarification. *American Sociological Review* (1951), 180–187.
15. Davis, M. H. Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of personality and social psychology 44*, 1 (1983), 113.
16. DeScioli, P., Massenkoff, M., Shaw, A., Petersen, M. B., and Kurzban, R. Equity or equality? moral judgments follow the money. *Proceedings of the Royal Society B: Biological Sciences 281*, 1797 (2014).
17. Eisenberg, N., and Miller, P. A. The relation of empathy to prosocial and related behaviors. *Psychological bulletin 101*, 1 (1987), 91.
18. Fazio, R. H. Multiple processes by which attitudes guide behavior: The mode model as an integrative framework. *Advances in experimental social psychology 23* (1990), 75–109.
19. Gee, J. P. Deep learning properties of good digital games: How far can they go. *Serious games: Mechanisms and effects* (2009), 67–82.
20. Gerling, K. M., Mandryk, R. L., Birk, M. V., Miller, M., and Orji, R. The effects of embodied persuasive games on player attitudes toward people using wheelchairs. In *Proc. CHI '14*, ACM (2014), 3413–3422.
21. Iacovides, I., and Cox, A. L. Moving beyond fun: Evaluating serious experience in digital games. In *Proc. CHI '15*, ACM (2015), 2245–2254.
22. Klimmt, C. *Serious games and social change: Why they (should) work*. Routledge, 2009, 248–270.
23. Klimmt, C., Hartmann, T., and Frey, A. Effectance and control as determinants of video game enjoyment. *Cyberpsychology & behavior 10*, 6 (2007), 845–848.
24. Lin, J.-H. Do video games exert stronger effects on aggression than film? the role of media interactivity and identification on the association of violent content and aggressive outcomes. *Computers in Human Behavior 29*, 3 (2013), 535–543.
25. Marsh, T., and Costello, B. Experience in serious games: between positive and serious experience. In *Serious Games Development and Applications*. Springer, 2012, 255–267.
26. Mayer, R. E. Multimedia learning and games. *Computer games and instruction* (2011), 281–305.
27. Mekler, E. D., Bopp, J. A., Tuch, A. N., and Opwis, K. A systematic review of quantitative studies on the enjoyment of digital entertainment games. In *Proc. CHI '14*, ACM (2014), 927–936.
28. Mitgutsch, K., and Alvarado, N. Purposeful by design?: a serious game design assessment framework. In *Proc. FDG '12*, ACM (2012), 121–128.
29. Montfort, N. *Twisty Little Passages: an approach to interactive fiction*. Mit Press, 2005.
30. Myrick, J. G., and Oliver, M. B. Laughing and crying: Mixed emotions, compassion, and the effectiveness of a youtube psa about skin cancer. *Health communication*, ahead-of-print (2014), 1–10.
31. Neys, J., and Jansz, J. Political internet games: Engaging an audience. *European Journal of Communication 25*, 3 (2010), 227–241.
32. Nummenmaa, L., and Niemi, P. Inducing affective states with success-failure manipulations: a meta-analysis. *Emotion 4*, 2 (2004), 207.
33. Oliver, M. B., and Bartsch, A. Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication Research 36*, 1 (2010), 53–81.
34. Peng, W., Lee, M., and Heeter, C. The effects of a serious game on role-taking and willingness to help. *Journal of Communication 60*, 4 (2010), 723–742.
35. Ratan, R., and Ritterfeld, U. Classifying serious games. *Serious games: Mechanisms and effects* (2009), 10–24.

36. Ritterfeld, U., Cody, M., and Vorderer, P. *Serious games: Mechanisms and effects*. Routledge, 2009.

37. Ritterfeld, U., Shen, C., Wang, H., Nocera, L., and Wong, W. L. Multimodality and interactivity: Connecting properties of serious games with educational outcomes. *Cyberpsychology & Behavior 12*, 6 (2009), 691–697.

38. Ruggiero, D. The effect of a persuasive social impact game on affective learning and attitude. *Computers in Human Behavior 45* (2015), 213–221.

39. Stoianova, V. Private funding: An emerging trend in humanitarian donorship. *Global Humanitarian Assistance* (2012).

40. Sweller, J., Van Merrienboer, J. J., and Paas, F. G. Cognitive architecture and instructional design. *Educational psychology review 10*, 3 (1998), 251–296.

41. Tsvetkova, M., and Macy, M. W. The social contagion of generosity. *PloS one 9*, 2 (2014), e87275.

42. Van Wassenhove, L. N. Humanitarian aid logistics: supply chain management in high gear. *Journal of the Operational Research Society 57*, 5 (2006), 475–489.

43. Wilson, G. V., and Kerr, J. H. Affective responses to success and failure:: a study of winning and losing in competitive rugby. *Personality and Individual Differences 27*, 1 (1999), 85–99.

44. Wouters, P., Van Nimwegen, C., Van Oostendorp, H., and Van Der Spek, E. D. A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology 105*, 2 (2013), 249.

Pre-Registered Report

Interactive Narratives Affecting Social Change

A Closer Look at the Relationship Between Interactivity and Prosocial Behavior

Sharon T. Steinemann,[1] Glena H. Iten,[1] Klaus Opwis,[1] Seamus F. Forde,[1] Lars Frasseck,[1] and Elisa D. Mekler[1,2]

[1]Center for Cognitive Psychology and Methodology, University of Basel, Switzerland
[2]HCI Games Group, Games Institute, University of Waterloo, Canada

Abstract: Interactive narratives offer interesting opportunities for the study of the impact of media on behavior. A growing amount of research on games advocating social change, including those focusing on interactive narratives, has highlighted their potential for attitudinal and behavioral impact. In this study, we examine the relationship between interactivity and prosocial behavior, as well as potential underlying processes. A yoked study design with 634 participants compared an interactive with a noninteractive narrative. Structural equation modeling revealed no significant differences in prosocial behavior between the interactive and noninteractive condition. However, support for the importance of appreciation for and engagement with a narrative on subsequent prosocial behavior was observed. In summary, while results shed light on processes underlying the relationship between both noninteractive and interactive narratives and prosocial behavior, they also highlight interactivity as a multifaceted concept worth examining in further detail.

Keywords: prosocial behavior, interactive narrative, appreciation, games for change, yoked design

A growing amount of research supports the idea that interactive narratives and games can be used not only for entertainment but also for education, health, and to further social change and prosocial behavior (Green & Jenkins, 2014; Steinemann, Mekler, & Opwis, 2015). Games for change are designed to motivate their players to support the social change they themselves are advocating. They have been created on a wide variety of subjects from the humanitarian crisis in Darfur (*Darfur Is Dying*), to the working poor in the United States (*Spent*), to the social status of women around the world (*Half the Sky*).

In recent years, studies have provided empirical support for the potential of interactive media to improve attitudes toward stigmatized groups (Ruggiero, 2015), increase willingness to help (Peng, Lee, & Heeter, 2010), and impart knowledge around peace efforts among people living in conflict zones (Kampf & Stolero, 2015). Notably, however, to our knowledge only one study to date has examined the effect of games for change on actual behavior. In that study, Steinemann et al. (2015) compared a game where the player takes the role of a refugee in Darfur, with an interactive text, a noninteractive text, and a video, all telling the same story as the game. After engaging with the story, participants were asked whether they would be willing to donate a percentage of a monetary reward they were receiving to a charity helping refugees in Darfur. The study found that participants in the interactive conditions (i.e., the interactive text and the game) donated significantly more than participants in the noninteractive conditions.

Understanding the impact that interactive media, such as games for change, can have on behavior, and specifically on prosocial behavior, is a highly interesting topic, both from an academic perspective (Ruggiero, 2015; Sundar, 2009) as well as from a practical perspective, as affecting behavior is arguably a crucial goal of games for change (Klimmt, 2009). In light of this first empirical support that games for change can indeed lead to prosocial behavior, the following sections will outline possible foundations for this effect.

Theoretical Background

Interactivity

Games for change vary widely in their visual presentation, use of game features, and narrative structure. What they

Journal of Media Psychology (2017), *29*(1), 54–66
DOI: 10.1027/1864-1105/a000211

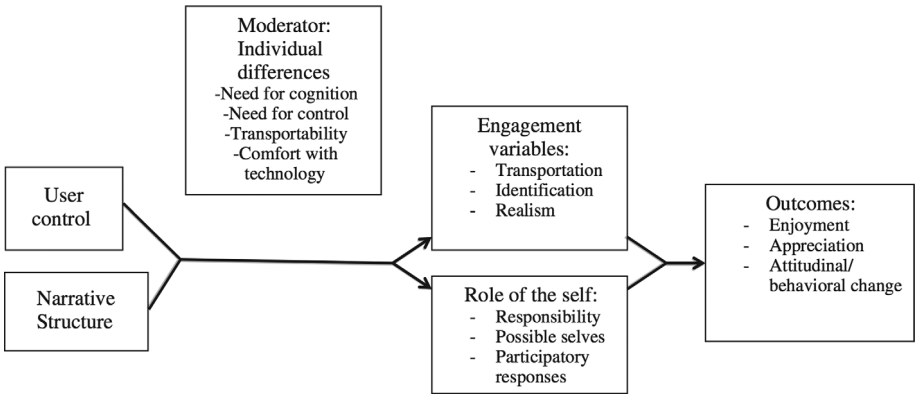

Figure 1. The conceptual model of the processes and outcomes of interactivity as proposed by Green and Jenkins (2014).

have in common, however, is that each game puts players in a role they would most likely never encounter in their day-to-day life, has them make decisions in this role, and experience their narrative consequences (Green & Jenkins, 2014). This taking of an active role in the narrative is referred to as *interactivity* (Green & Jenkins, 2014).

While an exact definition of interactivity is hampered by the fact that different forms of media will exhibit interactivity in a wide variety of ways (Bucy & Tao, 2007; Sundar, 2009), especially for narrative-heavy games, their ability to allow decision-making is arguably one of interactivity's most basic and defining features (Elson, Breuer, Ivory, & Quandt, 2014; Green & Jenkins, 2014).

Different studies have highlighted the importance of interactivity as crucial to the impact of games for change (Peng et al., 2010; Ruggiero, 2015; Steinemann et al., 2015). Notably, Steinemann et al. (2015) found an interactive text to be just as effective at increasing donations as an animated game. This finding lends credence to interactive texts as a valuable form of game for change. Indeed, several games for change already exist, which either are designed as interactive texts or rely heavily on interactive text as a primary game feature (e.g., *Spent, Depression Quest*, or *NationStates*). In this study, we therefore focus on interactivity in text-based narratives, as referring to decisions guiding the narrative, as opposed to, for example, dexterity-based interactivity possible in digital games.

Beyond empirically demonstrating the importance of interactivity to affect behavior, it is necessary to further understand the psychological processes that mediate this effect (Bucy & Tao, 2007). In the study by Steinemann et al. (2015), for instance, the effect of interactivity on donating behavior was mediated by appreciation.

Yet none of the other examined factors, which included willingness to help and enjoyment, were both impacted by interactivity and positively related to donating. The aim of this study therefore is to more closely examine the relationship between interactivity and prosocial behavior. Hence, we refer to the theoretical model of Green and Jenkins (2014), which discusses a number of variables that may help to explain the processes involved in the effects of interactive narratives on outcomes such as behavior (see Figure 1). In this model, interactivity leads to behavioral change by giving the reader control and allowing them to adapt the narrative structure (i.e., the course of the story) according to their individual personality and interests. This in turn leads to engagement (which includes factors such as identification) and allows the reader to play with different roles of the self, for example, by an increased sense of responsibility toward the characters in the interactive narrative or by exploring different aspects of their personality through possible selves presented in the narrative. Together, these variables are expected to impact outcomes such as enjoyment, appreciation, and attitudinal and behavioral change.

The current study aims to empirically examine some of these processes. We focus on variables that may be of particular interest when attempting to explain the impact of interactivity on prosocial behavior as the outcome.

Prosocial Behavior

While there is still little research specifically about the impact of games for change on actual behavior, the study by Steinemann et al. (2015) gives a first indication for such an effect, and interactivity as its source. While prosocial behavior can manifest itself in countless ways, in the study by Steinemann et al. (2015) prosocial behavior was instrumentalized as the percentage that, after engaging with a narrative, participants donated to a charity helping people like the main character in the narrative. Based on these results, combined with the findings of other studies that link interactive media with increased prosocial attitudes and behaviors (Green & Jenkins, 2014; Ruggiero, 2015), we hypothesize that:

Hypothesis 1 (H1): Interactivity will lead to a higher percentage donated.

Identification

In the context of media, identification describes the process of taking on the role of a character and sharing their goals and emotions (Cohen, 2001). In contrast to engagement with the narrative world, identification describes the merging with a character (Green & Jenkins, 2014). This merging with a character is facilitated by interactivity, as interactivity allows the player to choose actions for the character, which they personally agree with (Vorderer, Knobloch, & Schramm, 2001).

According to social identity theory, identification is crucial in the categorization of in- and outgroups, creating the line between people an individual will consider to be like themselves and treat more favorably and those they will not (Hogg, 2003). Identification has its basis in empathy, itself a well-established predecessor of prosocial behavior (Eisenberg & Miller, 1987). In the context of games for change, increased identification has been associated with higher willingness to help (Peng et al., 2010) and donating behavior (Steinemann et al., 2015).

We therefore hypothesize that:

Hypothesis 2 (H2): Interactivity will lead to more identification with the character.

Hypothesis 3 (H3): Identification will be positively related to a higher percentage donated.

Responsibility

As argued by Green and Jenkins (2014), while empathy with a character may occur in noninteractive narratives, feeling responsible for their actions is rare. By making decisions in the interactive narrative, however, the reader can see a direct link between their actions and their consequences. Through this sense of agency over the narrative, the likelihood of feeling responsible for the outcome and how it affects the main character increases (Green & Jenkins, 2014). A lack of agency has been associated with an increase in moral disengagement, which in turn is related to a decrease in prosocial behavior (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). Alternately, priming participants on their responsibility can increase empathy, which is related to prosocial behavior (Čehajić, Brown, & González, 2009). While there are no studies directly linking responsibility with prosocial behavior in interactive narratives, on the basis of these findings we hypothesize that:

Hypothesis 4 (H4): Interactivity will lead to more responsibility.

Hypothesis 5 (H5): Responsibility will be positively related to a higher percentage donated.

Appreciation

Finally, appreciation describes media experiences that are valued not necessarily for being fun but for their capability to be meaningful, moving, and thought-provoking (Oliver & Bartsch, 2010); such as when the player's character has to make a hard choice in the narrative.

While games research has long focused primarily on enjoyment, recent studies have highlighted the ability of games to lead to meaningful experiences (Elson et al., 2014; Oliver et al., 2015; Steinemann et al., 2015). A possible explanation for this effect is that interactivity may allow players to create a story that is more personally meaningful to them than a noninteractive equivalent (Elson et al., 2014).

Both feelings of meaningfulness as well as the ability of media to be moving have been repeatedly associated with increased likelihood of compassion and prosocial behavior (Morgan, Movius, & Cody, 2009; Myrick & Oliver, 2015; Small & Simonsohn, 2008). Furthermore, in the study by Steinemann et al. (2015) appreciation was not only higher in the interactive condition, it was also positively related to an increase in donations.

In the conceptual model of Green and Jenkins (2014), appreciation is an outcome, similar to behavior. However, as behavior is the focus of this study and because of the aforementioned research linking appreciation with both interactivity and prosocial behavior, we will treat appreciation as an additional process between interactivity and prosocial behavior (see Figure 2).

We therefore expect that:

Hypothesis 6 (H6): Interactivity will lead to more appreciation.

Hypothesis 7 (H7): Appreciation will be positively related to a higher percentage donated.

While identification, responsibility, and appreciation offer the clearest indications for their role as mediators between interactivity and prosocial behavior, other variables should also be considered in a comprehensive model of these processes. Therefore, we also controlled for the role of three additional variables. To control for individual differences in empathy, which may particularly impact identification, empathic concern was included (Cohen, 2001). Additionally, enjoyment, which is related to appreciation (Oliver & Bartsch, 2010), and narrative engagement (Busselle & Bilandzic, 2009), which may be related to all three potential mediators, was controlled for (see Figure 2).

To sum up, the goal of this study was to examine how an interactive narrative, compared with a noninteractive narrative, impacts prosocial behavior, identification with the character, responsibility toward the character, and

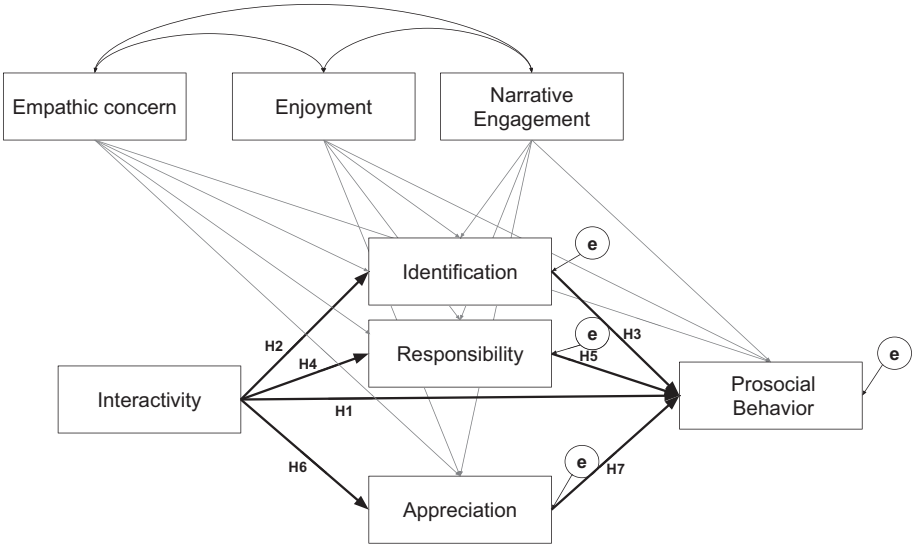

Figure 2. A model of the expected processes between interactivity and prosocial behavior. Lines in bold indicate hypotheses-relevant pathways.

appreciation of the narrative experience. Furthermore, we examined how these different variables in turn relate to prosocial behavior (see Figure 2). Thereby, the results offer a closer empirical examination of the theoretical model of Green and Jenkins (2014), as well as allowing a more sophisticated look at the relationship between interactivity and prosocial behavior.

Method

Ethics Statement

This research was registered with the Institutional Review Board of the authors' university. Written informed consent was obtained from all participants.

Design

To test our hypotheses, a between-subject experimental design was utilized. The independent variable was interactivity (interactive, noninteractive). The primary dependent variable was prosocial behavior, measured as the percentage of the reward that participants donated at the end of the study. The further dependent variables – expected to mediate the relationship between interactivity and prosocial behavior – were identification, responsibility, and appreciation. Empathic concern, enjoyment, and narrative engagement were added to the model as control variables.

An additional variable, text comprehension, served as a quality check and was analyzed across groups prior to testing the model, to ensure that interactivity did not affect participants' ability to understand the text.

Participants

To achieve an acceptable power for the specified model (see Figure 2), a sample of 580 was needed. To ensure we would conclude with a sufficient sample size, we aimed to recruit approximately 730 participants on the crowdsourcing platform CrowdFlower (http://www.crowdflower.com).[1] As recruitment over this platform was slow, Mechanical Turk was also included (https://www.mturk.com/mturk/).[2]

In all, 854 participants finished the study, of whom 796 correctly answered a bogus item ("This is a control item, please select 'completely disagree'"). To ensure data quality, an additional 162 participants were subsequently excluded, due to technical issues (n = 7), outliers (±3.00 *SD*) in completion time (n = 81), indicating that they had not carefully answered the study questions (n = 9), participating more than once (n = 25), and answering less than three out of six of the text comprehension questions correctly (n = 40). The final dataset consisted of a total sample of 634 participants (331 in the interactive, 303 in the noninteractive condition).

To ensure the samples collected on Mechanical Turk (n = 270) and CrowdFlower (n = 363) did not differ significantly in terms of the impact of interactivity on the

[1] Recruitment on CrowdFlower took place from June 2, 2016, to July 13, 2016.
[2] Recruitment on Mechanical Turk took place from July 8, 2016, to July 12, 2016.

dependent variables, a two-way multivariate analysis of variance (MANOVA) was conducted to examine the combined effects of platform and condition on identification, responsibility, appreciation, and donation. A significant main effect for condition was found ($p < .001$), but neither the main effect for platform, nor the interaction effect between platform and condition reached significance (p-values between .53 and .97). Therefore the two samples did not differ in terms of hypothesis-relevant effects.

To examine whether text comprehension differed between the interactive ($M = 5.27$, $SD = 0.62$) and noninteractive condition ($M = 5.25$, $SD = 0.93$), Welch's two-sample t test was conducted. No significant difference was found ($p = .419$).

As good English skills were essential for understanding the questionnaires and the stimulus material, we restricted recruitment to countries with English as a primary language. The majority of participants reported their nationality as US American ($n = 301$), Canadian ($n = 106$), or British ($n = 96$), with the remaining 131 reporting one of 31 other nationalities. Of the participants, 381 identified as female, 245 as male, three as transgender or non-binary, and four preferred not to say. Participants reported a wide variety of employment types, the largest groups being professional or managerial ($n = 268$), unemployed ($n = 111$), student ($n = 91$), blue collar or service ($n = 80$), and self-employed ($n = 84$).

Participants received US $0.2 for their participation, which they received after entering a code on CrowdFlower or Mechanical Turk that they were awarded at the end of the study. In addition, they received a reward of up to US $1 for carefully filling out the questionnaires and open questions, with respect to the aforementioned data quality checks. A percentage between 0% and 100% of this reward could be donated and served as our measure of prosocial behavior.

Stimuli

An interactive and a noninteractive version of a narrative were created using the authors' university webserver. Both versions contained the same story, told over 23 paragraphs. The text was based on the article "How I Became Homeless" (Marcus, 2014, December), which tells the story of how a single parent with three children becomes unexpectedly homeless and the struggles they face while trying to find a place to stay.

For the interactive condition, eight decisions were added (e.g., opening a letter immediately or waiting until the evening) and the original article's text was slightly modified (e.g., sentences were added in order to include the decisions). These decisions were designed to feel impactful, but at the same time to have a minimal impact on the narrative (e.g., choosing to open a letter a day later would lead to losing 1 day out of 4 for packing, but had no further impact on the story). However, to further ensure that the content of the specific decisions would not confound the effect of interactivity on our dependent variables, a yoked design was used. Therein, every time a participant in the interactive condition finished their version of the story based on their decisions, this version was saved and given to a participant in the noninteractive condition. This meant that the story was presented in as many different versions in the noninteractive condition as in the interactive condition. This "yoking" of the story version presented across conditions insured any differences between the two groups would be due to interactivity and not due to differences in the story or information presented.

The yoked design was implemented using Storyboard (Version 0.1), a software developed by the fifth author. The software utilizes a MySQL database and the PHP programming language. User interactions were recorded in our user tracking solution Datamice (Version 0.4) that was implemented with jQuery, PHP, Zend Framework, and MySQL.

An example of a noninteractive version of the story and the interactive story, as well as the code for the yoked design, can be viewed on the Open Science Framework website.[3]

Measures

Donating Behavior

Donating behavior was measured by asking participants which percentage of their participation reward they wished to donate to a charity. The charity chosen for this study was Habitat for Humanity, a nonprofit organization that aims to build and rehabilitate affordable houses around the world so as to help eliminate homelessness (http://www.habitat.org/). Participants chose the amount to donate from a drop-down list of ten-percent increments from 0% (no donation) to 100% (complete donation). This method was a slightly modified version of the method used by Steinemann et al. (2015), which informed participants of their reward in advance (instead of it being an unexpected bonus). This was done to increase the likelihood that participants would treat this money as their own (Clark, 2002). While US $1 was a fairly small amount of money, several previous studies have utilized this or similarly small amounts to examine donating behavior (e.g., Steinemann et al., 2015; Tsvetkova, Macy, & Szolnoki, 2014).

[3] Our project InteractiveNarratives can be accessed at https://osf.io/jstzv/

Responsibility

To measure responsibility, the 2-item scale by Jenkins (2014) was used (Cronbach's α = .95), which asks participants to which extent they feel responsible for the outcome of the story and the character's decisions.

All items for this and all following measures were presented on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

Identification With the Character and Empathic Concern

The 10-item identification scale by Cohen (2001) was used to measure identification with the main character (Cronbach's α = .92). The items for this as well as all following measures were modified to be applicable for both interactive and noninteractive narratives. To control for individual differences in empathy, the 7-item Empathic Concern subscale by Davis (1983) was used (Cronbach's α = .87).

Appreciation and Enjoyment

Appreciation (Cronbach's α = .88) and enjoyment (Cronbach's α = .89) were measured using the scale developed by Oliver and Bartsch (2010). This scale contains three items each for appreciation, that is, how meaningful, moving, and thought-provoking the story was, and enjoyment, that is, to which extent reading through the story was fun, considered a good time, and entertaining.

Narrative Engagement

To control for narrative engagement, the 12-item scale for narrative engagement developed by Busselle and Bilandzic (2009) was used (Cronbach's α = .85).

Text Comprehension

Based on the questionnaire originally developed for viewing comprehension by Hobbs and Frost (2003), a 6-item questionnaire was included to control for text comprehension. While the original questionnaire asked for open answers, considering our large sample size a multiple-choice format was used.

Procedure

After clicking on a link on CrowdFlower or Mechanical Turk, participants were informed on an introduction page of the approximate time that the study would take and that they would be receiving a US $1 reward for careful completion of the study, next to the upfront payment of US $0.2. Next, participants were asked to fill out the questionnaire for empathic concern. Following this, participants were randomly assigned to one of the experimental conditions. Afterward, participants were asked to fill out the identification, responsibility, appreciation, enjoyment, and narrative engagement questionnaires. Next, participants were thanked and told that they now had the opportunity to donate a percentage of their US $1 reward to a charity. The percentage they chose to keep for themselves was later given to them as a bonus on CrowdFlower or Mechanical Turk; the percentage they wished to have donated was donated to the charity. Finally, participants were asked to fill out the text comprehension questionnaire and demographic questions (including a 1-item question on whether they had experienced circumstances similar to the ones described in the narrative), thanked a second time, and given a code to enter on their respective crowdsourcing platform in order to receive their compensation and reward.[4]

Results

The dataset and R script used in this analysis can be found on the Open Science Framework.[5]

Preliminary Analysis

Using boxplots, univariate outliers were detected for empathic concern, narrative engagement, identification, and appreciation. These variables were subsequently winsorized (threshold: 95%) to minimize the influence of the outliers on the statistical estimates.

Inspecting normal Q-Q plots, the distributions of donation and responsibility were found to be substantially non-normally distributed. Additionally, inspection of the scatterplots of the standardized residuals against the standardized predicted scores indicated the presence of heteroscedasticity among residuals, likely due to the non-normal distribution of donation and responsibility (Kline, 2011). Therefore, subsequent analyses were conducted using bootstrapping and Spearman's rank correlation, as they are robust to violations of normality. Examination of the scatterplots indicated that all visible relations between the outcome variables were linear.

Means and standard deviations for all dependent and control variables across the two levels of interactivity are listed in Table 1. Participants in both conditions donated approximately 30% of their reward to the charity, which

[4] In order to donate and pay out the correct amounts to participants, participants received different codes depending on the amount they had chosen to donate.

[5] InteractiveNarratives (https://osf.io/jstzv/)

Table 1. Descriptive statistics: means and standard deviations by condition

	Noninteractive Narrative	Interactive Narrative
Variable	*M* (*SD*)	*M* (*SD*)
Percentage Donated	29.47 (37.35)	31.21 (38.10)
Responsibility	2.22 (1.48)	3.09 (1.83)
Identification	5.58 (0.94)	5.57 (0.94)
Appreciation	5.85 (0.95)	5.81 (0.97)
Empathic Concern	5.21 (1.02)	5.24 (1.05)
Enjoyment	4.46 (1.46)	4.69 (1.60)
Narrative Engagement	5.28 (0.91)	5.31 (0.90)

resulted in a total donation of US $214 for Habitat for Humanity. Further, the high values for identification and appreciation indicated that in both conditions, participants identified strongly with the character and found the story to be meaningful. Spearman's rank correlations are listed in Table 2. Of special note are the high correlations between appreciation, identification, and narrative engagement, contrasted with the fairly low correlations with donation.

Model Estimation

To test H1–H7 (Figure 2), a path analysis model was estimated with R (R Core Team, 2016) and the package lavaan (Rosseel, 2012), using standard error-bootstrapping and Satorra–Bentler correction due to non-normality (Kline, 2011).

Inspection of the fit indices showed the resulting model to have a good fit, $\chi^2 = 3.68$, $df = 3$, $p = .299$, comparative fit index (CFI) = .99, root mean square of approximation (RMSEA) = .02, 90% CI [.00, .07]. This model can be seen in Figure 3.

Next, the importance of the control variables empathic concern, enjoyment, and narrative engagement was examined by trimming the paths between them and the dependent variables. A χ^2 difference test determined that the trimming of these paths resulted in a significantly poorer fit ($\chi^2_{diff} = 927$, $df_{diff} = 15$, $p < .001$). Therefore, the original model was retained.

Despite the high covariance between identification, appreciation, and narrative engagement, multicollinearity was within acceptable ranges (VIF between 2.40 and 3.14, tolerance values between .32 and .42; Field, Miles, & Field, 2013).

Confirmatory Analysis

Hypotheses were tested using the estimated model (Figure 3). Our first hypothesis predicted that interactivity would lead to a higher percentage donated. This was not supported (β = .02, $b = 0.01$, $SE = 0.03$, $p = .696$). H2 and H3 predicted that interactivity would lead to more identification, which in turn would lead to a higher percentage donated. H2 was not supported (β = −.03, $b = -0.06$, $SE = 0.05$, $p = .169$), whereas for H3 a significant relationship in the opposite direction was found, with identification being negatively related to percentage donated (β = −.17, $b = -0.07$, $SE = 0.03$, $p = .013$). H4 and H5 predicted that interactivity would lead to more responsibility, which in turn would be related to a higher percentage donated.

H4 was supported (β = .23, $b = 0.80$, $SE = 0.12$, $p < .001$), while H5 was not (β = .08, $b = 0.02$, $SE = 0.01$, $p = .08$). H6 and H7 predicted that interactivity would lead to more appreciation, which in turn would be related to a higher percentage donated. H6 was not supported (β = −.05, $b = -0.10$, $SE = 0.05$, $p = .056$); however, H7 was supported (β = .17, $b = 0.07$, $SE = 0.02$, $p = .005$). An overview of all hypotheses and corresponding results can be seen in Table 3.

Exploratory Analysis

As 148 participants (23.30% of the study sample) indicated that they had themselves experienced circumstances similar to the ones described in the narrative, we added "experienced similar circumstances" (*yes/no*) as a further control variable into the model, as this may have simultaneously facilitated identification with the character in the story, while also making participants less likely to donate as they might still be in more difficult financial circumstances than someone who had never experienced similar circumstances. The resulting model had a good fit, $\chi^2 = 3.82$, $df = 4$, $p = .431$, CFI = 1.00, RMSEA = .00, 90% CI [.00, .06]. Of particular interest is the finding that the previously negative relationship between identification and donation was no longer significant in this model ($\beta = -.12$, $b = -0.05$, $SE = 0.03$, $p = .112$), but that instead having experienced similar circumstances was significantly negatively related to donation (β = −.13, $b = -0.11$, $SE = 0.03$, $p = .001$).

To further improve the model, the nonsignificant paths between experienced similar circumstances and appreciation and responsibility as well as the nonsignificant covariance between experienced similar circumstances and enjoyment were trimmed. A χ^2 difference test showed this to not significantly reduce the model fit ($\chi^2 = 3.33$, $df_{diff} = 3$, $p = .34$). Next, the nonsignificant paths from interactivity to identification, appreciation, and donation as well as the nonsignificant paths from identification to donation, responsibility to donation, empathic concern to donation, and narrative engagement to responsibility were trimmed. A χ^2 difference test showed this trimming to likewise not

Table 2. Spearman's rank-order correlations between Empathic Concern, Narrative Engagement, Enjoyment, Appreciation, Identification, Responsibility and Percentage Donated

Variables	Empathic Concern	Narrative Engagement	Enjoyment	Appreciation	Identification	Responsibility
Narrative Engagement	.53***					
Enjoyment	.14***	.26***				
Appreciation	.49***	.69***	.39***			
Identification	.55***	.73***	.33***	.77***		
Responsibility	.11**	.13***	.25***	.20***	.25***	
Donation	.11**	.19***	−.09*	.15***	.10**	.08*

Note. *$p < .05$; **$p < .01$; ***$p < .001$.

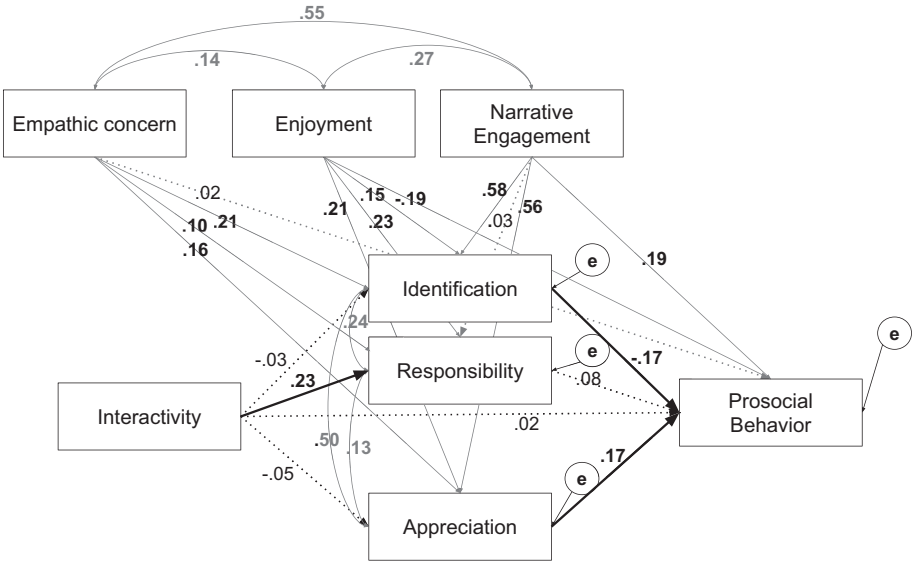

Figure 3. Structural equation model of the processes between interactivity and prosocial behavior examined in the confirmatory analysis including standardized estimates of direct effects. Dotted lines indicate nonsignificant pathways.

significantly reduce the model fit (χ^2 = 12.7, df_{diff} = 10, p = .239).

The resulting model fit was good, χ^2 = 16.60, df = 14, p = .278, CFI = 0.998, RMSEA = .02, 90% CI [.00, .04]. This exploratory model can be seen in Figure 4.[6]

Discussion

This study aimed to investigate how and why interactive narratives may impact prosocial behavior. Of the variables examined, responsibility alone was impacted by interactivity. Prosocial behavior was positively related to appreciation and narrative engagement and negatively related to enjoyment, and (in the confirmatory analysis) with identification. Responsibility and empathic concern were not significantly related to prosocial behavior. Narrative engagement was strongly related to both identification and appreciation.

The clearest result found was that interactivity in the form examined did not impact the percentage donated. These findings are in contrast to those previously found in other studies (Green & Jenkins, 2014; Peng et al., 2010; Ruggiero, 2015; Steinemann et al., 2015).

One possible explanation is that the experimental manipulation of interactivity did not work. However, considering that here interactivity was defined merely in terms of the ability to allow decision-making, which the story did, and the finding that participants did experience more responsibility for the story and the character, which have previously been strongly associated with interactivity (Green & Jenkins, 2014), the conditions did appear to differ, at least in these most basic respects.

[6] Further analysis conducted included analysis of variance for all four outcome variables, which found the same effects as the pathway analysis (i.e., responsibility was the only variable that was significantly different across the conditions of interactivity) and a multiple group analysis to test for a moderation effect of "experienced similar circumstances," which, however, found no significant differences in model fit. More information on these analyses can be found on the Open Science Framework.

Table 3. Overview of hypotheses, exploratory analyses, and corresponding results

Confirmatory Analysis			
Hypothesis		Finding	Hypothesis confirmed
H1	Interactivity will lead to a higher percentage donated	βH1 = .02	No
H2	Interactivity will lead to more identification with the character	βH2 = −.03	No
H3	Identification will be positively related to a higher percentage donated	βH3 = −.17	No
H4	Interactivity will lead to more responsibility	βH4 = .23	Yes
H5	Responsibility will be positively related to a higher percentage donated	βH5 = .08	No
H6	Interactivity will lead to more appreciation	βH6 = −.05	No
H7	Appreciation will be positively related to a higher percentage donated	βH7 = .17	Yes
Exploratory Analysis			
Research Question		Finding	Supported
RQ 1	Does experiencing similar circumstances impact the percentage donated?	βRQ1 = −.13	Yes

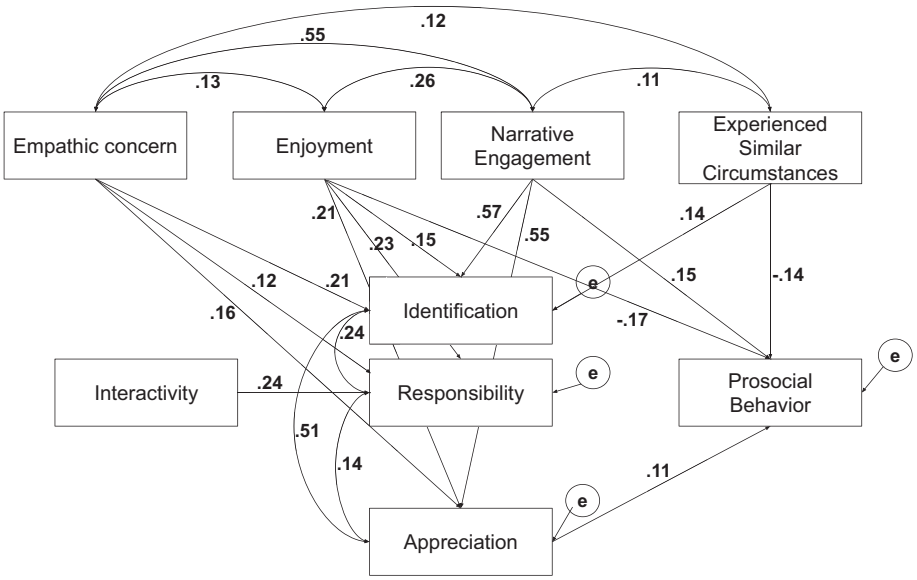

Figure 4. Structural equation model of the processes between interactivity and prosocial behavior examined in the exploratory analysis including standardized estimates of direct effects.

If, therefore, the conditions can be argued to differ in terms of interactivity, but the effects of interactivity were not comparable to those found in other studies on prosocial behavior and attitudes, it begs the question of whether the form of interactivity examined across these studies may have differed in fundamental ways, which would account for these differences.

To attempt to answer this question, we take a closer look at the stimuli used in this study compared with studies that have previously found interactivity to affect prosocial behavior and attitudes (Peng et al., 2010; Ruggiero, 2015; Steinemann et al., 2015). In the current study, a noninteractive article about a single parent who becomes homeless was used as a basis, to which interactive elements were added to examine the difference between an interactive and noninteractive story. The actions included options such as deciding whether to stay with one's mother or one's best friend, or how to respond to uncomfortable questions asked by coworkers. The interactive narrative ended for all players with a friend offering them and their children a place to stay for as long as they wished. While these decisions were designed to feel meaningful, they differed notably from the decisions in the interactive conditions used in the study by Peng et al. (2010), Ruggiero (2015), and Steinemann et al. (2015), who utilized the games for change *Spent* or *Darfur Is Dying*. In *Darfur Is Dying*, the player takes up the role of a person living in a refugee camp, who must venture out of the camp while having to avoid being captured by the militia patrolling the area. In *Spent*, the player is a single parent who recently lost their job and must try and survive the month on US $1,000, while facing difficult choices, such as whether or not to send their child

to an expensive gifted program. While these games tackle separate issues using different design approaches, they do have two crucial factors in common. First, almost every decision in the game had drastic consequences – either bringing the player ever closer to being caught by the militia or running out of money. Often, one wrong decision could mean losing the game. Second, both games are quite difficult; in Steinemann et al. (2015) for example, the vast majority of players of *Darfur Is Dying* lost the game. Contrasted with the far less severe consequences of choosing to stay with one's mother or a friend and ultimately ending up in a safe and stable environment, it could be argued that the decisions made in games such as *Darfur Is Dying* and *Spent* could be experienced as far more important and meaningful. Described in terms used by Green and Jenkins (2014), user control over the narrative structure was likely more strongly felt when players could see the clear consequences of their actions. This is supported by previous research that has found that inspirational and motivational video clips were only associated with increased prosocial behavior when combined with perceived choice (Ellithorpe, Ewoldsen, & Oliver, 2015). Yet another study found that participants were more satisfied making decisions instead of having a decision made for them only when they clearly could differentiate between two options and that only the differentiated options led to a higher sense of responsibility (Botti & McGill, 2006). In the current study, while responsibility did differ between the interactive and noninteractive conditions, responsibility in neither condition was particularly high. The low sense of responsibility even in the interactive narrative could well be due to the fact that decisions were rarely followed by clear consequences, for example, opening the letter in the morning instead of the evening led to a day less time to pack, but had no further consequence or lasting repercussions.

Furthermore, the most important positive relationships with prosocial behavior were engagement with and appreciation for the narrative. We first hypothesized that interactivity would lead to more appreciation (Elson et al., 2014; Oliver et al., 2015; Steinemann et al., 2015) and this in turn would relate to more prosocial behavior (Morgan et al., 2009; Myrick & Oliver, 2015; Small & Simonsohn, 2008). Perhaps, however, the concept of interactivity should be considered in more nuanced terms than this, in that interactivity can lead to more appreciation by the meaningfulness of the decisions this interactivity entails. In other words, the more meaningful interactivity is perceived, the more appreciation is felt and the more this will in turn lead to prosocial behavior.

While further research comparing different forms of interactive narrative is necessary, the present findings suggest that interactivity is more complex than simply adding decisions to a story. Taken together, the differences between interactive narratives used in the current study and those used by Peng et al. (2010), Ruggiero (2015), and Steinemann et al. (2015) imply that decisions must feel meaningful and offer clear consequences with emotional ramifications for the player. To be more effective than their noninteractive counterparts, the interactive narrative must be capable of impacting variables such as appreciation and narrative engagement.

Another possible explanation for the failure to find a relationship between interactivity and prosocial behavior could be that interactivity does in fact *not* lead to an increase in prosocial behavior. Arguably, previous studies have suffered from methodological drawbacks, with the studies of both Peng et al. (2010) and Steinemann et al. (2015) being underpowered, which may have led to an over-estimation of effects (Button et al., 2013). Furthermore, to our knowledge no previous studies examining the effects of interactivity on prosocial behavior or attitudes have utilized a yoked design (e.g., Peng et al., 2010; Ruggiero, 2015; Steinemann et al., 2015). Yoked designs have been used in the past to allow for conclusive results on the effects of interactivity on a number of topics from neural activation (Cole, Yoo, & Knutson, 2012) to learning performance (Kickmeier-Rust, Marte, Linek, Lalonde, & Albert, 2008) to the amount of voluntary reading children with dyslexia are willing to do (Ward, McKeown, Utay, Medvedeva, & Crowley, 2012). When the interactive and noninteractive condition are not yoked, it becomes difficult to ensure that any differences between the conditions are truly due to interactivity and not due to differences in the information presented in the conditions. Owing to the high power of the present study, its employment of a yoked design, as well as the use of a preregistered confirmatory analysis, the finding that interactivity does not impact prosocial behavior – at least under the conditions used in this study – can be assumed to be robust. To examine whether interactivity affects prosocial behavior under other conditions, future studies should therefore aim both for sufficient power and, importantly, for the use of a yoked design. Preregistry of confirmatory analysis is recommendable for research across fields.

While interactivity failed to impact any processes save responsibility in the estimated model, a number of interesting effects between the examined psychological processes and prosocial behavior were observed. For one, the positive relationship between appreciation and prosocial behavior corroborates previous findings (Steinemann et al., 2015), further establishing appreciation as an important experience to consider when designing for prosocial behavior in contexts such as, but not limited to, games for change. The previously unexamined positive relationship between narrative engagement and prosocial behavior suggests an interesting factor to keep in mind in further research.

The negative effect of identification on prosocial behavior was unexpected. The exploratory analysis provided a possible explanation, as having oneself experienced similar circumstances to those depicted in the narrative was associated both with higher identification with the character and a smaller donation. Including this variable in the model led the negative relationship between identification and prosocial behavior to disappear. A possible interpretation could be that having experienced similar circumstances to those of a homeless family might be associated with an increased chance of still being in difficult circumstances, potentially needing the money more, and therefore being less willing to donate. It is also possible that in the context of the story used in this study, experiencing similar circumstances, and thereby identifying more with the character, affected donations negatively, because participants who had experienced similar circumstances in the past did not believe that donations to charities would necessarily improve the situation of the person affected. In future studies, it may therefore be worth controlling for perceived efficacy of proposed solutions. However, even controlling for the effect of previous experience, the hypothesized positive relationship between identification and prosocial behavior was not observed in the model. Considering that instead appreciation and narrative engagement were related to prosocial behavior, this may suggest that, at least under certain circumstances, a narrative's meaningfulness and its ability to engage the reader may perhaps be more important for promoting prosocial behavior than character identification is (Bartsch, Kalch, & Oliver, 2014; Small & Simonsohn, 2008). Put differently, a reader could identify with a character or a character's action, but would not necessarily think of the issue as meaningful or engaging enough to donate.

Enjoyment being negatively related to prosocial behavior, while appreciation was positively related, further supports the differentiation between these two forms of media experience (Oliver & Bartsch, 2010). For games for change, the findings that the less fun and entertaining, yet the more meaningful and moving the experience is, the more people will donate at the end, hints at the importance of focusing on creating experiences that are appreciated rather than enjoyed (Bartsch et al., 2014; Myrick & Oliver, 2015; Steinemann et al., 2015). This finding comes, however, with the caveat that this is solely related to whether people will donate. Other experiences, such as willingness to share the interactive narrative with other people or starting to play in the first place, may be impacted by the degree of enjoyment experienced or expected to be experienced (Cohen, 2014). Further research on the impact of appreciation and enjoyment on prosocial behavior other than donating is therefore recommended.

Limitations and Outlook

While this study offers several promising findings, it also has clear limitations. Most importantly, the main question of this study of how and why interactivity impacts prosocial behavior presupposed that a significant impact of interactivity on prosocial behavior would be found. As this was not the case, mediation effects could not be observed. While these remain interesting research questions, the findings of this study as they were observed may offer valuable insights into why interactivity may work in some cases but not in others. Future studies on the relationship between interactive narratives and prosocial behavior should therefore carefully consider how interactivity is manipulated, in particular whether the decisions are considered meaningful by participants.

Furthermore, the high values for appreciation and identification may have led to a ceiling effect, which would make differentiating between experimental conditions more difficult and therefore may have impeded the analysis. However, while not the main focus of the study, the positive relationship of appreciation, narrative engagement, and prosocial behavior suggests interesting avenues for future research on interactive narratives. For example, the possibility of losing and facing negative consequences when wrong decisions are made, or the simple uncertainty of the outcome and the resulting suspense, may be crucial factors worth future study (Hall, 2015; Ruggiero & Becker, 2015).

Conclusion

The results of this study support the importance of appreciation, enjoyment, and narrative engagement in the context of media trying to further prosocial behavior.

The results, however, also indicate that the relationship between interactivity and prosocial behavior may not be as simple as previously assumed. We argue that examination of further interactivity-related variables, such as the emotional consequences of decisions made, as well as the outcome of the story (i.e., whether one can lose or experience a negative outcome), may be crucial elements when creating interactive narratives with the goal of encouraging prosocial behavior. Lastly, while donating behavior as an instrumentalization of prosocial behavior is both relevant and meaningful, other behavioral consequences of interacting with narratives, for example, how willing people are to share the narrative with friends or to start reading the narrative in the first place, may offer interesting themes for future research.

Acknowledgments

We would like to sincerely thank Markus Stöcklin, Mathias Jenny, and Michelle Wobmann for their valuable advice and assistance. Furthermore we would like to express our warmest gratitude to the editors, Malte Elson and Andrew K. Przybylski, and to the anonymous reviewers, who throughout the development phases of this preregistered research offered careful, competent, and extremely helpful feedback.

References

Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (1996). Mechanisms of moral disengagement in the exercise of moral agency. *Journal of Personality and Social Psychology, 71*(2), 364.

Bartsch, A., Kalch, A., & Oliver, M. B. (2014). Moved to think: The role of emotional media experiences in stimulating reflective thoughts. *Journal of Media Psychology, 26*(3), 125.

Botti, S., & McGill, A. L. (2006). When choosing is not deciding: The effect of perceived responsibility on satisfaction. *Journal of Consumer Research, 33*(2), 211–219.

Bucy, E. P., & Tao, C.-C. (2007). The mediated moderation model of interactivity. *Media Psychology, 9*(3), 647–672.

Busselle, R., & Bilandzic, H. (2009). Measuring narrative engagement. *Media Psychology, 12*(4), 321–347.

Button, K. S., Ioannidis, J. P., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S., & Munafò, M. R. (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience, 14*(5), 365–376.

Čehajić, S., Brown, R., & González, R. (2009). What do I care? Perceived ingroup responsibility and dehumanization as predictors of empathy felt for the victim group. *Group Processes & Intergroup Relations, 12*(6), 715–729.

Clark, J. (2002). House money effects in public good experiments. *Experimental Economics, 5*(3), 223–231.

Cohen, E. L. (2014). What makes good games go viral? The role of technology use, efficacy, emotion and enjoyment in players' decision to share a prosocial digital game. *Computers in Human Behavior, 33*, 321–329.

Cohen, J. (2001). Defining identification: A theoretical look at the identification of audiences with media characters. *Mass Communication & Society, 4*(3), 245–264.

Cole, S. W., Yoo, D. J., & Knutson, B. (2012). Interactivity and reward-related neural activation during a serious videogame. *PLoS One, 7*(3), e33909. doi: 10.1371/journal.pone.0033909

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*(1), 113.

Eisenberg, N., & Miller, P. A. (1987). The relation of empathy to prosocial and related behaviors. *Psychological Bulletin, 101*(1), 91.

Ellithorpe, M. E., Ewoldsen, D. R., & Oliver, M. B. (2015). Elevation (sometimes) increases altruism: Choice and number of outcomes in elevating media effects. *Psychology of Popular Media Culture, 4*(3), 236.

Elson, M., Breuer, J., Ivory, J. D., & Quandt, T. (2014). More than stories with buttons: Narrative, mechanics, and context as determinants of player experience in digital games. *Journal of Communication, 64*(3), 521–542.

Field, A., Miles, J., & Field, Z. (2013). *Discovering statistics using r*. London, UK: Sage.

Green, M. C., & Jenkins, K. M. (2014). Interactive narratives: Processes and outcomes in user-directed stories. *Journal of Communication, 64*(3), 479–500.

Hall, A. E. (2015). Entertainment-oriented gratifications of sports media: Contributors to suspense, hedonic enjoyment, and appreciation. *Journal of Broadcasting & Electronic Media, 59*(2), 259–277.

Hobbs, R., & Frost, R. (2003). Measuring the acquisition of media-literacy skills. *Reading Research Quarterly, 38*(3), 330–355.

Hogg, M. A. (2003). *Social identity*. New York, NY: Guilford Press.

Jenkins, K. M. (2014). *Choose your own adventure: Interactive narratives and attitude change*, (Unpublished doctoral dissertation). The University of North Carolina at Chapel Hill.

Kampf, R., & Stolero, N. (2015). Computerized simulation of the Israeli–Palestinian conflict, knowledge gap, and news media use. *InformationCommunication & Society, 18*(6), 644–658.

Kickmeier-Rust, M. D., Marte, B., Linek, S., Lalonde, T., & Albert, D. (2008). The effects of individualized feedback in digital educational games. In T. Conolly & M. Stansfield (Eds.), *Proceedings of the 2nd European Conference on Games Based Learning* (pp. 227–236). Barcelona, Spain: Academic Publishing.

Klimmt, C. (2009). Serious games and social change: Why they (should) work. In U. Ritterfeld, M. Cody, & P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 248–270). New York, NY: Routledge.

Kline, R. B. (2011). *Principles and practice of structural equation modeling*. New York, NY: Guilford Publications.

Marcus, M. (2014, December). *How I became homeless*. Retrieved from http://www.salon.com/2014/12/25/how_i_became_homeless

Morgan, S. E., Movius, L., & Cody, M. J. (2009). The power of narratives: The effect of entertainment television organ donation storylines on the attitudes, knowledge, and behaviors of donors and nondonors. *Journal of Communication, 59*(1), 135–151.

Myrick, J. G., & Oliver, M. B. (2015). Laughing and crying: Mixed emotions, compassion, and the effectiveness of a YouTube PSA about skin cancer. *Health Communication, 30*(8), 820–829.

Oliver, M. B., & Bartsch, A. (2010). Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication Research, 36*(1), 53–81.

Oliver, M. B., Bowman, N. D., Woolley, J. K., Rogers., R, Sherrick, B. I., & Chung, M.-Y. (2015). Video games as meaningful entertainment experiences. Advance online publication. *Psychology of Popular Media Culture*, 1–16. doi: 10.1037/ppm0000066

Peng, W., Lee, M., & Heeter, C. (2010). The effects of a serious game on role-taking and willingness to help. *Journal of Communication, 60*(4), 723–742.

R Core Team. (2016). *R: A language and environment for statistical computing* [Computer software manual]. Vienna, Austria: Retrieved from https://www.R-project.org/

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1–36. Retrieved from http://www.jstatsoft.org/v48/i02/

Ruggiero, D. (2015). The effect of a persuasive social impact game on affective learning and attitude. *Computers in Human Behavior, 45*, 213–221.

Ruggiero, D., & Becker, K. (2015). Games you can't win. *The Computer Games Journal, 4*(3–4), 169–186.

Small, D. A., & Simonsohn, U. (2008). Friends of victims: Personal experience and prosocial behavior. *Journal of Consumer Research, 35*(3), 532–542.

Steinemann, S. T., Mekler, E. D., & Opwis, K. (2015). Increasing donating behavior through a game for change: The role of interactivity and appreciation. *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play* (pp. 319–329). New York, NY: ACM.

Sundar, S. S. (2009). Media effects 2.0: Social and psychological effects of communication technologies. In R. L. Nabi & M. B. Olives (Eds.), *The Sage handbook of media processes and effects* (pp. 545–560). Thousand Oaks, CA: Sage Publications.

Tsvetkova, M., Macy, M. W., & Szolnoki, A. (2014). The social contagion of generosity. *PloS one, 9*(2).

Vorderer, P., Knobloch, S., & Schramm, H. (2001). Does entertainment suffer from interactivity? the impact of watching an interactive TV movie on viewers' experience of entertainment. *Media Psychology, 3*(4), 343–363.

Ward, A., McKeown, M., Utay, C., Medvedeva, O., & Crowley, R. (2012). Interactive stories and motivation to read in the raft dyslexia fluency tutor. In Y. Nakano, M. Neff, A. Paiva, & M. Walker (Eds.), *International Conference on Intelligent Virtual Agents* (pp. 260–267). Berlin, Germany: Springer.

Received January 15, 2016
Revision received December 14, 2016
Accepted December 15, 2016
Published online March 21, 2017

Sharon T. Steinemann
Center for Cognitive Psychology and Methodology
University of Basel
Missionsstrasse 62a
4055 Basel
Switzerland
sharon.steinemann@unibas.ch

Sharon Steinemann is a research assistant and PhD candidate in the Human-Computer Interaction Lab at the Center for Cognitive Psychology and Methodology at the University of Basel. Her research interests focus on the impact of interactive media on prosocial behavior and attitude change and understanding the psychological processes involved.

Glena Iten is a research assistant and PhD candidate in the Human-Computer Interaction Lab at the Center for Cognitive Psychology and Methodology at the University of Basel. Her research interests focus on media recovery, moral reasoning in games, and applied cognitive psychology.

Klaus Opwis is a Full Professor for Cognitive Psychology and Methodology at the University of Basel. His research interests focus on applied cognitive psychology (e.g., training of working memory, HCI, aesthetics, and visual perception) and on methodological topics (e.g., measurement theory, structural equation models).

Seamus Forde is a HCI Master's student and research assistant at the HCI research group at the University of Basel. His research interests focus on computer games, gamification, and motivation.

Lars Frasseck is a research associate and software engineer at the Department of Psychology at the University of Basel. His research interests focus on web software as means for data collection and analysis in psychological studies.

Elisa Mekler is a post-doctoral fellow at the HCI Games Group at the University of Waterloo. Her research focuses on the characteristics of enjoyable and meaningful user experiences with games, gamification, and interactive technology in general. She is particularly interested in the value of emotional experiences with technology and their potential to motivate attitude and behavior change.

Choosing to Help Monsters: A Mixed-Method Examination of Meaningful Choices in Narrative-Rich Games and Interactive Narratives

Glena H. Iten, Sharon T. Steinemann, Klaus Opwis
University of Basel, Department of Psychology, Center for Cognitive Psychology & Methodology
Missionsstrasse 62a, 4055 Basel, Switzerland
glena.iten@unibas.ch, sharon.steinemann@unibas.ch, klaus.opwis@unibas.ch

ABSTRACT

UPDATED—January 8, 2018. The potential of narrative-rich games to impact emotions, attitudes, and behavior brings with it exciting opportunities and implications within both entertainment and serious game contexts. However, effects are not always consistent, potentially due to game choices not always being perceived as meaningful by the players. To examine these perceptual variations, we used a mixed-method approach. A qualitative study first investigated meaningful game choices from the players' perspectives. Building on the themes developed in this first study, a quantitative study experimentally examined the effect of meaningful game choices on player experiences of appreciation, enjoyment, and narrative engagement. Results highlight the importance of moral, social, and consequential characteristics in creating meaningful game choices, which positively affected appreciation. Meaningfulness of game choices may therefore be crucial for narrative-rich games and interactive narratives to impact players.

ACM Classification Keywords

J.4 Social and Behavioral Sciences: Sociology, Psychology; K.8.0 Personal Computing: Games

Author Keywords

Meaningful Choice; Appreciation; Games Narrative; Player Experience.

Please note that this paper contains spoilers for several games.

INTRODUCTION

Much has been written about the potential of games to evoke emotions [4, 14, 16], change attitudes [31], or even influence behavior [6, 14]. Games can make people laugh, cry, or think [4]. They have been found to change attitudes towards minorities [31] and observed to encourage healthy living [12, 18] and prosocial behavior [38]. Compared to other forms of media, games can uniquely use the power of interactivity to allow for an engagement with their content that otherwise might not have been possible. Looking specifically at interactivity operationalized as making choices in narrative-rich games and interactive narratives, Elson et al. [11] argue that the ability of games to enable players to create stories personalized to their own values and wishes, allows for an experience less likely to be available to other forms of media, such as films or television. However, research has found mixed results when examining the effects of interactivity. On the one hand, findings, such as the above-mentioned effect of games on attitude change [31] or prosocial behavior [38], were causally linked to the games' interactivity, as both studies experimentally compared interactive (the game) with non-interactive narratives (a text or a film with similar [31] or identical [38] content). In contrast however, a large-scale pre-registered experimental study found no effect of narrative interactivity on narrative engagement, identification with the character, or behavior [37]. Similarly, a study on moral choices in a post-apocalyptic narrative found no effect of interactivity on enjoyment, meaningfulness, or attachment to the character [35]. These results suggest that simply adding narrative choices as a feature of interactivity may not lead to beneficial outcomes. While the existence of mixed results does not devalue the potential of interactive narrative-rich games to produce desired outcomes, it may indicate that without further knowledge of why some of the previous research on choices in games finds effects and some does not, expecting games to have benefits beyond that of non-interactive media may amount to an often-times unfruitful gamble. A primary goal of this paper therefore will be to shed light on when narrative interactivity, that is making choices in narrative-rich games, may lead to effects and when it will not.

A first step in this direction is to clarify what is understood by making choices as a feature of interactivity in narrative-rich games. While previous research investigated interactivity operationalized as making choices in a variety of different narrative-rich games [31, 35, 38, 37], interactivity as an overall concept has received much attention and is widely discussed in HCI games research (e.g., [3, 9, 10, 33]). For instance, Crawford's definition of interactivity in interactive storytelling [10] focuses on the cyclic process between the player and the game as a system where good listening, speaking and thinking define a good interaction. Similar to Salen and Zimmerman [33], Bogost [3] defines interaction in games as players explor-

CHI 2018, April 21–26, 2018, Montréal, QC, Canada.

http://dx.doi.org/10.1145/3173574.3173915

ing possible manipulations of the game and its rules. If well designed, a choice, that players make within these rules, can be an example of a good manipulation [3]. In sum, the need to make choices can add to the interactivity of the game [10] and is even defined as a most basic interactive feature that makes a media into a game [9, 11, 15]. The question follows, when choices result in a good interaction. Bogost [3] addresses this issue within the context of persuasive games in that a game is most persuasive – and hence good – if players do not just randomly select options without mental effort, but they are provoked to think as a result of making choices. Notable for narrative-rich games is that effects of narrative interactivity have been found to be largely independent of visual representations and can therefore be examined using text-based games [38] and game prototypes [5]. Therefore, in this paper we focus on choices being made in narrative-rich games.

Steinemann et al. [37] argued that for interactivity, defined here as making narrative choices, to have an effect, these choices must be perceived as meaningful. With this they meant that players must perceive the choice as important enough to lead to a different experience than if they had been passively reading or watching the same narrative. In this study, the narrative focused on a person who became homeless. While this narrative may in itself have been perceived as meaningful, the choices used may well not have been, as they centered mostly around the order in which to stay with friends and relatives and often-times had little to no consequences on the further course of the narrative. In contrast, the narrative used by Ruggiero [31] followed a person who must survive on $1000 for a month, with each difficult choice, such as whether or not to pay for medication for a sick parent, severely affecting the course of the game and its outcome. Similarly, Steinemann et al. [38] used the game *Darfur is Dying* [G21] about a Darfurian refugee child named Poni, who must leave the refugee camp and brave the dangers outside to bring back water for her family. Here too, each choice of which direction to run, or whether to hide, had immediate consequences and could mean the capture of Poni and the end of the game. Relatedly, Salen and Zimmerman [33] define play as a meaningful interactivity if the interaction between player's action and the games' outcome results in meaning. As in this current study we want to evaluate whether play is meaningful and therefore the interaction is good enough to persuade players [3], we focused on Salen and Zimmerman's *integrated evaluative meaningful play* [33], because it implies that the game can be successful if players react in an emotionally meaningful way to the outcome of their interaction within the game. Oliver and Bartsch [26, 2] also focus on emotional and cognitive reactions within the experience of meaningfulness called appreciation. It could therefore be interesting to empirically investigate whether choices in narrative-rich games lead to meaningful experiences if they and their consequences evoke emotional and cognitive reactions that are also perceived as meaningful by players.

Supporting the argument that the effect of narrative interactivity may be related to the meaningfulness of choices, are the results in the study on *Darfur is Dying* [G21], where the effect of interactivity on behavior was mediated by appreciation [38]. Appreciation is a measure for the extent to which a media experience is meaningful in the sense that it is thought-provoking, emotionally moving, and insightful [2, 25]. Appreciation was also measured in the study covering the narrative of a homeless person [37], in which appreciation was once again related to behavior, but, akin to behavior, was not impacted by the interactivity in that particular narrative [37]. A further goal of this present study therefore is to understand what characteristics make narrative game choices meaningful in that they lead to a higher appreciation.

THEORETICAL BACKGROUND

Meaningful choices in games have been the subject of a focused analysis in entertainment research conducted by Nay and Zagal [24]. In this analysis it is postulated that meaningful choices in games often take the form of moral choices that can create ethical player experiences, through which the player can significantly impact the course of the game. That these choices have clear consequences is often argued to be a crucial factor in their being perceived as meaningful [34, 39]. However, the importance of consequences is also under debate, as opponents argue that more crucial than manifested consequences, is the choice itself and what it signifies to the player [24, 22, 36]. For example, if in *The Walking Dead* [G16] players must decide whether to let a wounded animal suffer or to kill it quickly, as argued by Nay and Zagal [24], the outcome would be the same, however the choice is meaningful, due to how this choice reflects on how players see their character, or even themselves.

While antecedents and effects of meaningful choices in games have, to our knowledge, so far not been empirically examined, there is a wealth of interdisciplinary research on the perception of choice on the one hand, and experiences of meaningfulness in games on the other that can inform our understanding. In a study examining the impact of emotionally moving games on player experience, Bopp et al. [4] found particularly strong feelings of sadness, such as loss due to the death of a character, as well as mixed affect to be related to feelings of meaningfulness in games. Further predictors of appreciation were feelings of contemplativeness, such as when the player paused to consider what they would personally have done in the same situation. In a study directly comparing fun and meaningful game experiences, Oliver et al. [26] highlighted the importance of social connection for meaningful experiences. In a related study, Rogers et al. [30] found meaningfulness to be related to rich narratives, connecting with other players and in-game characters, the depth of the characters, and feelings of accomplishment. Beyond this, the argument for the importance of morality made in the theoretical discussion by Nay and Zagal [24] of meaningful choices was mirrored in the results of Rogers et al. [30]. One of the most prominent distinctions of meaningful experiences found in this study was in the presence of morally difficult situations, such as in *Star Wars: Knights of the Old Republic* [G5] or in *The Witcher 3* [G20]. Furthermore, Rusch [32] understands deep and meaningful games as games with content related to the human condition, defined as deep, insightful and purposeful experiences that are somehow also related to the players' personal life. This understanding finds support in an interview study by Mitgutsch

[32], where participants associated a variety of game experiences such as mastering challenges, learning skills, and social relations with meaningfulness. According to their conclusion, an experience within the game may become particularly meaningful for players, if their current personal life circumstances fit the game content.

Research by Krcmar and Cingel [21] on moral decision-making in games has previously found participants playing *Fallout 3* [G23] to reason along sophisticated foundations of morality, similar to moral reasoning in real-life. In this study, moral reasoning was coded along the moral foundations of Moral Foundation Theory by Haidt and Joseph [17]. This theory defines five foundations of morality: a) *Harm/Care*: taking care of others versus harming them, b) *Fairness/Reciprocity*: acting fairly, c) *Ingroup/Loyalty*: acting loyal to the ingroup, d) *Authority/Respect*: respecting authority, and e) *Purity/Sanctity* being in line with relevant purity rules (e.g., chastity, hygiene). The foundation *Harm/Care* was used most frequently in moral in-game reasoning [21].

Finally, a further aspect of meaningful choices in games theoretically discussed [24], which finds empirical support from interdisciplinary research, is the importance of consequences. From an educational and psychological perspective, choices are considered meaningful when people can decide autonomously. In order for a choice to be perceived as autonomous, the person choosing must understand what the choice entails, in other words, what the potential consequences of the choice are [27, 40]. The importance of autonomous choice, where the person feels responsibility for the choice, is often highlighted as crucial for learning [1, 39], as it allows for comparisons between different options on the one side and necessitates active reflection to reach a conclusion on which to base the choice, on the other [40]. Concurrently, these are the same arguments on which the potential of interactivity for learning are based on (e.g., [29]).

Aim of this paper

In study 1, the goal is to qualitatively explore how players perceive meaningful choices in games and identify overarching themes. This is done in an initial first examination of descriptions of meaningful choices that players experienced. Building on what we learn, the goal of the quantitative study 2 is to create a narrative in a high-meaningful and a low-meaningful version, and to experimentally test the effect of meaningfulness on appreciation. Furthermore, the goal is to see how meaningfulness impacts the effect of narrative interactivity on appreciation, to examine whether the inclusion of meaningful narrative elements may be a possible explanation for differing effects of a very simple form of narrative interactivity in games.

STUDY 1

The goal of this exploratory study is to examine what specific characteristics players associate with meaningful choices in games (*RQ1*). To this end, we aim to extend the knowledge on meaningful player experiences, by specifically looking at possible characteristics of meaningful choices in games, and the thoughts and feelings related with the concept of meaningfulness.

Methods

Participants

We created an online survey which was distributed on an experiment platform for the students of our institute (students received course credit for participation, $n = 10$), among our own social network (Facebook $n = 11$), and the media aggregation platform Reddit ($n = 4$). The total sample consisted of 27 participants (8 females; mean age: 24.85 years, ranged from 20 to 33 years) who were primarily students ($n = 19$).

Survey Questions and Procedure

Participants read and signed a consent form before being instructed to recount meaningful choices in games. They were asked to name the game in which they encountered a meaningful choice (*q1*: "What is the name of a game in which you had to make choices that you perceived as meaningful?"), describe at least one choice they had to make that was experienced as meaningful (*q2*: "Please describe at least one of the choices you had to make that you experienced as meaningful.") , and explain what about this choice made it meaningful to them (*q3*: "What about this choice made it meaningful to you?"). To keep our definition of meaningfulness as open as possible for this first round of research, participants were instructed to base their answer on whatever "meaningful" meant to them personally. Participants were asked to be as concrete as possible and write at least 30 words. Last, they were asked to provide demographic information on gender, age, and occupation. The study took 10.4 minutes to complete on average.

Coding Procedure

To understand what the characteristics of the meaningful choices were, we conducted a thematic analysis (based on Clarke, Braun and Hayfield [8]) of the responses to the two open-ended questions *q2* and *q3*. The first and the second author coded all 27 responses together, while differences were readily resolved in discussion. As we analyzed and interpreted the reported experiences based on knowledge gained from previous work on meaningful choices [24], meaningful game experiences [26, 25], and morality [17, 21], we conducted a *deductive* thematic analysis [8]. By following the recommended analysis steps [8], we read through all responses and wrote down the game scene, the content and number of choice options. As a first step, this was done to familiarize ourselves with the choices that participants encountered in the specific games. This helped with the basic understanding of the reported choices and their context. Second, we discussed the possible code categories and formulated their definition based on the nine concepts associated with meaningfulness addressed in previous literature (Morality [21, 24, 30], Moral Foundations Theory [17, 21], Strategic vs. Moral Choices [21], Moral and Other Dilemmas [30], Social Relations [26, 25], Consequences of Choices [24], Thought-Provoking and Emotionally Moving [26, 25]). These concepts were used as the framing for our coding. Third, we went through the first 10 responses and discussed whether the above listed concepts occurred as defined in the respective literature. Forth, all responses were coded a first time. After this first round of coding, the code definitions were defined as follows:

Type of Option: All choice options a participant mentioned were categorized as either moral (options related to moral prin-

ciples [21]) or strategic (options beneficial for game outcome, [21]). Besides moral and strategic options, we discovered that certain choices made by participants were neither beneficial for game outcome nor related to moral principles, but described best as emotional or affective (e.g., *Grand Theft Auto V (GTA V)* [G19]: choose to kill one of three characters although you have emotional bonds to each of them). Hence we defined a third category: emotional options. Options could be in conflict with each other in various ways, for instance a choice between the option to steal, which would mean your group would survive but others would starve (strategic and moral towards your group), versus the option not to steal, which would mean your group could starve, but others would survive (moral towards the others).

Moral Foundations and Moral Dilemmas: Options that were categorized as moral, were additionally more finely classified according to the five foundations of Moral Foundation Theory [17]. When moral options were pitted against each other, they were furthermore coded as moral dilemmas (yes/no).

Social Interactions: Descriptions were coded for whether there was a social interaction (yes/no), and whether either other human players or Non-Player Characters (NPCs) were involved.

Consequences: Each answer was coded in terms of whether the consequences of the choice was described (yes/no, e.g., choices without describing the consequences could be to take the path into the forest or the path up the mountain, but not saying where the path would lead to), whether these consequences were clear (yes/no), and what kind of consequences these were (i.e., someone will be punished).

The first author coded all responses a second time and then clustered the found codes based on their thematic similarity and formulated descriptions of these groups. Finally, the first and the second author discussed these groups and adapted their descriptions accordingly, which are reported in the result section.

Results

The 27 survey participants reported on meaningful choices experienced in 24 different digital games through a wide variety of genres and scenarios (see Table 1 in Supplementary Materials for an overview of the individual game choices by game). Thematic analysis of the open answers to *q2* and *q3* lead to the following overarching themes to be developed.[1]

Consequential Choices: Taking Consequences into Account

In the descriptions participants gave of why a choice was meaningful, all but one of the explanations included information on how the choice shaped consequences.

> *"I had to choose whether to assist an alternate universe character in suicide, or to let this character die painfully and slowly. In this alternate universe, she is paralyzed and cannot breathe normally."* (P22, Life is Strange)[2]

There was a difference however in how much knowledge participants had of the short- and long-term consequences of their choices, before committing to them. Often participants only knew what the short-term consequences would be, for example when a participant recounted deciding whether to stay with potentially treacherous pirates or to go through a gate to an unknown level (P21). In these situations, the participants only knew that the story (e.g., *Deus Ex* [G22], *Baldur's Gate II* [G4]), or the character (e.g., *Skyrim* [G24], *Guild Wars 2* [G1]) would change, but they did not know – while deciding – what this change would exactly look like. Instead of taking away from the meaningfulness of the choice, unknown long-term consequences seemed to add to the meaningfulness for some participants, as in *The Witcher 3* [G20] and in *BioShock* [G10].

> *"I didn't realize at first that what I did would have repercussions to the effect that it did. This lead to me carefully considering everything and choosing between what is easy and what is right."* (P25, The Witcher 3)

> *"Drugs are a precious resource for the player, and whenever you meet a Little Sister, you have a chance to kill them and take all of the drugs they have on them; or you can try to save them, collecting only half as much valuable drugs. [...] the Little Sisters you save start leaving you presents throughout the world containing other valuable items. [...] Their kindness reminds me that choosing the evil option, to kill them for immediate gain, isn't worth the cost of their lives. Even in desperate times when it seems it's every man for himself, charity comes around."* (P23, BioShock)

Having influence over the narrative through their choice was also an important factor that made the choice meaningful to some players:

> *"The storyline of the game is dependent on the choices I make, so I try to make the choices that are most suitable both for the outcome of the game but also from my personal perspective."* (P5, Persona 5)

Furthermore, in *Deus Ex* [G22] players had the ability to experience different sequences of story events, where the meaningful choices made the narrative order personalized to each player:

> *"It allowed for the story to follow a natural narrative; you weren't constrained to following the leads put in front of you. You had the option of which information to obtain first, and based on that information, followed an organic lead which exposed you to more or less of the story in advance of this confrontation."* (P24, Deus Ex)

Moreover, an interesting aspect of being able to choose in a story was the factor that players had choices with lasting repercussions. For example, in *Guild Wars 2* [G1], a game that can be played for dozens of hours, players could only choose an order for their character once:

> *"The fact that you can't change order later on adds further importance."* (P16, Guild Wars 2)

[1] Preliminary results of the first 16 participants were published as a work-in-progress extended abstract [19].

[2] In all direct participant quotes: Where mistakes related to grammar and spelling were made, they have been corrected to improve legibility.

Such experiences combined with consequences such as (possible) harm, lead players to more carefully consider what to choose in the end.

Social Choices: It Means More When Someone Else Is There

The vast majority of reports of meaningful choices included mention of a social aspect to the choice. Interestingly, all but two of these social instances were with NPCs, not with other players. Players often reported developing an emotional bond with NPCs. This made choices that affected this character particularly meaningful.

> *"...And then there was the girl. I usually try to identify myself with my character and me and that vampire girl became friends. So joining the hunters would have meant to let her down. And I found her very friendly and cool. And I felt a bit sorry for her because she was threatened unfairly so I wanted to help her."* (P6, Skyrim)

Some participants drew parallels to real life, considering what they would do, were this to happen in their own relationships (i.e., *Halo 2* [G11], *Dragon Age Series* [G6], *The Sims* [G18], and *Life is Strange* [G13]). For instance, player P22 stated:

> *"It made me think deeply about whether I would make this same decision in my real life if my best friend were under the same circumstances."* (P22, Life is Strange)

Moral Choices: When There Is No Right Choice

Most of the choices described contained at least one moral option. While some choices weighed moral against strategic options, most moral choices consisted of two moral options pitted against each other, creating a moral dilemma. In these moral dilemmas, different moral foundations according to the Moral Foundation Theory [17] had to be weighed against one another. The most frequent combination was for choices to force players to decide between caring for (or not harming) an outgroup member on the one hand and the good of their ingroup on the other.

This was the case in *Metro 2033* [G15], where P9 was responsible for the survival of their ingroup (humans) who believe themselves to be threatened by an outgroup (void-monsters that might just want to communicate and even negotiate). Being given the opportunity to destroy the monsters, resulted in the following reasoning for the choice to be meaningful:

> *"I get to choose if they live or if they die, if they are no harm to humans, just simply misunderstood and it's an immense moral decision, where I have to evaluate my own values depending my personal morals and the ones I see that are practiced upon the rest of the post-apocalyptic society."* (P9, Metro 2033)

Similarly, in *This War of Mine* [G8], where player P1 had to decide whether to take medicine belonging to an old couple to support their own group also in need of medical supplies:

> *"The elderly couple in the game beg you not to, with the husband stating that his wife will not survive if you take the medicine, and that they will both starve if you take the food. At this point in the game however, the playable characters are themselves starving and sick, and may also die if you do not steal the food and/or medicine."* (P1, This War of Mine)

Further Findings

While moral choices made up the bulk of meaningful choice options, in some cases meaningfulness was a consequence of the emotionality of the situation, such as in *GTA V* [G19], where the player had to choose which of three characters, with each of which they had built up a connection, to kill.

> *"The worst thing about this was that I then had to kill them myself, making me sit in front of the screen, telling myself that I could not do it but still doing it after all in the end."* (P8, GTA V)

Both losses and accomplishments were mentioned in the context of meaningful choices, although these examples were few. Some players observed that, as a result of their choice, they gave up when they realized that they had made the wrong choice (e.g., *Persona 5* [G3], *Yu Gi Oh Duel Links* [G17], *Harry Potter and the Chamber of Secrets* [G2]). Conversely, one player (P27) recounted how an unexpected win due to making the right choices felt meaningful while playing *PlayerUnknown's Battlegrounds (PUBG)* [G9].

> *"First there was the excitement of the play/the strategy. It was about evaluating the pros and cons, and then when performing the made decision the excitement/thrill kicked in. Second there was the weight of the decision. We knew that if we took the wrong settlement, things could go very south for us."*(P27, PUBG)

Discussion Study 1

Study 1 identified three overarching themes in the meaningful game choices described by participants. These consisted of choices being defined by social and moral characteristics, and these choices having consequences. Within and beyond these themes, there was a wide variety of aspects that participants associated with meaningful choices, similar to previous findings [23, 30] and the various descriptions of the human condition in the context of deep and meaningful games [32]. An alternative clustering of experiences is the differentiation between participants associating choices to the mechanics versus the narrative of the game. For game choices to be meaningful, it was argued that both mechanics and narrative can lead to players being meaningfully affected [33]. For instance, a player reported being confronted with tough choices in *PUBG* [G9], where places to hide were limited. Similarly Elson et al. [11] discussed that such obstacles, as a mechanic game aspect, can also meaningfully affect players. In the report on *PUBG* [G9], the focus was more on moving forward or selecting the best strategic move. However, a more often reoccurring pattern was the combination of the three meaningful themes and the three different choice options pitted against each other, while most of the games were narrative-rich. For instance, in *Skyrim* [G24] as well as in *Bioshock* [G10] participants reported on choices allowing them to more easily move forward (strategic option) while also wanting to help other game characters (emotional and social). While helping resulted in a loss of time and was hence strategically worse in the short-run, in the long-run players received other things such as trust or gifts from the

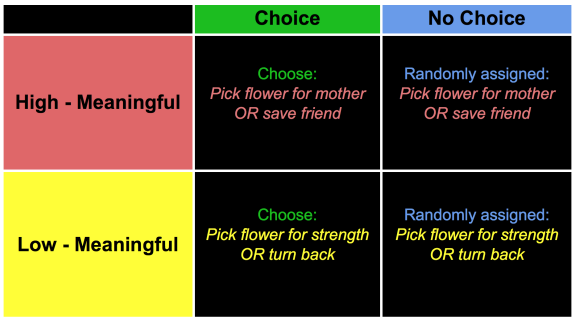

Figure 1. The experimental 2x2 design consisted of the four conditions *choice x high-meaningful*, *no choice x high-meaningful*, *choice x low-meaningful*, and *no choice x low-meaningful*. Each participant was randomly assigned into one of the conditions.

helped characters. Whereas moving forward alone may be a more strategic perspective focusing on winning the game, adding social, moral and emotional options was associated with players not only focusing on winning the game, but additionally caring for other game characters, which may in itself contain more meaning. These findings offer an interesting first empirical look into the way players describe meaningful choices in primarily narrative-rich games. They however do not allow assumptions of whether these characteristics can be causally linked to narratives being perceived as more meaningful. To extend these findings therefore, a second study was conducted to experimentally examine these themes and their impact on making a choice as a feature of interactivity.

STUDY 2

To test whether the addition of the characteristics identified in study 1 as central to meaningful choice would lead to a higher appreciation (*RQ2*), a narrative was designed based on these findings. This narrative was created in a high-meaningful (including social, moral and consequential choice characteristics) and low-meaningful (without social, moral and consequential characteristics) version. Additionally, we wished to examine whether the effect of making a choice on appreciation would change based on the meaningfulness of the choice (*RQ3*). Therefore the narrative was also presented in choice and no choice versions. The resulting four conditions can be seen in Figure 1.

Methods

An experimental 2x2 between-subject design was used. The independent variables were the very simple form of narrative interactivity "choice" with two levels (choice, no choice) and "meaningfulness" with two levels (high-meaningful, low-meaningful). The primary dependent variable was *appreciation*. Further dependent variables were *enjoyment* and *narrative engagement*. To control for confounding effects, *care morality* was also included.

Stimuli

The stimuli used was a short story written by the second author based on the findings of study 1. The narrative was written to mirror the choice scenarios seen in study 1, which often played in fantasy contexts (e.g., *Skyrim* [G24], *Baldur's Gate II* [G4], *Dragon Age - Inquisition* [G7], *The Witcher 3* [G20]) and included choices between loyalty to your ingroup and caring for an outgroup member (often represented as a monster e.g., *Metro 2033* [G15], *Undertale* [G14], *Skyrim* [G24]).[3]

The short story followed the narrative of an adventurer who ventures into an enchanted forest to find a magical flower. On the way they encounter several obstacles, such as a werebear, whom the adventurer befriends, moth creatures from whom the bear and adventurer must save each other, and ultimately a sleeping dragon that is guarding the flower. The narrative existed in two different versions (high-meaningful, low-meaningful) with four different endings (two for the high-meaningful version that differed based on the choice and two for the low-meaningful version that were very similar irrespective of the choice, see Supplementary Materials for all story versions).

To ensure that we could examine the impact of a meaningful choice, the choice conditions differed from the no choice conditions solely in the presence of one choice at the end of the story, of whether or not to pick the magical flower, which determined the final outcome of the narrative. Therefore, participants in the choice conditions could choose whether to pick the flower or not, while participants in the no choice conditions were randomly assigned to one of the outcomes. The choice and no choice conditions were yoked, in that the outcome distribution in the no choice conditions was matched to the choice outcome distribution in the choice conditions, thereby controlling for the effect of the individual outcomes.

Meaningfulness was experimentally manipulated by adding narrative elements to the choice, which in study 1 had been associated with meaningful choices. These were the framing of the choice as having social and moral components, as well as clear immediate consequences due to the choice made. Therefore in the high-meaningful condition, the participants were told that the flower was the last hope to heal the adventurer's mother from a serious illness. In contrast, in the low-meaningful conditions, participants were told that the flower would grant them unparalleled strength. Additionally, in the high-meaningful condition, the werebear would accompany the adventurer up until the dragon's lair, at which point it was attacked by the same moth creatures previously encountered. The resulting commotion would awaken the dragon. In the low-meaningful conditions, the werebear would leave before the final leg of the journey.

In the high-meaningful conditions therefore, when confronted with the choice whether to dare to pick the flower, participants had to choose between the options of picking the flower from under the awakened dragon's nose to save their mother or to leave the flower to be destroyed by dragon fire in order to save their friend the bear from the moth creatures. This choice was intended to mirror the moral dilemmas with a social component often mentioned in study 1 as particularly meaningful choices.

In the low-meaningful conditions, when confronted with the choice whether to dare to pick the flower from under the

[3]The short story was evaluated for comprehensibility and narrative engagement using an open-ended answer and a questionnaire, respectively, described in the measurement section.

dragon's nose, the participants simply had to choose between risking the dragon waking up while they snuck up to pick the flower, or returning home empty-handed. This choice also had less dire long-term consequences. Picking the flower occurred without the dragon awakening. Not picking the flower lead to the adventurer encountering another flower outside of the dragon's lair, which could be picked without risk. In contrast, in the high-meaningful conditions, saving the bear meant the flowers were lost and the adventurer would have to live with the knowledge that they had lost the last hope of healing their mother (a dire long-term consequence compared to the low-meaningful condition). Picking the flower on the other hand meant the adventurers, while managing to pick the flower, were severely burnt in the process and had to live with the knowledge that they had left their friend to die.

Participants

Participants were recruited on the crowdsourcing platform Mechanical Turk and the media aggregation platform Reddit. Mechanical Turk participants received US$2 for participating and all participants had the opportunity to partake in a lottery for one of four US$50 Amazon gift cards. Of the total sample of 261, 49 were excluded for dropping out before the last mandatory question, 16 for insufficiently answering an open answer about the content of the read narrative, three for self-reporting that their data should not be used for analysis, and one for participating more than once. The resulting sample size of 192 participants (107 female) was included in all further analysis. The sample consisted of 165 participants from Mechanical Turk and 27 participants from Reddit. The mean age was 36 years, ranged from 18 to 77 years. The majority of participants (n = 177) resided in the United States. 148 participants were employed or self-employed, 26 were students, 18 were unemployed, six were retired, four self-identified as homemakers or stay-at-home parents and two as disabled.

Measures

Appreciation, as a measure of the experience of meaningfulness, and *enjoyment* were measured using the scales developed by Oliver and Bartsch [25], consisting of three items for appreciation ("I was moved by this story", "I found this story to be very meaningful", "The story was thought-provoking"; Cronbach's α = .90) and three items each for enjoyment ("The story was entertaining", "It was fun for me to read through the story", "I had a good time reading through this story"; Cronbach's α = .96). Items were measured on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

Narrative engagement was measured using the scale developed by Busselle and Bilandzic [7]. It consists of six positively formulated items (e.g., "While reading, my body was in the room, but my mind was inside the world created by the story") and six reverse items (e.g., "I found my mind wandering during the story"; Cronbach's α = .87). Items were measured on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

The moral foundation "care" of the Moral Foundation Theory was measured using the subscale developed by Graham et al. [13]. This subscale consists of six items in total. The first three items relate to how relevant certain considerations are for judging an action as right or wrong (e.g., "Whether or not someone cared for someone weak or vulnerable"). These items were measured on a 6-point Likert scale (1 = not at all relevant, 6 = extremely relevant). For the last three items participants indicated their agreement with statements (e.g., "One of the worst things someone could do is hurt a defenseless animal"). These items were measured on a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree). The resulting variable will be referred to from here on as *care morality* (Cronbach's α = .77).

In an open question participants were asked to describe the narrative in three to four sentences, in order to evaluate whether they had read and understood it.

Procedure

After signing a consent form, participants began the study by filling out the *care morality* scale. Next, they were randomly assigned to one of the four experimental conditions. After reading the narrative in the version of their condition, participants filled out the questionnaires on *appreciation*, *enjoyment* and *narrative engagement*, and described the content of the story in an open-ended response format. Finally, participants filled out a demographic questionnaire, were given the opportunity to leave optional comments on the study, were thanked and informed that they had reached the end of the study. The study took 24.6 minutes to complete on average.

Results

An alpha level of .05 was used for all statistical tests. All analyses were conducted with R [28].

Descriptive Results

Using boxplots, univariate outliers were detected for *enjoyment*, *narrative engagement*, and *care morality*. These variables were subsequently winsorized (threshold: 95%) to minimize the influence of outliers on statistical estimates. Means, standard deviations and sample sizes for all dependent and covariables by condition are listed in Table 1. Notable are the relatively high ratings for *appreciation*, *enjoyment* and *narrative engagement* across conditions. Pearson's correlations can be seen in Table 2. Notable are the high correlations between all variables. As the pre-experimentally measured variable *care morality* correlated significantly with *appreciation* and the other dependent variables, it was included as a covariable in further analysis.

	Choice		**No Choice**	
	High-Meaningful	*Low-Meaningful*	*High-Meaningful*	*Low-Meaningful*
N	51	50	46	45
Appreciation	5.43 (1.32)	4.61 (1.43)	5.05 (1.54)	4.64 (1.64)
Enjoyment	6.10 (.92)	6.02 (.98)	5.94 (1.11)	6.08 (.95)
Narrative Engagement	5.48 (.90)	5.34 (.80)	5.62 (.89)	5.37 (.90)
Care Morality	4.50 (.72)	4.75 (.64)	4.79 (.78)	4.72 (.76)

Table 1. Descriptive statistics: Means, standard deviations and sample sizes by condition.

	Appreciation	Enjoyment	Narrative Engagement
Appreciation			
Enjoyment	0.68***		
Narrative Engagement	0.64***	0.71***	
Care Morality	0.28***	0.32***	0.26***

Table 2. Pearson's Correlations among dependent and covariables over all conditions. ***Significant at p < .001

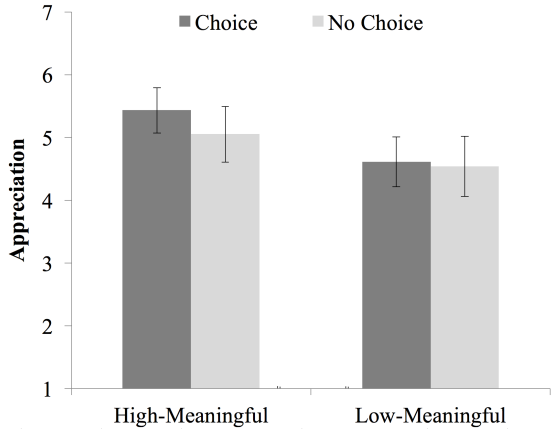

Figure 2. Mean differences in appreciation across conditions. Error bars depict the 95% confidence intervals.

Effect of Meaningfulness on Appreciation

Building on the results of study 1, our second research question (*RQ2*) was whether the intended manipulation of the meaningfulness of the choice would lead to increased *appreciation* for the narrative. To examine this, a two-way analysis of covariance (ANCOVA) was conducted with meaningfulness (high-meaningful, low-meaningful) and choice (choice, no choice) as the independent variables and *care morality* as the covariable. There was a significant main effect for meaningfulness $F(1, 184) = 9.59$, $p = .002$, $\eta^2 = .044$, while the main effect for choice was not significant $F(1, 184) = 1.42$, $p = .23$, $\eta^2 = .006$. *Care morality* was significantly associated with *appreciation* $F(1, 184) = 20.51$, $p < .001$, $\eta^2 = .093$, justifying its inclusion. No interaction effects were significant (p-values between .061 and .688). *RQ2* therefore could be answered in the affirmative.

Effects of Choice on Appreciation in high-meaningful Compared to low-meaningful Conditions

Our third research question (*RQ3*) concerned whether the effect of choice on appreciation would be different for high-meaningful compared to low-meaningful choices. To examine this, a contrast analysis examined three planned contrasts: (c1) the choice compared to the no choice narrative in the high-meaningful conditions, (c2) the choice to the no choice narrative in the low-meaningful conditions, and (c3) the high-meaningful choice condition compared to the other three conditions. The analysis showed a significant effect for (c1) $t(184) = 2.04$, $p = .042$, Cohen's $d = 0.30$, no significant effect for (c2) $t(184) = 0.83$, $p = .407$, Cohen's $d = 0.12$, and a significant effect for (c3) $t(184) = 2.19$, $p = .03$, Cohen's $d = 0.32$. This indicates that choice lead to a significant increase in appreciation when the choice was high-meaningful (c1), but not when the choice was low-meaningful (c2), and that the high-meaningful choice condition lead to a higher appreciation than the other three conditions (c3). In terms of *RQ3*, the results suggest that choice lead to an increase in appreciation in the high-meaningful conditions, but not in the low-meaningful conditions.

Exploratory Analysis of Further Effects

To explore the effect of choice and meaningfulness on further experience variables, a two-way multivariate analysis of covariance (MANCOVA) was conducted with meaningfulness and choice as the independent variables, *enjoyment* and *narrative engagement* as the dependent variables and *care morality* as the covariable. The analysis showed no significant effects of either choice or meaningfulness on *enjoyment* or *narrative engagement* (p-values between .067 and .997), with solely *care morality* relating to enjoyment $F(1, 184) = 19.96$, $p < .001$, $\eta^2 = 0.107$ and narrative engagement $F(1, 184) = 9.85$, $p < .001$, $\eta^2 = 0.067$. These results indicated that both our manipulation of meaningfulness and of choice had primarily impacted *appreciation*, leaving *enjoyment* and *narrative engagement* relatively unchanged across conditions.

Additionally, an exploratory analysis examined whether *appreciation* differed between groups depending on the narrative outcome they had received or chosen. To examine this, first the difference in *appreciation* between the high-meaningful outcomes for "help the werebear" (M = 5.25, SD = 1.39) and for "pick the flower for your mother" (M = 5.26, SD = 1.5) were compared using a simple one-way analysis of variance (ANOVA). The results were not significant ($p = .976$). Likewise, the difference in *appreciation* between the low-meaningful outcomes for "turn back without the flower" (M = 4.21, SD = 1.47) and for "pick the flower" (M = 4.68, SD = 1.53) were compared. These results were also not significant ($p = .339$).

GENERAL DISCUSSION

This paper aimed to examine what characteristics players associate with meaningful choices (*RQ1*) and how these choices impact appreciation in narrative-rich games (*RQ2*). Of particular interest was the question of whether the meaningfulness of choices could explain why choice as a feature of interactivity may impact appreciation in some narratives, but not in others (*RQ3*). Study 1 focused on *RQ1*, utilizing a qualitative study design, in which participants of an online survey were asked to describe meaningful game choices. Analysis of responses resulted in the overarching themes of consequential, social, and moral characteristics central to meaningful choices in primarily narrative-rich games.

The theme related to the consequences of the choice was characterized by players having knowledge relating to repercussions of the choice options. Such as when the consequences of helping one's friend commit suicide were evident to the player in *Life is Strange* [G13]. While immediate consequences were clear, unknown long-term consequences could add to the meaningfulness of the choice. In retrospect, choices could

gain additional meaningfulness through the further repercussions that they caused, such as when sparing a character lead to the death of another later in the narrative (*The Witcher 3* [G20]). The social theme was embodied by the presence of either another player or a non-player character in the vast majority of choices mentioned. Thereby for example, the choice of becoming a vampire became meaningful to a large extent through the friendship the player had built with a vampire in *Skyrim* [G24]. In another example the choice to kill one of three characters in *GTA V* [G19] was given gravity through the hours spent playing and developing a relationship with all three characters. Finally, the moral theme was categorized by the meaningful choices in which the player had to make difficult moral choices, often having to weigh two moral values, such as care or harm for a stranger against care or harm for one's ingroup (e.g., *This War of Mine* [G8], *The Walking Dead* [G16] or *Heavy Rain* [G12]). These choices forced players to evaluate their own values and choose between options in which there were oftentimes no right answers.

Based on these themes, a narrative was created for study 2, in which choice and meaningfulness could be experimentally manipulated. Results showed a significant effect of the meaningful conditions on appreciation, independently of choice. This finding indicated that the manipulation had worked and the inclusion of the themes identified in study 1 of consequential, social, and moral characteristics of the choices did indeed lead to a higher appreciation of the narrative. A separate analysis of the effect of making a choice in the meaningful conditions revealed a significant difference between the choice and the no choice conditions for the narratives where the choice was constructed to be meaningful. The same analysis for the low-meaningful conditions showed no difference. Finally, the high-meaningful choice condition was perceived as more meaningful than the other three conditions, suggesting that making a choice can indeed add a valuable benefit to a narrative, if this choice is meaningful. These findings have several implications, which are discussed in the following sections.

Meaningful Choice as an Important Property of Effective Narrative Interactivity

The finding that making a choice only affected appreciation for the conditions with a high-meaningful choice, but not for the conditions with a low-meaningful choice, offers interesting implications in terms of the mixed results found for the effect of interactivity in narrative-rich games (e.g., [38, 37, 31, 35]). Steinemann et al. [37] discussed that the choices used in their study may not have been perceived as meaningful, thereby potentially causing the making of these choices to have no effect. Findings from study 2 offer support for this argument that making a choice in narrative-rich games may only then be effective when the choices are perceived as meaningful. Based on the findings of study 1 and corroborated by the findings of study 2, we can furthermore offer suggestions on the characteristics likely to lead to the perception of meaningful choices.

Choice Consequences

For choices to be perceived as meaningful, the inclusion of a belief that one's choice had consequences appeared as crucial in the accounts in study 1. This supports previous theoretical arguments on the subject [34, 39]. At the same time, this characteristic is more nuanced than it would perhaps seem at first glance. As raised by Nay and Zagal [24], more important than the outcome of a choice is that the impact of what one has done is felt. This theoretical discussion is also mirrored in the results of study 1, where some instances had a scenario where players could not prevent a negative outcome from occurring, no matter which choice they made. For example in *Life is Strange* [G13], where players must choose whether to assist their friend in committing suicide. The friend would die either way, but players had to decide whether to help them die quickly of their own hand or wait for them to die slowly and painfully. Similarly, in the meaningful conditions of study 2, players could not prevent both deaths, and could merely choose to save either their friend or their mother. While analysis for these conditions showed that the outcome itself had no effect on appreciation, what did impact appreciation was the ability to choose. The central point, as argued by Nay and Zagal [24], is that players must decide which choice fits to their own values or the personality of the character they are representing. This is also reflected in arguments made by Elson et al. [11] that an important element of interactive narratives is their ability to let players create a narrative fitting their personal preferences.

Moral Choices in a Social Context

Most choices mentioned in study 1 contained choices that were characterized by moral and social elements. The importance of social elements reflects the findings on the importance of social presence for meaningful game experiences in general [26, 30]. Interestingly, more often than not the social element was provided by a Non-Player Character (NPC), not a real person. Nevertheless, due to the attachments formed by the player towards these characters, choosing to harm or care for them became a meaningful and often difficult choice. This is in line with past research that has found that oftentimes relationships with fictional characters in games are treated similarly to real-life relationships [21, 41, 42]. A possible explanation for the prevalences of NPCs in the meaningful choices in this study could be that, while the player could not conceivably be harmed in the game, no matter which choice was made, consequences for NPCs could be dire, potentially even permanent. An interesting discussion on the nuances of differences between perceptions of NPCs and player characters has already begun [42] and deserves further attention. The importance of moral elements for meaningful choices is in line with both theoretical arguments on the topic of game choices specifically [24] and empirical findings on the topic of game experience generally [30]. Moral dilemmas were central in the meaningful choices reported. Often, the moral foundation *Harm/Care* was pitted against *Ingroup/Loyalty*. As in study 2 *care morality* correlated strongly with appreciation, it stands to reason that the effect of including moral dilemmas will depend on individual differences in the importance of the foundations in question. The inclusion of Moral Foundation Theory [17] in examinations of meaningfulness of choices in games may offer promising directions for the future.

Further Findings

There were different potential characteristics of meaningful choices in games that could have been expected based on the theoretical background [4, 30, 32, 33], but did not appear as themes in our analysis of study 1. Emotional reasons for the meaningfulness of particular choices, while present, did not occur as a central theme. While emotion may have been perceived by the participants as secondary for the meaningfulness of the choice, it may have still played an important role, particularly in keeping the choice salient. The role of emotion in meaningful choice is certainly worth further research.

Rogers et al. [30] discussed the importance of rich narratives for meaningful experiences. While not prevalent in study 1, study 2 did find a significant correlation between narrative engagement and appreciation. Mitgutsch [23] and Rogers [30] also highlighted the importance of accomplishment for meaningful experiences. This did not emerge as a central theme in the current study, however instances of both defeat (e.g., in *Harry Potter and the Chamber of Secrets* [G2]) and achievement (e.g., in *PUBG* [G9]) were mentioned. This is certainly also an interesting avenue for future research.

It is interesting that neither meaningfulness nor making a choice would have affected enjoyment or narrative engagement, while both constructs were closely related to appreciation. While this does add further strength to the argument that appreciation and enjoyment are two different concepts [25, 26], it is also possible that longer exposure might have lead to different results, with enjoyment and narrative engagement in longer less meaningful narratives likely to decrease with time.

Limitations, Strengths & Future Research

While we believe this study offers many valuable insights, there are also clear limitations. For study 2, a strength and weakness in one was the use of only one choice in the choice condition. The strength, and the reason why it was done, was that this allowed all differences between conditions to be clearly ascribed to this one choice and its influencing characteristics. The weakness however is that the effect of this simple form of interactivity might have been stronger, had there been more choices throughout the narrative. Additionally, perhaps even in the non-meaningful condition this one choice may have been perceived as more meaningful than intended, due to its novelty. That one meaningful choice alone was enough to lead to significant differences between conditions, does however strongly speak for the value of meaningful choices for the understanding of interactivity features such as choice. Nevertheless, future research should focus on examining meaningful choice with a broader selection of choices. An interesting question here will be whether one meaningful choice in a selection of otherwise meaningless choices still leads to an overall more meaningful experience than a non-interactive version of the same narrative.

Furthermore, this work's findings are restricted to one particular feature of interactivity, which is making a specific choice that was experienced as meaningful. Previous work done on meaningfulness in games [3, 10, 9, 33] points out the importance and potential of elements of meaningful choices in games. However, no research to our knowledge has examined these choices empirically. As theoretically discussed before [33], what is important for the concept of meaningful play is the evaluation of it as meaningful enough so that a game can be successful in affecting players' emotional and psychological states, which we did by showing how meaningful choices could affect appreciation. Moreover, empirical research on appreciation of entertainment has focused on non-interactive forms of media, making this contribution not only a first empirical examination of meaningful choices in games, but also one of the first studies on appreciation of interactive media. Therefore, we present a novel opportunity to discuss meaningful choices in narrative-rich games from an empirical standpoint.

Another interactivity-related limitation was the focus on solely narrative choices. Other forms of interactivity, such as dexterity-based interactivity needed in fast-paced action games, have their own potential and most likely their own rules for when they will be more effective than non-interactive alternatives. Another limitation was the restriction of measures to only subjective experiences, excluding behavior or attitude change. These were outside of the scope of this study, which serves as a first step in examining the effect of meaningfulness and its relation to making a choice in narrative-rich games. The hope is however, that future research will extend these insights to include behavior and attitude measures. Likewise outside of the scope was the independent examination of the effects of the identified characteristics (consequential, social, and moral) of meaningful choices. This too deserves further research.

Finally, a central strength of this study was the use of mixed-methods. This allowed a qualitative study to first explore the concept of meaningful choices in narrative-rich games, upon which the second study then experimentally tested and expanded on the conclusions drawn in the first study. This allowed a more comprehensive and informative examination of the topic area, consequently strengthening the results [20].

CONCLUSION

Using a mixed-methods approach, meaningful choices in narrative-rich games and their impact on the effect of making a choice on appreciation in narrative-rich games were examined through two studies. The results of the qualitative study 1 revealed meaningful choices in participants' accounts to be defined by the presence of social and moral characteristics and a belief that their choices impacted the resulting immediate consequences. The results of the quantitative experimental study 2 found the presence of these mechanics to significantly impact appreciation as the experience of meaningfulness, thereby validating the findings of study 1. Furthermore, the finding that making a choice had an effect on appreciation only for the high-meaningful choice condition supports the argument that adding a choice as a form of narrative interactivity is not a silver bullet, but may only be effective when the choices the player can make are perceived as meaningful.

ACKNOWLEDGMENTS

We thank Ben Geelan, Cordian Röthlisberger, and the reviewers for their valuable feedback.

REFERENCES

1. Albert Bandura. 1997. *Self-efficacy: The exercise of control*. W. H. Freeman and Company: New York.
2. Anne Bartsch and Mary Beth Oliver. 2016. *Appreciation of Meaningful Entertainment Experiences and Eudaimonic Wellbeing*. Routledge, pp. 222–248.
3. Ian Bogost. 2007. *Persuasive games: The expressive power of videogames*. MIT Press.
4. Julia Ayumi Bopp, Elisa D Mekler, and Klaus Opwis. 2016. Negative Emotion, Positive Experience?: Emotionally Moving Moments in Digital Games. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. ACM, 2996–3006.
5. Jason T Bowey and Regan L Mandryk. 2017. Those are not the Stories you are Looking For: Using Text Prototypes to Evaluate Game Narratives Early. In *Proceedings of the 2017 Annual Symposium on Computer-Human Interaction in Play*. ACM.
6. Asi Burak and Laura Parker. 2017. *Power Play: How Video Games Can Save the World*. St. Martin's Press.
7. Rick Busselle and Helena Bilandzic. 2009. Measuring narrative engagement. *Media Psychology* 12, 4 (2009), 321–347.
8. Victoria Clarke, Virginia Braun, and Nikki Hayfield. (2015). *Qualitative psychology: A practical guide to research methods*. Sage, Chapter Thematic Analysis, pp. 222–248.
9. Greg Costikyan. 2002. I Have No Words & I Must Design: Toward a Critical Vocabulary for Games. *Proceedings of Computer Games and Digital Cultures Conference* (2002), 9–33.
10. Chris Crawford. 2012. *Chris Crawford on interactive storytelling*. New Riders.
11. Malte Elson, Johannes Breuer, James D Ivory, and Thorsten Quandt. 2014. More than stories with buttons: Narrative, mechanics, and context as determinants of player experience in digital games. *Journal of Communication* 64, 3 (2014), 521–542.
12. Carina S González, Nazaret Gómez, Vicente Navarro, Mariana Cairós, Carmela Quirce, Pedro Toledo, and Norberto Marrero-Gordillo. 2016. Learning healthy lifestyles through active videogames, motor games and the gamification of educational activities. *Computers in Human Behavior* 55 (2016), 529–551.
13. Jesse Graham, Brian A Nosek, Jonathan Haidt, Ravi Iyer, Spassena Koleva, and Peter H Ditto. 2011. Mapping the moral domain. *Journal of personality and social psychology* 101, 2 (2011), 366.
14. Isabela Granic, Adam Lobel, and Rutger CME Engels. 2014. The benefits of playing video games. *American Psychologist* 69, 1 (2014), 66.
15. Melanie C Green and Keenan M Jenkins. 2014. Interactive Narratives: Processes and Outcomes in User-Directed Stories. *Journal of Communication* 64, 3 (2014), 479–500.
16. Matthew Grizzard, Ron Tamborini, Robert J Lewis, Lu Wang, and Sujay Prabhu. 2014. Being bad in a video game can make us morally sensitive. *Cyberpsychology, Behavior, and Social Networking* 17, 8 (2014), 499–504.
17. Jonathan Haidt, Craig Joseph, and others. 2007. The moral mind: How five sets of innate intuitions guide the development of many culture-specific virtues, and perhaps even modules. *The innate mind* 3 (2007), 367–391.
18. Maria L Hwang and Lena Mamykina. 2017. Monster Appetite: Effects of Subversive Framing on Nutritional Choices in a Digital Game Environment. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. ACM, 4082–4096.
19. Glena H Iten, Sharon T Steinemann, and Klaus Opwis. 2017. To Save or To Sacrifice? – Understanding Meaningful Choices in Games. In *Proceedings of the 2017 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts*. ACM, 495–502.
20. R Burke Johnson, Anthony J Onwuegbuzie, and Lisa A Turner. 2007. Toward a definition of mixed methods research. *Journal of mixed methods research* 1, 2 (2007), 112–133.
21. Marina Krcmar and Drew P Cingel. 2016. Moral foundations theory and moral reasoning in video game play: using real-life morality in a game context. *Journal of Broadcasting & Electronic Media* 60, 1 (2016), 87–103.
22. Matt McCormick. 2001. Is it wrong to play violent video games? *Ethics and Information Technology* 3, 4 (2001), 277–287.
23. Konstantin Mitgutsch. 2013. Playful Learning Experiences: Meaningful Learning Patterns. *Design, Utilization, and Analysis of Simulations and Game-Based Educational Worlds* (2013), 177.
24. Jeff L Nay and José P Zagal. 2017. Meaning without consequence: virtue ethics and inconsequential choices in games. In *Proceedings of the 12th International Conference on the Foundations of Digital Games*. ACM, 14.
25. Mary Beth Oliver and Anne Bartsch. 2010. Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication Research* 36, 1 (2010), 53–81.
26. Mary Beth Oliver, Nicholas David Bowman, Julia K Woolley, Ryan Rogers, Brett I Sherrick, and Mun-Young Chung. 2015. Video Games as Meaningful Entertainment Experiences. *Psychology of Popular Media Culture* (2015), 1–16.
27. Erika A Patall, Harris Cooper, and Jorgianne Civey Robinson. 2008. The effects of choice on intrinsic motivation and related outcomes: a meta-analysis of research findings. *Psychological Bulletin* 134(2) (2008), 270–300.

28. R Core Team. 2016. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. Retrieved from: https://www.R-project.org/.

29. Ute Ritterfeld, Cuihua Shen, Hua Wang, Luciano Nocera, and Wee Ling Wong. 2009. Multimodality and interactivity: Connecting properties of serious games with educational outcomes. *Cyberpsychology & Behavior* 12, 6 (2009), 691–697.

30. Ryan Rogers, Julia Woolley, Brett Sherrick, Nicholas David Bowman, and Mary Beth Oliver. 2017. Fun versus meaningful video game experiences: A qualitative analysis of user responses. *The Computer Games Journal* 6, 1-2 (2017), 63–79.

31. Dana Ruggiero. 2015. The effect of a persuasive social impact game on affective learning and attitude. *Computers in Human Behavior* 45 (2015), 213–221.

32. Doris C Rusch. 2017. *Making Deep Games: Designing Games with Meaning and Purpose*. CRC Press.

33. Katie Salen and Eric Zimmerman. 2004. *Rules of play: Game design fundamentals*. MIT press.

34. Karen Schrier. 2010. *Ethics and Game Design: Teaching Values through Play: Teaching Values through Play*. IGI Global.

35. Daniel M Shafer, Sophie Janicke, and Jonmichael Seibert. 2016. Judgment and Choice: Moral Judgment, Enjoyment and Meaningfulness in Interactive and Non-Interactive Narratives. *IOSR Journal of Humanities and Social Science* 21(8) (2016), 97–106.

36. Miguel Sicart. 2005. Game, player, ethics: A virtue ethics approach to computer games. *International Review of Information Ethics* 4, 12 (2005), 13–18.

37. Sharon T Steinemann, Glena H Iten, Klaus Opwis, Seamus F Forde, Lars Frasseck, and Elisa D Mekler. 2017. Interactive Narratives Affecting Social Change. *Journal of Media Psychology* (2017).

38. Sharon T Steinemann, Elisa D Mekler, and Klaus Opwis. 2015. Increasing Donating Behavior Through a Game for Change: The Role of Interactivity and Appreciation. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '15)*. ACM, New York, NY, USA, 319–329.

39. Lance Vikaros and Darnel Degand. 2010. Moral development through social narratives and game design. *Ethics and game design: Teaching values through play* (2010), 197–216.

40. Tanner LeBaron Wallace, Hannah C Sung, and Jasmine D Williams. 2014. The defining features of teacher talk within autonomy-supportive classroom management. *Teaching and Teacher Education* 42 (2014), 34–46.

41. Andrew J Weaver and Nicky Lewis. 2012. Mirrored morality: An exploration of moral choice in video games. *Cyberpsychology, Behavior, and Social Networking* 15, 11 (2012), 610–614.

42. Rina R Wehbe, Edward Lank, and Lennart E Nacke. 2017. Left Them 4 Dead: Perception of Humans versus Non-Player Character Teammates in Cooperative Gameplay. In *Proceedings of the 2017 Conference on Designing Interactive Systems*. ACM, 403–415.

LUDOGRAPHY

1. ArenaNet. 2012. *Guild Wars 2*. Mac OS X and Microsoft Windows. (28 August 2012). NCSOFT, Seoul, South Korea.

2. Eurocom Griptonite Argonaut, Aspy and KnowWonder. 2002. *Harry Potter and the Chamber of Secrets*. PlayStation, PlayStation 2, Xbox, GameCube, Game Boy Advance, Microsoft Windows, OS X, Game Boy Color. (5 November 2002). Argonaut Games: London, England, UK; Aspyr Media, Inc.: Austin, Texas, US; Eurocom: Derby, England, UK; Griptonite Games: Kirkland, Washington, US; KnowWonder: Kirkland, WA, US.

3. Atlus. 2016. *Persona 5*. PlayStation 3 and PlayStation 4. (15 September 2016). Atlus, Tokyo, Japan and Deep Silver, Höfen, Austria.

4. BioWare. 2000. *Baldur's Gate II: Shadows of Amn*. Windows. (21 September 2000). Electronic Arts, Redwood City, CA, USA.

5. BioWare. 2003. *Star Wars: Knights of the Old Republic*. Xbox. (15 July 2003). Electronic Arts, Redwood City, CA, USA.

6. BioWare. 2009. *Dragon Wars*. Mac OS X, Microsoft Windows, PlayStation 3, PlayStation 4, Xbox 360 and Xbox One. (3 December 2009). Electronic Arts, Redwood City, CA, USA.

7. BioWare. 2014. *Dragon Age: Inquisition*. Microsoft Windows, PlayStation 3, PlayStation 4, Xbox 360, Xbox One. (18 November 2014). BioWare Edmonton, Alberta, CA.

8. 11 bit studios. 2014. *This War of Mine*. Android, iOS, Linux, Mac OS, Microsoft Windows, PlayStation 4 and Xbox One. (14 November 2014). 11 bit studios, Warsaw, Poland and Deep Silver, Höfen, Austria.

9. Bluehole. 2017. *PlayerUnknown's Battlegrounds (PUBG)*. Microsoft Windows, Xbox One. (23 March 2017). Microsoft Studios, Redmond, Washington, US.

10. 2K Boston and 2K Australia. 2007. *BioShock*. Microsoft Windows, Xbox 360, PlayStation 3, Mac OS X iOS, PlayStation 4, Xbox One. (21 August 2007). 2K Boston: Irrational Studios LLC., Westwood, Massachusetts, US; 2K Australia Pty Ltd: Canberra, Australia.

11. Bungie. 2004. *Halo 2*. Microsoft Windows, Xbox and Xbox One. (9 November 2004). Microsoft Game Studios, Redmond, WA, USA.

12. Quantic Dream. 2010. *Heavy Rain*. PlayStation 4, PlayStation 3. (18 February 2010). 54 Boulevard DAVOUT 75020, Paris, France.

13. Dontnod Entertainment. 2015. *Life is Strange*. OS X, Linux. (30 January 2015). Don't Nod Entertainment SARL, Paris.

14. Toby Fox. 2015. *Undertale*. Linux, Mac OS X, Microsoft Windows, PlayStation 4 and PlayStation Vita. (15 September 2015). Toby Fox, independent video game developer.

15. 4A Games. 2010. *Metro 2033*. Linux, Mac OS X, Microsoft Windows, PlayStation 4, Xbox 360 and Xbox One. (16 March 2010). THQ, Agoura Hills, CA, USA and Deep Silver, Höfen, Austria.

16. Telltale Games. 2012. *The Walking Dead*. Android, iOS, Kindle Fire HDX, Linux, Mac OS X, Microsoft Windows, Ouya, PlayStation 3, PlayStation 4, PlayStation Vita, Xbox 360 and Xbox One. (Between April and November 2012). Telltale Games, San Rafael, CA, USA.

17. Konami. 2016. *Yu-Gi-Oh! Duel Links*. iOS and Android. (17 November 2016). Konami, Tokyo, Japan.

18. Maxis. 2000. *The Sims*. Microsoft Windows. (4 February 2000). Redwood Shores, California, U.S.

19. Rockstar North. 2013. *Grand Theft Auto V*. Microsoft Windows, PlayStation 3, PlayStation 4, Xbox 360 and Xbox One. (17 September 2013). Rockstar Games, New York City, NY, USA.

20. CD Projekt RED. 2015. *The Witcher 3: Wild Hunt*. Microsoft Windows, PlayStation4 and Xbox One. (19 Mai 2015). CD Projekt, Warsaw, Poland.

21. Susana Ruiz, Ashley York, Mike Stein, Noah Keating, and interFUEL Santiago, Kellee. 2006. *Darfur is Dying*. Online/Web (Free). (30 March 2006). MTV Networks On Campus Inc., New York, USA. Played June 2017.

22. Ion Storm. 2000. *Deus Ex*. Microsoft Windows, Mac OS, PlayStation 2. (17 June 2000). Ion Storm Inc., Texas, US.

23. Bethesda Game Studios. 2008. *Fallout 3*. Microsoft Windows, PlayStation 3, Xbox 360. (28 October 2008). Bethesda Softworks LLC, a ZeniMax Media company.

24. Bethesda Game Studios. 2011. *The Elder Scrolls V: Skyrim*. Microsoft Windows, Nintendo Switch, PlayStation 3, PlayStation 4, Xbox 360 and Xbox One. (11 November 2011). Bethesda Softworks, Rockville, MD, USA.

Potentials and pitfalls of increasing prosocial behavior and self-efficacy over time using an online personalized platform

Sharon T. Steinemann[1*], Benjamin J. Geelan[1], Stephan Zaehringer[1], Kamalatharsi Mutuura[1], Ewgenij Wolkow[1], Lars Frasseck[1], Klaus Opwis[1],

[1] Department for General Psychology and Methodology, Faculty of Psychology, University of Basel, Basel, Basel-Stadt, Switzerland

*Corresponding author
E-mail: sharon.steinemann@unibas.ch (SST)

Abstract

Background. This longitudinal mixed methods experimental study aimed to better understand the interplay between digital technology exposure over time, self-efficacy, and prosocial behavior in everyday contexts.

Methods. 66 psychology students tracked their daily prosocial behavior over three weeks. Additionally, half of the participants were randomly assigned to receive access to an online platform, which made personalized suggestions for prosocial actions to complete. Qualitative post-study interviews complemented quantitative measures.

Results. Platform exposure had no measurable impact beyond that of tracking over time on either prosocial behavior or self-efficacy. Tracking increased self-efficacy to perform everyday prosocial actions, but did not affect self-efficacy to impact change. Prosocial behavior was predicted by self-efficacy to impact change. Enjoyment of the platform predicted completing higher numbers of suggested prosocial actions and was related to a higher likelihood to continue using the platform in the future. Avenues for increasing platform effectiveness include context-specific action personalization, an effective reminder system, and better support for the development of self-efficacy to impact change through meaningful actions.

Conclusion. Technology for prosocial behavior should be enjoyable, capable of being seamlessly integrated into everyday life, and ensure that suggested actions are perceived as meaningful in order to support the sustainable development of self-efficacy and prosocial behavior over time.

Introduction

Advances in digital technology bring with them an exceptional potential for beneficial impacts on individuals, communities, and, ultimately, societies. Technology can inform, connect, encourage, and facilitate action on a scale previously impossible [1, 2]. At its best, technology can support people throughout their lives; Assisting them in meeting their goals, living healthier lives, increasing wellbeing, helping others, and contributing to their community (e.g., [3–6]). However, at its worst, both through unintended consequences and by design, technology can also facilitate hostility and distress and offer platforms for ridicule and anger (e.g., [7, 8]). To guide the development of technology towards benefit and not to harm, a deeper understanding is necessary of the interactions between new forms of technology in everyday contexts and human behavior. Without this understanding, any attempts at creating innovative solutions run the risk of being ineffectual, or worse, damaging. Research on the impact of technology on reaching goals and supporting healthy behavior has been the focus of several recent studies [5, 6, 9]. However, relatively little research has focused on supporting prosocial behavior directed towards others, such as everyday acts of helping friends and strangers [1].

The aim of this exploratory study is therefore to examine the prospects of using an early iteration of an online platform to support prosocial behavior in everyday contexts and increase self-efficacy, an important predictor of behavior [10], in its users over time. The following sections will give an overview of the theoretical foundation on which this work builds.

Theoretical background

Behavior change and self-efficacy

Self-efficacy is the belief in one's abilities to successfully perform the actions necessary to achieve a specific goal [10]. Self-efficacy theory postulates that increasing self-efficacy

for a specific behavior (e.g., biking to work), will increase the likelihood that this behavior will be undertaken. This close relation between self-efficacy and behavior has been supported by a plethora of empirical evidence across different areas, such as educational outcomes [11], disease prevention [12], and pro-environmental behavior [13]. Self-efficacy beliefs can vary in terms of their generality, from task-specific self-efficacy beliefs to general self-efficacy beliefs which transcend across tasks and situations [14].

However, the predictive power of self-efficacy on behavior tends to be greatest, the more specifically self-efficacy is measured [10]. For example, one's belief in one's ability to bike to work should better predict the probability of actually biking to work than the more general belief in one's overall competence to perform moderate exercise activities.

To increase self-efficacy, mastery experiences, defined as experiences in which one has successfully performed actions relevant to one's ultimate goal, have been found to be particularly effective [15]. So, for example, one's belief in one's ability to successfully bike to work will likely be increased by having experienced biking successfully in different levels of traffic, in different types of weather, and at different times of day.

Research on the relationship between self-efficacy and prosocial behavior has found general social self-efficacy (one's general belief in one's ability to interact well with others) to predict public prosocial behaviors, but not anonymous prosocial behavior [16]. Examining a more specific form of self-efficacy, White et al. [17] found higher belief in one's ability to have an impact on an observed social injustice to increase participants' intentions to purchase fair trade products. Importantly, this self-efficacy to impact social change, and ultimately the intention to purchase fair trade products, was predicted by how effective participants were led to believe the fair trade solution to be.

This highlights the importance of mastery experiences for both prosocial self-efficacy and ultimately for probability of repeated prosocial behavior. This is also supported by past research by Sargeant et al. [18] on the importance of feeling accomplished for people contributing to charities.

This is also in line with research on charitable giving where people have been found to be more likely to donate if they feel as though their contribution will make a difference [19, 20]). Considering this, we argue for the importance of the self-efficacy belief we define as *change impact self-efficacy*, or, the belief in one's abilities to successfully perform actions that will lead to prosocial change. This concept is the generalization to prosocial change of justice restoration self-efficacy, as measured by White et al. [17] in the context of fair trade behavior.

Change impact self-efficacy is however still a fairly broad concept, considering that prosocial change can be achieved in a variety of ways. As our goal is to understand everyday prosocial behavior, ideally we would therefore wish to examine *everyday helping self-efficacy* or, belief in one's ability to perform everyday actions, which are intended to help others. As no such measure so far exists, a first questionnaire for everyday self-efficacy was developed in this study.

Changing behavior through technology

The question of how technology can positively impact behavior has been of great interest in the past decades. Past studies have focused on changing behavior such as healthy eating (e.g., [21]), improved learning outcomes [22], supported smoking cessation [23–25] and increased physical activity (e.g., [26, 27]), wellbeing [4], and stress relief [4].

These technologies leverage the unique potentials of technology-based solutions to support their users in performing behavior they may not otherwise have been motivated or capable of doing [1, 28, 29]. For example, exercise games can lead to exercise activities being experienced as more enjoyable, leading to users engaging for longer and ultimately

burning more calories than with non-game equivalents [26]. Similarly, applications to assist in learning languages, such as *Duolingo*, can encourage users to learn languages on their own outside of more traditional classroom settings [30].

Recent reviews point to a multitude of specific features of digital technology, which may be particularly helpful in changing behavior. Self-Monitoring and -tracking, personalized feedback, social sharing, reminders, as well as gamified elements including points, progress visualization, and virtual rewards are features frequently used to support behavior change [5, 6, 31]. Many of these features may be particularly effective due to the fact that they support mastery experiences by making users aware of their progress and successes and prompting them to improve slowly over time.
Indeed, studies on the effectiveness of these features indicate that particularly tracking, feedback, and gamified elements are in many cases able to affect behavior [6, 31]. However, findings are not always clear-cut, demonstrated by the conclusions of a recent systematic literature review examining gamified elements, which noted that particularly rigorous studies have been more likely to find mixed or non-significant results on the effectiveness of such features [31]. Thorough investigations under controlled conditions are therefore necessary in order to draw consistent conclusions [31]. Several avenues for improvement are open here, as research on the impact of technology on behavior change has been hampered in the past by a number of theoretical and methodological issues. Firstly, there is an over reliance on tracking of behavior as a way of facilitating behavior change [32]. Secondly, the tools examined often lack theoretical grounding for why they are expected to work, making it difficult to answer the question of why tools may or may not have produced the expected impact [5, 32]. Thirdly, a lack of experimental manipulation makes conclusions as to the effectiveness of tools difficult [31]. Relatedly, as often several features are combined in one tool, it becomes difficult to pinpoint the specific effect of individual features [5, 31]. And finally, there is a dearth of studies examining effects over time [5, 6, 28, 31], thereby leaving it unclear to which extent technology allows for sustainable behavior change over longer periods of time, and which studies are illustrating novelty biases through the introduction of new technologies.

Changing prosocial behavior through technology

Prosocial behaviors are defined as actions, which are intended to benefit one person or multiple people other than oneself [33, 34]. It covers behavior such as helping a stranger by giving up one's seat in public transport, comforting a friend by cooking them dinner, or taking a dog from a rescue shelter for a walk. Next to benefits to others, prosocial behavior is also related to increases in benefactor wellbeing [35–39]. Despite the breadth of behaviors included in this definition and the benefits to all parties involved, research examining the impact of technology on such behavior is scarce. What research there is however, highlights the potential of technology to impact prosocial behavior [3, 40]. For example, research on the impact of games on prosocial behavior has found that playing as a refugee in a game can lead to players donating higher amounts to aid refugees directly after the game [41]. Relatedly, research on virtual reality applications found virtually simulating what it is like to be color blind to lead to increased volunteering to help color blind individuals [42] and virtually simulating flying like Superman leading participants to be more likely to help out the experimenter at the end of the study by picking up dropped pens [43]. Outside of the lab setting, a study by Konrath et al. [44] found that sending high-empathy text messages for two weeks can be enough to increase prosocial behavior in text-message recipients. While these series of results are encouraging, the study by Konrath et al. [44] alone offers insight into whether prosocial behavior can be affected over time and in settings beyond the immediate study situation. Further examination of the sustainable long-term benefits of technology on prosocial behavior is therefore needed.

Aim of this study

Based on this past research, the intent of this study was to use an experiment to explore the potential of technology to positively affect prosocial behavior and self-efficacy over time.

On the foundation of self-efficacy theory literature, our goal was to create a platform, with which participants could practice successfully mastering prosocial actions, thereby increasing self-efficacy and ultimately their prevalence of prosocial behavior. To facilitate these mastery experiences within the platform, we used the COM-B (Capability, Opportunity, Motivation, Behavior) model developed by Michie et al. [29]. This model was developed based on an extensive review of behavior change theory literature and argues that behavior (e.g. going for a 30-minute jog) is facilitated when one is capable of performing an action (e.g., one can keep up a good running pace for 30 minutes), has the opportunity to do so (e.g one has 30 minutes to spare and has a running trail close by), and is motivated to do so (e.g. one enjoys running; or would like to improve one's fitness). While several similar models exist, the COM-B model was chosen, due to having a careful foundation on behavior change theories and being well-established in the field of applied behavior change research (e.g. [26, 45]).

Following this model, we created a digital platform, which allowed prosocial action suggestions to be personalized to individual participants' capabilities, opportunities, and motivations. The platform also tracked the number of suggested actions participants reported to have performed in any given week. In addition to offering personalized actions, the platform was designed to include gamified elements in form of progress visualization (a map showing the location of their performed actions) and virtual rewards in the form of badges for actions completed (see Materials section for details).

At the same time, participants were asked to track their daily prosocial behavior, which they had performed external from and without the prompting of the platform. These features were chosen as a first set, which based on past research offered promise of supporting behavior change.

To examine the effect of the additional gamified platform features compared to merely tracking behavior on the platform's effectiveness, we created two experimental conditions. Participants in the first condition (Platform Group) used the platform while tracking their daily prosocial behavior. Participants in the second condition (Tracking-Only Group) merely tracked their daily prosocial behavior, without being exposed to any of the other features available on the platform (personalized suggested action, progress visualization, and virtual rewards). An overview of the features each group was exposed to can be seen in Table 1.

Table 1.

Features	Tracking-Only Group (TG)	Platform Group (PG)
Tracking everyday prosocial behavior	X	X
Personalized suggested actions	-	X
Progress Visualization	-	X
Virtual Rewards	-	X

Overview of the difference in feature exposure between the two experimental groups. The Tracking-Only Group simply received daily reminders to track their everyday prosocial behavior. The Platform Group additionally received personalized action suggestions, progress visualization and virtual rewards based on the actions they performed.

To understand the effectiveness of these different features over time, we conducted a three week longitudinal study, in which we had participants track their daily prosocial

behavior, suggested actions completed, and self-efficacy. Past research on games, gamification, and other media experiences over time has highlighted the particular importance of enjoyment and other forms of gratification for users to repeatedly engage with technology [46–48]. We therefore wished to examine the extent to which interacting with the platform was experienced as enjoyable [49] and its effect on engaging with the platform through the completion of suggested actions. Finally, we wanted to ensure that we would understand not only what actions people were doing, but also the reasons behind their actions. Therefore we planned to include a qualitative interview at the end of the study, which would provide a richer understanding of how participants had experienced the tracking and the platform, as well as ways in which both could be improved upon in the future.

Of interest to us was the exploration of the following research questions.

RQ1: Daily prosocial behavior & platform exposure
Over the course of the three weeks...

(a) Does exposure to the platform features (Platform Group) affect daily prosocial behavior differently to merely tracking daily prosocial behavior (Tracking-Only Group)?

(b) Is daily prosocial behavior related to self-efficacy?

RQ2: Suggested action completion using the platform
Over the course of three weeks...

(a) Is completion of suggested actions related to self-efficacy?

(b) Is completion of suggested actions related to enjoyment of the platform?

RQ3: Self-efficacy & platform exposure
Over the course of three weeks...

Does exposure to the platform features (Platform Group) affect self-efficacy differently to merely tracking daily prosocial behavior (Tracking-Only Group)?

RQ4: Improving the platform
What steps could be taken to improve the platform in the future in order to increase self-efficacy, support suggested action completion and daily prosocial behavior?

Method

Study design

The experiment had a longitudinal mixed design (Table 2). The outcome variables of interest were *daily prosocial behavior, suggested actions completed*, and two measures for self-efficacy: *change impact self-efficacy* and *everyday helping self-efficacy*. The between-subject experimental variable was platform exposure with two levels, "Platform Exposure" (Platform Group) and "No Platform Exposure" (Tracking-Only Group). The within-subject variable was time, with daily measurements over the course of 21 days for daily prosocial behavior, and weekly measurements over the course of three weeks for all other variables. Exclusively measured for the Platform Group were platform *enjoyment*, *appreciation* (an additional gratification measure), and *usability* (a control variable to determine the extent to which the platform allowed for an effective, efficient and satisfactory experience). Additionally measured across all participants were *general*

self-efficacy (in order to compare with the two principal measures of self-efficacy variables) and *wellbeing* (in order to examine previously found effects that prosocial behavior is related to increases in wellbeing). The quantitative examination of these variables throughout the study was complemented with qualitative post-study interviews for a mixed methods exploration of the research questions.

Table 2. Experimental Study Design

Variable Type	Variables Measured
Outcome Variables	Daily prosocial behavior, suggested actions (Platform Group), change impact self-efficacy, everyday helping self-efficacy
Between-Subject Variable	Platform Exposure (Platform Exposure, No Platform Exposure)
Within-Subject Variable	Time (0-21 days; 0-3 weeks)
Covariables & Control Variables	Enjoyment, Appreciation & Usability (Platform Group), General Self-Efficacy, Wellbeing

Materials

Interactive platform: Designing for behavior change

The personalized interactive online platform used was a functioning prototype called *Simple Acts*, which was conceptualized and designed by the first and second author and implemented by the sixth author.

The interactive platform was designed to support the behavior change desired in accordance with the COM-B model for behavior change through intervention [29], and in alignment with literature using behavioral tracking and virtual incentives to prompt changes in behavior [5]. The techniques utilized are summarized in Table 3. Michie et al [29] describe intervention functions as having multiple components that can be facilitated through technology, such as psychological capability being facilitated through providing timely feedback, social opportunities being facilitated through the provision of non-verbal social rewards, and the provision of incentives and rewards (even non-tangible) when undertaking desired behaviors. The Simple Acts platform is therefore an ideal avenue for supporting these behavioral interventions, as digital technology supports immediate and personalised feedback to participants.

Towards this goal, the Simple Acts platform was designed specifically to support several Behavior Change Techniques [29] related to feedback, as well as both reflective and automatic motivational affordances commonly found to be beneficial for changing behavior through gamified and persuasive technologies [26, 50]. It was expected that the use of positive feedback mechanisms within the virtual platform would provide a support-based intervention that educates and models prosocial behaviors [51]. For example, the use of overt or extrinsic incentives and rewards has been associated with detrimental long term impacts upon displayed behavior, motivation to undertake behavior, and self-efficacy [52]. In contrast, studies that examined the effect of positive feedback in subtle but personally meaningful ways have been found to better support positive outcomes such as feeling competent and contributing towards social goals [53] and supported longer term engagement with behavioral interventions through the development of mastery [26, 54].

Personalization of suggested actions.

While the platform was fully functional, it worked in a relatively simple fashion. Personalization was achieved by collecting information on platform users' interests (to personalize to motivation) and activities (to personalize to capability) prior to granting access. For this study, our users were all students in the same university town, making

Table 3. Behavior change techniques utilized by the platform.

Behavior Change Technique (Michie et al 2014)	Platform components
Feedback on behavior	Immediate Feedback: Upon completion of an Action, participants were provided with immediate positive feedback. This has been found to have a significant and substantial impact upon participant behavior [26, 55].
Incentive	Virtual Rewards: Badges provided at the completion of an Action helps participants visualise the impact that they can have on the world around them. Intangible but symbolic incentives such as badges are often found to have positive impacts on the perception of system-based activities, compared to tangible or less subtle extrinsic reward mechanisms [56].
Identity associated with changed behavior	Virtual Rewards: As above. Progress Visualisation: Participants are presented with a map of their location, and are able to decorate it by placing the Virtual Reward icons upon it, thereby tracking their personal progress. The use of personally meaningful representations have been found to contribute towards feelings of identity that can be associated with desired behaviors, thereby increasing the likelihood of long term display of such behaviors and supporting mastery [29].
Information about social and environmental consequences	Personalised Suggested Actions: Participants are presented with information about the societal and environmental benefits that these actions can have, as reasons supporting the display of these behaviors. The provision of contextual information surrounding desired behaviors has been shown to be beneficial to supporting behavior change [5].

Table 4. Platform personalization based on the COM-B Model.

Behavioral Facilitator	Personalization based on
Capabilities	Current activities participants listed as enjoying (e.g., making others feel appreciated, going outside, getting to know new people).
Opportunities	Location (all participants were students in the same university town). Brevity of actions.
Motivation	Interest in topics listed by participants as being important to them (e.g., supporting local business, animals, poverty, disability)

personalization to opportunity easier as we could focus on opportunities in one location. Table 4 summarizes how personalization to the COM-B model was achieved.

To personalize suggested actions to their capabilities, opportunities, and motivations, participants were asked to rate twelve interests and eight activities on a scale from 1 (not at all interested) to 5 (very interested). An action database was created by the fourth and fifth author based on prosocial activities, which could be undertaken in and around the university town, supporting their opportunities. These activities could be performed without long-term commitments and in a relatively short amount of time, again supporting opportunity, varying between a few seconds (saying "thank you" to the bus driver) and a few hours (playing football with a group, striving to connect locals and foreigners in the local community). The action database consisted of 55 actions, which were dichotomously coded (0 or 1) for whether they related to each activity and interest. Based on participants' answers to the activities and interests questions, they could therefore be assigned a fit score for each action, indicating to which extent these actions matched their motivations and capabilities. Over the course of the three weeks participants in the Platform Group were assigned the nine actions (three per week) with their individually highest fit scores. Participants could then choose which (if any) of these actions they wanted to complete. In order to ensure that the completion of actions was not inhibited by the financial capacity of participants, each participant's suggested actions selection was checked to ensure that each participant received no more than one donation-related action per week.

Interactive platform: participant interactions.

Using their unique participant code, participants in the Platform Group could log into the platform over a browser of their choice on either desktop or mobile devices. After logging in, participants saw an interface that displayed a map of a university town (see Interactive platform: Designing for behavior change) and three suggested actions (see Fig 2). These suggested actions were prosocial activities, which had been personalized to the participant based on their interests in issues and preferred activities (see section "Personalization of suggested actions" for more detail on the personalization). Each suggested action was described with a colorful icon, a title, a one-line subtitle, a paragraph on the reason why this activity was important, and a step-by-step guide of how to complete the action (see Fig 2 for an example). Additionally, each suggested action description included a button, with which participants could report having completed that action. The button took participants to a short survey, in which they could indicate how easy the suggested action had been to complete and whether they had any issues while completing it. Once an action was marked as completed, participants received a virtual reward in the form of a badge (the icon for that action), which, to visualize their progress, on desktop could be

dragged-and-dropped onto the map on the approximate location at which the action had been completed.

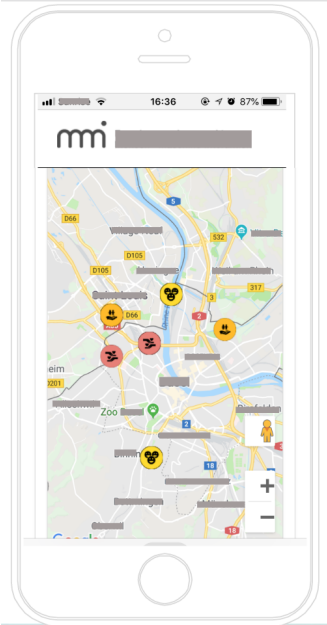

Fig 1 The map (progress visualization) with badges (virtual rewards). Participants received badges for actions they had completed. They could pull the badge onto the place on the map where they had performed the action to visualize their progress. Map location and research group name masked for review.

Fig 2 Example of a suggested action. This suggested action, named "Make your own choice!", explained to participants how they could find out more about organ donation and why it was important to make an informed choice about whether or not to carry an organ donor card. Under the Why?-section, participants were told that signing up to become an organ donor after death could lead to up to seven lives being saved. Under the How?-section, participants were given a step-by-step guide on how to find more information about organ donation, including exploring the official national organ transplant page, making a pro/con list for themselves, and talking to someone about the topic.

Measurements

In the following, the questionnaires, items, and interview questions used in this study are presented. All communication and measures were displayed to participants in German, the official language in the university town where this study was conducted. In this chapter and throughout the rest of the manuscript items and quotes are English translations. The German original material can be found on the Open Science Framework (OSF), where this project can be found under the following link: https://osf.io/dnu3y/.

Daily prosocial behavior

Daily prosocial behavior was measured using the question "Please think back on yesterday. How many actions did you do that you would describe as prosocial?". Additionally, they were asked to list all actions that they could think of in an open text field. To ensure that participants across the study were thinking about prosocial behavior in a comparable way, all participants were given a definition of prosocial behavior. This definition described prosocial behavior as voluntary, not related to material gain, and defined by a positive effect on others. They were also given examples of prosocial behavior, including giving up one's seat in public transport, donating, or letting someone know that they are appreciated.

Daily prosocial behavior scores were the mean number of daily actions a participant reported. For week-level analysis, these means were averaged across the week.

Suggested actions completed

Suggested actions completed was tracked using the platform, on which participants could mark actions as completed. Participants could complete between zero and three actions per week.

Self-efficacy

As previously discussed, self-efficacy is most accurate as a predictor of behavior, when it is measured as specifically as possible. Therefore, we focused on two particularly relevant forms of self-efficacy. Firstly, change impact self-efficacy, building on the previous conceptualization by White et al. [17]. Secondly, everyday helping self-efficacy, the belief in one's ability to perform, even in the face of challenges, everyday actions, which benefit others. As no measurement for everyday helping self-efficacy existed, a scale was developed in two pilot studies and a preliminary validation performed during the main study. A measure for general self-efficacy was also used for inclusion in correlational analyses.

Change impact self-efficacy. To measure change impact self-efficacy, the scale by White et al. [17], which was developed in the context of fair trade purchasing choices, was modified to the more general context of this study. The scale consisted of four items (*"I believe that small actions can make a difference"* , *'I believe that the actions, which I undertook this past week can improve the lives of others"*', *"I believe that I can positively impact the lives of others."*, *"I believe that the actions, which I undertook this past week can improve society at large."*). Each statement could be evaluated on a scale from 0 (Not at all) to 100 (Completely). The scale had high internal consistency (Cronbach's $\alpha = .79$).

Everyday helping self-efficacy. To our knowledge no measures exist, which have

been built to examine self-efficacy specifically in the context of everyday prosocial behavior. Therefore, in order to measure everyday helping self-efficacy, prior to the longitudinal study, we conducted two pilot studies in order to develop a scale to measure everyday helping self-efficacy.

Pilot study 1. We began by conducting a qualitative online survey in which 28 participants answered the questions "What makes it difficult for you to act prosocially in an everyday context" and "What makes it easy for you to act prosocially in an everyday context?" [57]. The responses were analyzed and discussed among three of the authors. Based on this discussion, similar responses were combined and responses with more than one statement were separated. The resulting list of statements were re-written into 46 items, which began with the prephrasing "To what extent do you believe in your abilities to successfully help in an everyday situation, if...". These items could be answered on a scale from 0 (Not at all) to 100 (Completely) [57].

Pilot study 2. The 46 items were given to a new sample of 62 participants. The participants responded to all prepared items and additionally rated a subsample of 13 to 26 items in terms of how understandable they were.Understandability was measured on a 5-point Likert scale from 1 (Not at all) to 5 (Completely).

The items were then analyzed in terms of their understandability, difficulty indices, discriminatory power, and inter-item correlation (values can be found on the Open Science Framework). Based on these analyses, 14 items were removed and one item was rephrased to be better understandable.

Based on the data from the baseline measurement of the longitudinal study, these 32 items were evaluated using a principal component analysis, based on the procedure described by Field et al. [58]. An initial analysis was run to obtain eigenvalues for each component in the data. Three components had eigenvalues over Kaiser's criterion of 1. However, due to the preliminary nature of this questionnaire it was decided to maintain a single component structure and focus on a smaller number of items similar to that of other questionnaires used in this study (between 3 and 6 items). Items with commonalities lower than .5 on the primary component were removed (26 items). The final analysis was conducted with the remaining six items (Table 5). Factor loadings for all six items were above .7. The six items were evaluated on a scale from 0 (Not at all) to 100 (Completely). The scale correlated moderately with general self-efficacy (r=.47, $p < .001$), highly with change impact self-efficacy (r=.53, $p < .001$) and had a high internal consistency (Cronbach's $\alpha = .90$).

Table 5. The six items of the *Everyday Helping Self-Efficacy Scale.* These items were generated in pilot study 1

To what extent do you believe in your abilities to successfully help in an everyday situation, when...	
Item	Factor Loadings
...you are feeling angry.	**.82**
...it feels as if your help is unimportant	**.81**
...no one will thank you for helping.	**.79**
...you are afraid you might do something incorrectly.	**.77**
...you see that no one else is helping.	**.76**
...in the past you failed at a similar attempt to help.	**.73**
Eigenvalue	3.64
% of variance	60.73

General self-efficacy. To measure general self-efficacy, the scale developed by Chen et al. [14] was utilized. The six items (e.g., *"I believe I can succeed at most any*

endeavor to which I set my mind.") were measured on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The scale had high internal consistency (Cronbach's α =.93).

Platform experience

Behavioral facilitators have, amongst other things, the purpose of making the interaction with a platform more enjoyable and thereby encourage increased and sustained interaction. In line with this, past research has shown that technology-based behavioral facilitators can lead to increased enjoyment when engaging with tasks related to tasks such as learning [48] and exercise [26] Furthermore enjoyment has been used as an effectiveness measure for digital game-based learning [59]. Interactivity and prosocial behavior were previously shown to be related to appreciation [41]. A similar connection was therefore expected in this study. Since media can be both appreciated and enjoyed at the same time [48] both concepts were measured. To ensure the continued usage of a platform or system it has been shown that user experience is a crucial element [46–48]. Since the present study required participants to use the gamified platform for ideally two weeks, it was important to create and ensure a usable and enjoyable platform.

Enjoyment. In order to measure enjoyment, the audience response scale for enjoyment, developed by Oliver and Bartsch [49] was adapted to the study context. The three items (e.g., *"Working with the Simple Acts platform was fun for me"*) had a high internal consistency (Cronbach's α = .83).

Appreciation. In order to measure appreciation, the audience response scale for appreciation, developed by Oliver and Bartsch [49] was adapted to the study context. The three items (e.g. *"Working with the Simple Acts platform was very meaningful for me"*) had a high internal consistency (Cronbach's α = .92).

Usability. Usability was measured using the Usability Metric for User Experience (UMUX) scale developed by Finstad [60]. The scale consists of four items, one each to measure efficiency (*"I have to spend too much time correcting things with this platform"*; reverse scored), effectiveness (*"This platform's capabilities meet my requirements."*), satisfaction (*"Using this platform is a frustrating experience''*; reverse scored), and an overall usability item (*"This platform is easy to use."*). Items are evaluated on a 7-point Likert scale from 1 (Strongly disagree) to 7 (Strongly agree). Item scores subtract 1 (or are subtracted from 7 for reverse scored items). The UMUX score is the sum of the four items, divided by 24 and multiplied by 100, which leads to a range of 0 to 100 (Cronbach's α = .64; see Finstad, [60] for a discussion of the UMUX score calculation).

Wellbeing

In order to measure wellbeing, the 5-item World Health Organization Well-Being Index (WHO-5) was used, which has been repeatedly shown to consist of simple and non-invasive questions, which can measure wellbeing across a range of study fields (see Topp et al. [61] for an overview). The items were adapted to the study context to refer to a one-week period, instead of a two week period. Items (e.g., *"Over the past week, I have felt active and vigorous"*) were scored on a 5-point Likert scale from 0 (At no time) to 5 (All the time). The scale had high internal consistency (Cronbach's α = .87)

Likelihood to continue

In order to understand whether participants would wish to continue using the platform in the future, a single item at the end of the study asked how likely participants would be to use the platform in the following week, if the platform were openly available. The item was measured on a 7-point Likert scale from 1 (Very unlikely) to 7 (Very likely).

Interview questions

Following the study, a post-study interview was conducted in order to understand what worked well and what could be improved upon for future iterations of the platform. The interview was conceptualized and run as semi-structured, allowing the interviewer to adapt questions to each participant while still following a general structure across participants.

Participants were asked a series of questions related to their experiences with the behavior tracking and how tracking had impacted the way they thought about their prosocial behavior on a day-to-day basis (e.g *"How did you experience being confronted with questions around prosocial behavior on a daily basis?"*). Additionally, participants in the Platform Group were asked about their experiences interacting with the platform and how it could be improved upon, especially in order to support prosocial behavior more effectively (e.g., *"What would you like to see changed about the platform? What would you definitely want to keep?"*). Questions were asked both about the platform in general as well as about specific features, such as the personalized suggested actions and the map.

Participants

68 participants began the longitudinal study. Two participants were excluded for filling out only one entry in the weekly questionnaires. 18 participants had dropped out by the third weekly measurement (eight from the Platform Group). As multilevel analyses were utilized to examine the research questions, existing data for participants with missing data could be incorporated into the analysis [58]. Therefore, data from 66 participants (33 in each condition) were included in the study. 78 percent of participants identified as female. Participants ranged in age from 18 to 37, with a mean age of 22.7 years (SD = 3.2). All participants were bachelor students of psychology.

Participants were recruited over the faculty study advertisement platform. The advertisement explicitly mentioned prosocial behavior and its facilitation as a central part of the study. Participants were rewarded with course credit for each weekly survey they participated in; The incentives were dependent neither on the amount of platform usage, nor daily prosocial behavior reported. Participants were allocated to conditions randomly. Research was conducted in accordance with university guidelines on ethical practices for Psychology research. Written informed consent of the participants was obtained before beginning the study. Participant data was anonymized.

Procedure

The study measured data at six different timepoints: Prestudy, baseline, week 1, week 2, week 3, and post-study interviews. Which variables were measured at which time points is summarized in the following sections. The procedure is additionally illustrated in Fig 3 .

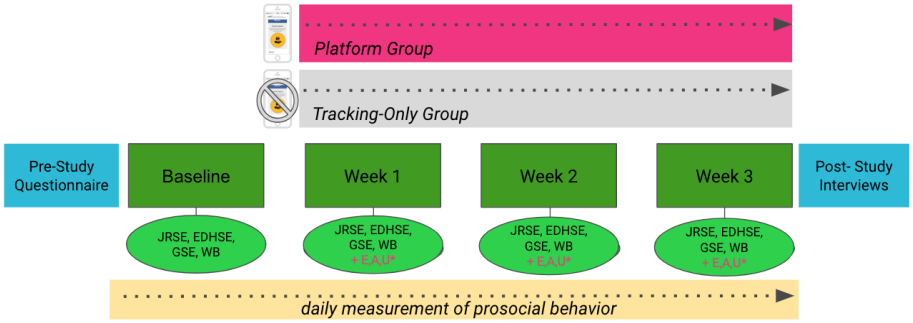

Fig 3 Study Procedure. An overview of the three week study procedure, including the experimental manipulation, the pre-study questionnaire, baseline, week 1, 2, and 3 measurements, and the post-study interviews.

Pre-study. After signing up for the study, participants filled out a 15-minute pre-study questionnaire, in which they answered questions used to personalize suggested actions based on their preferences regarding activities and interests. Subsequently, participants received a personalized participant code and answered basic demographic questions (age, gender, occupation).

Baseline measurement & week 1. The following week, participants began the three-week study, which began with a baseline measurement for both 2-minute daily (daily prosocial behavior) and 15-minute weekly measurements (change impact, everyday helping, and general self-efficacy, as well as wellbeing). For the next 21 days all participants then tracked their daily prosocial behavior by responding to a daily email reminder. Weekly reminders prompted participants to fill out the weekly questionnaires. Additionally, the Platform Group were given access to the Simple Acts platform after the baseline measurements. They were instructed on how to log in but allowed to choose if and how they used the platform. Each week, the platform would suggest three new actions, which participants could then choose to complete if they wished. After the first week, for participants in the Platform Group, the weekly questionnaire included additional questions on the platform experience. These questions were on enjoyment, appreciation, and usability of the platform.

Week 2 and 3. At the end of week 2 and week 3, participants answered the same set of questions as after week 1. In addition, at the end of Week 3, participants from both groups received an additional question asking whether they would be interested in participating in a final post-study interview. Participants in the Platform Group were additionally asked how likely they would be to continue using the platform in the next week, if it were openly available.

Post-study interviews. Eight participants were included in the exploratory post-study interview, which was conducted in person at the university research facilities. As the focus of the interview was on the platform and how to improve it, six of eight participants were selected from the Platform Group. The number of participants chosen was based on the recommendations given by Clarke et. al. [62] for a research project of small to medium size. Preliminary screening of the interview data showed medium to high saturation of all major topics (see [63, 64]) was reached fairly quickly, at around 5 to 6 interviews, depending on topic. This is also helped by the fact, that the group interviewed was fairly homogeneous and the interviews followed a semi-structured approach, which generally makes it easier to uncover the major topics in a sample [65]. The participants were asked questions relating to their experiences and the ways in which these experiences and the effectiveness of the platform to promote prosocial behavior could be improved.

Results

All statistical analysis was performed in R [66] using an alpha level of .05. The data sets and R scripts used in the analysis can be found on the OSF. To analyze effects over time, multilevel modeling [67] was used following the procedure described by Field et al. [58]. To examine qualitative interview data, reflexive thematic analysis was conducted as outlined by Braun and Clarke [68] and Clarke et al. [62].

Data preparation

Data from five different datasets were taken into account for the following analyses. Firstly, the dataset from the pre-study questionnaire containing demographic information on the participants. Secondly, the dataset from the main study containing the measurements of daily prosocial behavior. Thirdly, the dataset from the main study containing the measurements of weekly change impact self-efficacy, everyday helping self-efficacy, enjoyment, appreciation, usability, general self-efficacy, and wellbeing. Fourthly, the dataset from the main study containing each Platform Group participant's completed suggested actions. Fifthly, the dataset containing the transcripts of the post-study interviews. All datasets but the fifth were linked based on the participants' designated codenames. The fifth dataset, which pertained to the in-person interviews was not linked to the rest of the data to maintain participant anonymity throughout the study. The second, third, and fourth dataset were merged for analysis. After the merger, variable distributions were examined and four outlier values removed from daily prosocial behavior.

Descriptive and correlative results

Means, standard deviations, and measurement ranges for the Platform Group and the Tracking-Only Group at the end of week 3 can be seen in Table 6. Results show that both groups performed on average between one and two prosocial actions per day in the third week. In addition, participants in the Platform Group had performed on average between one and two of the possible nine suggested actions by the end of the study. Results also show moderate values for change impact self-efficacy and everyday helping self-efficacy, as well as enjoyment, appreciation, usability, and likelihood to continue using the platform.

Pearson correlations across groups can be seen in Table 7. As can be discerned here, all self-efficacy scales correlate moderately to highly with one another, as do enjoyment, appreciation, and usability. Daily prosocial behavior correlates most strongly with change impact self-efficacy, while completed suggested actions correlates most strongly with enjoyment of the platform. As can be seen in Table 7, higher enjoyment, appreciation, and usability ratings were all associated with a higher likelihood of continuing use of the platform.

Exploring research questions 1-3 with multilevel models

In order to examine RQs 1-3, six multilevel models were analysed. These models took into account both within-subject effects over time, as well as between-subject effects due to platform exposure and random variance in intercepts and slopes. In preparation, variables were grand mean centered [58]. Model parameters can be found in Table 8.

RQ1: Daily prosocial behavior & platform usage

As can be seen in model RQ1a (Table 8), platform exposure did not significantly predict daily prosocial behavior ($b = .08$, $p = .772$). Time was significantly negatively

Table 6. Descriptive statistics by condition.

	Tracking-Only Group	**Platform Group**
Variables *(Range)*	M (SD)	M (SD)
Daily prosocial behavior *(0-5)*	1.32 (0.97)	1.29(.97)
Total completed suggested actions *(0-6)*	-	1.28 (1.42)
Change impact self-efficacy *(33.30-95.50)*	69.21 (13.49)	67.90 (17.39)
Everyday helping self-efficacy *(16.83-93.33)*	58.38 (23.54)	53.57 (19.99)
Enjoyment of platform *(1.00-6.67)*	-	4.21 (1.54)
Appreciation of platform *(1.00-6.67)*	-	3.69 (1.64)
Usability of platform *(45.83-100.00)*	-	70.66 (17.99)
Likelihood to Continue *(1-7)*	-	3.21 (2.00)
General self-efficacy *(2.33-7.00)*	5.69 (0.86)	5.60 (1.04)
Wellbeing *(1.00-5.00)*	3.29 (0.89)	2.87 (0.94)

associated with daily prosocial behavior (b = -.31, $p < .001$).

In model RQ1b (Table 8), change impact self-efficacy additionally positively predicted daily prosocial behavior (b = .02, p = .012). Everyday helping self-efficacy did not significantly predict daily prosocial behavior (b = .001, p = .865).

This means that platform exposure did not impact daily prosocial behavior more than simply tracking daily prosocial behavior. Change impact self-efficacy positively predicted daily prosocial behavior, while everyday helping self-efficacy did not. Reports of daily prosocial behavior decreased over the course of the three weeks.

RQ2: Suggested action completion using the platform.

In model RQ2a (Table 8), we examined the relationship between self-efficacy and the number of weekly suggested actions participants in the Platform Group completed. Change impact self-efficacy significantly predicted completion of suggested actions (b = .01, p = .017), but everyday helping self-efficacy did not (b = -.01, p = .271). Time was significantly negatively associated with completion of suggested actions (b = -.19, p = .035).

In model RQ2b (Table 8), enjoyment of the platform predicted completion of suggested actions (b =.12, p = .034), while time did not (b = -.17, p = .058).

This means that completion of suggested actions was predicted by change impact self-efficacy and enjoyment of the platform, but not by everyday helping self-efficacy. Participants completed less suggested actions as time progressed, although the inclusion

Table 7. Pearson Correlations.

	Completed suggested actions	Change impact self-efficacy	Everyday helping self-efficacy	Enjoyment of platform	Appreciation of platform	Usability of platform	Likelihood to Continue	General self-efficacy	Wellbeing	Time
Daily prosocial behavior	.01	**.29*** **	**.15***	.15	.20	.02	-.20	.12	**.17***	**-.20****
Completed suggested actions		**16***	.02	**.25***	.18	.12	.05	.06	-.004	.06
Change impact self-efficacy			**.53*** **	**.39*** **	**.33****	**.33****	.19	**.39*** **	**.38*** **	-.01
Everyday helping self-efficacy				**.49*** **	**.37*** **	**.38*** **	.39	**.47*** **	**.42****	**.16***
Enjoyment of platform					**.78*** **	**.49*** **	**.55****	**.26***	**.45*** **	-.14
Appreciation of platform						**.30****	**.66*** **	.14	**.22***	-.10
Usability of platform							**.51***	**.40*** **	**.27*** **	-.05
Likelihood to Continue								**.42***	.15	-
General self-efficacy									**.47*** **	.10
Wellbeing										**.13***

Note: $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

of enjoyment in the model lead to this relationship no longer being significant.

A note on multicollinearity

To account for the potential effect of multicollinearity, the effects of change impact self-efficacy and everyday helping self-efficacy were isolated in separate models for RQ1b and RQ2a. For RQ1b, the two models showed effects in the same direction as the combined RQ1b model. That is, a significant effect for change impact self-efficacy (b = 0.01,p = 0.005) and no significant effect of everyday helping self-efficacy (b = 0.01 ,p =0.2822). For RQ2a, the two models as well showed effects in the same direction as the combined RQ2a model. That is, a significant effect for change impact self-efficacy (b = 0.01,p =0.029) and no significant effect of everyday helping self-efficacy (b =0.002 ,p =0.639). This suggests that multicollinearity did not bias the results.

RQ3: Self-efficacy & platform exposure

In model RQ3i (Table 8), neither time (b = -.57, p = .49) nor platform exposure (b = 2.94, p = .304) were associated with increases in change impact self-efficacy. In model RQ3ii (Table 8), time was associated with increases in everyday helping self-efficacy (b = 2.86, $p < .001$), while platform exposure was not (b = -1.03, p = .815).

This means that over the course of the three weeks, participants gained everyday helping self-efficacy, but not change impact self-efficacy. Platform exposure affected neither form of self-efficacy.

Table 8. Multilevel models for Research Questions 1-3.

	Model RQ1a		**Model RQ1b**		**Model RQ2a**		**Model RQ2b**		**Model RQ3i**		**Model R 3ii**	
	Outcome Variable: Daily prosocial behavior		*Outcome Variable: Daily prosocial behavior*		*Outcome Variable: Suggested actions completed*		*Outcome Variable: Suggested actions completed*		*Outcome Variable: Change impact self-efficacy*		*Outcome Variable: Everyday helping self-efficacy*	
Predictor Variables	*b*	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*
Fixed Effects												
Time	**-.31****	.08	**-.30*****	.08	**-.19***	.09	-.17	.09	-.57	.83	**2.86****	.80
Platform Exposure	.08	.28	.03	.27					2.94	3.50	-1.03	4.37
Change impact self-efficacy			**.02***	.01	**.01***	.01						
Everyday helping self-efficacy			.001	.01	-.01	.01						
Enjoyment							**.12***	.06				
Random Effects (participant level)												
Random intercept variance	**1.35***		**1.35***		0.06		**0.07***		**218.02***		**122.94***	
Random slope variance	**.11***		**0.08***		.0002		.0001		**22.49***		**5.59***	
Random intercept / Random slope correlation	-.98		-.98		-.11		.01		**-.46***		.34	
AIC/BIC	*716.49/743.96*		*713.27/747.61*		*193.78/215.87*		*191.43/208.61*		*1928.50/1952.80*		*1912.86/1940.68*	
Fixed Effects R^2	***.08****		***.13****		***.12****		***.11****		***.01****		***.06****	

Note: $^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Examining wellbeing over time

As the correlational analysis had shown a positive relationship between wellbeing and time, we decided to examine wellbeing over time and across groups with a further multilevel model (Random intercept variance = -0.01, $p < .05$; Random slope variance = 0.01 $p < .05$, Random intercept-random slope correlation = -.20, $p > .05$; AIC = 567.07, BIC = 591.40, Fixed Effects R^2 = .03, $p < .05$).
Results found time to significantly positively predict wellbeing (b=.11, p=.016), while platform exposure did not (b = -.09, p = .63).

Exploring research question 4: Improving the interactive platform

In order to examine RQ 4, the data from the post-study interviews were explored using thematic analysis, a technique for the analysis of qualitative research developed by Braun and Clarke [68]. Thematic analysis utilizes a systematic and rigorous approach to coding and theme development and purposefully avoids the quantification of qualitative results, emphasizing the researcher's active role in the research process (see Clarke et al. [62] for an excellent overview on thematic analysis).

Coding procedure

Interview transcripts were used to perform a reflexive thematic analysis of the interview material [62,68]. An open, data driven, inductive approach was used. The interviews were conducted by the third and fourth author, then transcribed and analyzed by the third author in continuous discussion with the first author. As suggested by Braun and Clarke [68], analysis commenced with data familiarization and open coding. The codes were also sorted into topics, checked for saturation and were then developed into themes in further iterations. To keep track of the coded passages, the qualitative data analysis program MaxQDA was used.

The analysis resulted in five main themes: (1) *Being aware of situations where one can help and one's attitude towards helping,* (2) *Fun and Empowering* (3) *Appreciated but easily forgotten* (4) *The importance of fitting seamlessly into daily life* (5) *The need to see an impact.*

Being more aware of situations where one can help and one's own attitude towards helping

While participants reported that daily tracking of the activities was a bit boring, they also reported that tracking their prosocial behavior made them think about prosocial behavior more and that they became more capable of spotting situations in which they could act prosocially. This was mainly attributed to the fact that they were confronted with the themes of prosocial behavior and helping others daily. This is showcased by the following excerpts.

> "To me it feels like I got more perceptive, that I saw more situations where I actually could help." (P6)

> "The study generally got you thinking about the topic [of prosocial behavior]." (P4)

Next to being more aware of situations in which they could help, participants reported that being confronted with prosocial behavior daily made them more aware of their own attitude towards the topic of.

> "[The study] was exciting. You could see what prosocial behavior you are really showing and if you could do more. You questioned your behavior more and more each day." (P8)

These reports, however, were tempered by participant doubts that any changes would last beyond the run of the study. While participants felt that their perception of and their attitude towards prosocial behavior had changed, they did not expect lasting changes in their behavior. They felt that they had changed their behavior throughout the three week study, but they were not sure how they would continue after the study when they were no longer confronted with the topic daily.

> "The perception changed more than the actual behavior. Maybe the behavior changed more when it came to little things, like inviting someone to dinner. But 'bigger' prosocial behavior was harder to show. [...] It's just that with these things, it needs more time." (P9)

Fun and empowering

Participants in the Platform Group reported generally enjoying the platform.

> "[The platform] was very appealing, with its weekly actions, bringing books to a thrift shop in [town], clothing as well." (P2)

Beyond this, participants who completed suggested actions reported feeling empowered by the guidance they received on the platform.

> "I felt more responsible, I also helped [when I was not directly affected]. For example, I walked by a trash can and the trash was lying beside it. First I was like, why didn't people do anything about this, but then I thought I can do that myself and put the trash into the can." (P1)

> "I [was on vacation] and picked up stuff at the beach. It is a really nice thought, one gets more aware of what can be done to help." (P3)

> "Even just the feeling [changed]. Just the small things. When I cook, then I'm helping the people around me. I won this belief that I am capable of helping others." (P2)

Appreciated, but easily forgotten

While the general concept of the platform seemed to appeal to the participants, for the most part they engaged only irregularly with it. Reasons therefore seemed to lie in the fact that the platform was not particularly easy to use - having to actively be sought out via browser on mobile or desktop. This lead to participants completely forgetting about the platform for most of the time.

> "Often times I looked at the actions at the beginning of the week and checked out which ones I could do and thought, ohh this one and that one, but then the week was suddenly over." (P1)

To counteract this, participants suggested that the platform could have regularly reminded them of the actions they had been assigned because they forgot about them during the week.

> "A reminder would have been nice, maybe as a push message on my mobile." (P1)

> "I think it would be really cool if the platform would remind you via push or email." (P10)

Another issue could have been that features designed to reward and encourage participants were not perceived as interesting or useful enough to support across different situations and over time. For example, while the map was considered to be a nice detail, it was not seen as particularly helpful or important.

> "The problem with the map was that I live in [another town] and the map was centered on [the university town]. I was not sure if or how I could have changed that." (P10)

The importance of fitting seamlessly into daily life

Overall the personalization of actions was either something that participants were not aware of until told during the interview or something that was considered helpful.

> "[The personalization] worked well, I got offered actions that I could easily take care of." (P2)

However, several issues participants reported revolved around a lack of fit between the platform, its actions, and their daily life. For one, because performing the suggested actions often necessitated going to specific places, participants wanted to use the platform across different types of devices. In general however, mobile was the preferred way to access the platform.

> "'I used the platform with the mobile, it worked pretty well. I think the mobile is very important, so that you can do the actions on-the-go." (P2)

While the platform was available to use on mobile, this was over a mobile website. Different participants suggested that the platform could be run as a mobile application. This could either be a newly created app or an integrated feature of apps they already use.

> "An app would be nice, but it could be integrated into an app that already gets used, for instance email, social media like Instagram or Facebook." (P1)

Participants expressed the need for suggested actions to fit into their daily schedule. They criticised the fact that they had at times been offered suggested actions that did not fit into their time budget or current situation.

> "[When choosing an action], my stress level as well as the needed time to complete it are important. I would say the time it takes to complete an action is the most important [thing I consider]." (P6)

Relatedly, participants criticized the limited selection of suggested actions. During the study, participants received three suggested actions per week. In the interviews the wish was expressed to have been offered more options, which would have allowed them more flexibility to find something fitting their current circumstances.

> "It would be cool if there was a bigger selection of actions to choose from. (...) Filtering [the actions] would be great, especially by effort, mood, and stress level." (P6)

> "If you had more choices when you're offered actions, maybe 2 or 3 per category, then the chance that (one of those) actions fits is higher." (P1)

This makes apparent that action personalization needed to understand capability, opportunity, and motivation in more nuanced terms, as they could change based on context, such as their current mood or time restraints. Beyond this, there seemed to be a need for choice.

The need to see an impact

An additional issue surfaced, which the selection of suggested actions had not adequately addressed. In advance of the study, care had been given during the action suggestion process to include a maximum of one donation-related action per participant per week. Despite these efforts, the interviews made clear that for some participants calls for donations were simply not interesting and that they preferred actions for which they could directly see the impact.

> "I think the personalization worked okay. But let's say you ticked helping animals on the survey, I thought to myself: "yes great". But then I was asked to donate to some animal rights group..." (P3)

> "The only thing that matters to me is that whenever I do something that I really help someone. It needs to be meaningful." (P1)

Above all, actions needed to seem meaningful, with the benefit as apparent as possible. Donations in particular did not seem to allow for enough of a sense of meaningfulness.

Discussion

The aim of this study was to investigate the impact of a personalized platform on daily prosocial behavior (RQ1), platform-prompted personalized suggested action completion (RQ2), and self-efficacy (RQ3). Additionally, we wished to gain insights into potential approaches to improving the platform in the future (RQ4).

In order to explore these research questions, a three week experiment was conducted, along with a pre-study questionnaire and a post-study interview. Multilevel models were used to explore the study's first three research questions. The post-study interview focused on the fourth and final research question and was examined using reflexive thematic analysis.

Results showed that platform exposure with its features of suggested actions, progress visualization, and virtual rewards impacted neither daily prosocial behavior, nor self-efficacy more than merely tracking daily prosocial behavior. This highlights the importance of understanding how this or other similar platforms can be improved upon in the future in order to be more effective. Post-study interviews were used to understand what had worked and what had not in the current platform version. In these interviews, participants reported feeling more responsible, more aware of situations in which they could help, and more likely to help. They however also described the platform being forgotten about in the complexities of everyday life, as well as wanting more emphasis on the impact they would have with their actions. In the quantitative results we observed that likelihood to continue using the platform was related to higher levels of enjoyment, appreciation and usability of the platform. Beyond this, higher enjoyment predicted a larger number of completed suggested actions. In order to support engagement over a longer time period these results point to the importance of ensuring the maintenance of a positive experience over time. The role of enjoyment and usability here is in line with past research on sustained usage [46–48]. The role of appreciation is in line with past research on the positive relationship between appreciation and prosocial behavior [41, 69]; This study, however, is the first time this effect was examined for behavior over time.

Both measured forms of prosocial behavior, completed suggested actions and daily prosocial behavior, were predicted by change impact self-efficacy. This is in line with self-efficacy theory [10]. Interestingly, however, everyday helping self-efficacy did not predict either form of prosocial behavior. Existing research on prosocial behavior repeatedly highlights the importance of knowing that one's actions will make a difference for people to act prosocially [17, 19]. While everyday helping self-efficacy focused on the specific actions involved in daily prosocial behavior, it appears as though this belief was not enough to galvanize participants into prosocial action. Technology wishing to support prosocial behavior change would therefore do well to ensure that users are strengthened, particularly in their belief to affect change.

Both multilevel modeling as well as correlational analysis pointed to everyday helping self-efficacy and wellbeing, but not change impact self-efficacy, increasing over time in both groups. Keeping in mind that causality remains unclear, it is possible that tracking daily prosocial behavior may have led to this increase in everyday helping self-efficacy and wellbeing. This is in line with recently published findings that recalling prosocial behavior can increase wellbeing [38]. As tracking daily prosocial behavior would have made participants aware of the number of prosocial actions they were already doing, it is reasonable to assume that this perception of mastery experiences could also lead to increases in everyday helping self-efficacy. Particularly, as everyday helping self-efficacy, unlike change impact self-efficacy, was focused on the belief in the

ability to perform everyday prosocial actions such as the ones tracked by participants. The platform features of personalized suggested actions, progress visualization and virtual rewards were designed with the intention of increasing both everyday helping self-efficacy and change impact self-efficacy. However, as previously discussed, neither form of self-efficacy was increased by platform exposure.

Interview results offer potential avenues in which the platform could be improved upon in the future to better support both forms of self-efficacy as well as prosocial behavior. In the interviews, participants emphasized the importance of seeing the impact they were having. While the formulation of the suggested actions (including a "why" section highlighting the impact), the progress visualization, and digital rewards on the platform were meant to support a feeling of impact, the interview data made clear that these features were not prominent or understood enough to be effective. Furthermore, participants described how they had forgotten to interact with the platform, even though they had planned to. As the platform had to be accessed via web browser and was otherwise designed to be unobtrusive, it was easy for a week to pass without participants being reminded of the platform. Finally, interview participants described issues of personalization, where receiving only three actions meant it was sometimes difficult to find actions, which could easily be completed in the location and with the amount of time and energy at their disposal in that moment.

Based on these findings, we propose in the following a list of ways in which technology for prosocial behavior change can be improved upon in the future.

Implications for the design of effective technology for prosocial behavior change

Design for actions to feel impactful for the user.

It is vital that users understand that their actions have an impact. While believing in one's capabilities to help in an everyday context is important and should be examined, our results suggest that this may not be enough to invoke action. As past research [17, 19] has discussed and this study supports in new, it is crucial that potential helpers are aware not only of another person's need but also the ways in which their actions can have an impact. In this study, participants were reluctant to donate as donations tended to be considered a less meaningful and effective form of prosocial behavior. This is particularly relevant, as donations have in the past been used as a measure for prosocial behavior [41, 69]. These findings suggest that the processes leading to donations may be different from those involved in other forms of daily prosocial behavior.

Illustrating the impact an action will have is of course a challenge, as many social issues are often opaque in their causes and slow to be improved [70]. In this study, the focus was on prosocial actions, which could be undertaken in the local community. While at this level as well, change may not be easy and thereby also difficult to highlight, it may nevertheless offer some opportunity to show change - both individual and collective. In this study, we used a map and badges to both reward participants and visualize progress, however these features were not made clear enough to participants and their benefit not evident enough. This highlights the importance of user-centered design and iterative improvement of features throughout the process of the creation of new technology [71]; Especially those designed for behavior change. Improved upon, such features may offer a possibility to make clear to users what impact they are having through their actions.

Design for incorporation into everyday life.

While it may be enticing to believe otherwise, behavior change technology aiming to promote prosocial behavior is unlikely to become a central part of a user's daily life. Such technology will have to compete for the user's time with well-established habits and responsibilities [29, 72, 73], as well as countless other forms of technology [73]. In order to win over some of this time, our findings suggest that actions need to be easy to incorporate into existing daily routines as well as clearly valuable to the specific user. One approach here would be to ensure personalization of tasks is advanced enough that actions are suggested that the user will find fun and meaningful and can easily be performed with the time and at the place where the users is at that particular moment. An additional option would be to allow the user more choice, by offering a larger overview of potential actions, through which the user could then search and choose as they see fit.

Beyond this, our results point to the importance of ensuring that the platform is readily available and remains easily visible (e.g. by reminding users with notifications). In his work, Fogg [2, 74] describes the potential of ubiquitous technology to remind users to perform an action at the opportune moment when they are both motivated and capable of performing that action. For example, users could be reminded shortly before leaving the house in the morning to pack some spare change to give to anyone asking for a little money or to pack a reusable water bottle or coffee mug to prevent having to buy a one-way use alternative during the day. Fogg [2], however, also warns that if reminders are sent at a time when either motivation and capability are lacking, they will be perceived as annoying or frustrating rather than helpful. Identifying the correct time and place at which to send reminders is therefore challenging but an invaluable avenue for future improvement.

Design for sustained usage over time.

While interacting with a new form of technology may be fun and novel the first time it is performed, a lack of variety may lead to loss of interest fairly quickly [48, 75]. Our results emphasize the importance of making the experience with the platform enjoyable. Even if the subject matter is serious and the motivation of the users to interact with the platform may be altruistic, as these results show, enjoying interacting with the platform is important to encourage users to want to return and engage with the platform over time. Enjoyment could, for example, be supported by introducing new features or narrative elements over time, a strategy long used effectively in games (e.g., [76, 77]). Another option would be the use of social features, allowing users to hold each other accountable, motivate and support each other, or even join forces to completed actions [9, 78].

Limitations and further research

While this study was strengthened by an experimental, theory-driven, longitudinal design, there are limitations, which we wish to discuss, both in terms of the limits to the interpretability of the results as well as in terms of avenues we see for future research.

This study advertised itself to potential participants explicitly as focusing on increasing prosocial behavior. This was done in order to attract participants interested in increasing their prosocial behavior (and detracting participants who would find this of no interest). However, we did not explicitly measure participants' motivation for participating. Thereby, it is uncertain what role motivation played in the effectiveness

of the platform, as well as the degree to which these findings can be generalized to less interested populations. It is however important to note here that the goal of this platform was to work with participants own motivation to facilitate changes in their behavior. Extrapolations from these results onto ways of changing the behavior of people uninterested to do so, is therefore neither recommended, nor intended.

The use of a self-developed platform was decided on due to the lack of real-world platforms for prosocial action personalization and meant that we were flexible in measurement and stimuli manipulation. However, the simpleness of the platform also meant that, for example, the personalization was based on a pre-study assessment of motivation, capability and opportunity. As we learned, context- and time- sensitive understandings of the COM-B model is crucial in the context of prosocial behavior. Future research would therefore be advised to ensure that personalization is more sophisticated than that which was possible with this platform. For example, future research could improve the present methodology by providing real-time notifications based on the location of participants when they are near where they could accomplish a action.

The measure of daily prosocial behavior represented both a valuable source of information and a weakness in terms of accurate measurement. Across groups, daily prosocial behavior decreased during the study. This may have been due to the fact that daily measurements included both a quantitative and a qualitative measure of the past day's prosocial behavior. Most likely, participants fatigued particularly of the qualitative question, which necessitated them to write a list of prosocial actions. While the measure allowed the tracking of an approximate of prosocial behavior over time and across groups, future measurements should consider using only a quantitative, easy-to-complete measure, if asking for daily participant answers.

The platform was only accessible via the browser on either a laptop or a smartphone. Since multiple steps were needed to open the platform, log in and look for further assigned actions, this might have had an impact on accomplishing the assigned actions. It is not clear whether participants that did not use the platform, did so because they forgot to log their actions, or whether the platform design was too cumbersome and the effort too high for participants to log their actions. In terms of tracking daily prosocial actions, the timing of the notification (sent the next morning) might have lead to memory-loss-effects, that is, participants forgetting their prosocial actions by the time they were reminded to track them. Future research could improve this by increasing the frequency of the email reminders, although this could lead to annoyed participants.

The results of this study suggest that the relationship between self-efficacy and prosocial behavior is more nuanced than previously assumed - with the self-efficacy for performing concrete prosocial actions and self-efficacy for acting in a way which will have a tangible impact playing differing roles in the interplay between technology and behavior. The *Everyday Helping Self-Efficacy* scale was developed in its current state in order to offer a first, more specific examination of self-efficacy in the context of everyday helping behavior. Considering the importance of self-efficacy for behavior, we would encourage the examination of this and other forms of specific self-efficacy in the context of prosocial behavior. Beyond this, examinations of the interplay between different forms of self-efficacy may also offer more nuanced views on the forces behind behavior.

While data collection over three weeks offered first insights into the relationships between the examined variables, a longer running time of the study - especially also the inclusion of data points after exposure to the platform and daily prosocial behavior tracking ceased - could offer future studies additional insights into the interaction

between technological tools and behavior change over time.

Conclusion

Designing for outcomes as diverse and complex as prosocial behavior may seem daunting. However, research on the interaction between technology and psychology can offer valuable insights into how to design to support prosocial behavior. The findings of this study point to the potentials and pitfalls of attempting to use one such form of technology to increase prosocial behavior over time. Tracking prosocial behavior over time was related to increases in participants' belief in their ability to help others in everyday settings. However, in order to increase prosocial behavior, these results suggest that other features of the platform would need to be improved upon in order to support participants' belief in their ability to affect change. This could potentially be achieved by highlighting the impact of suggested actions and creating engaging progress visualisations. As such technology will need to compete for the user's time and attention, it is important to ensure that it fits well into everyday life and is prominent enough to not be forgotten. Personalizing to individuals capabilities, opportunities, and motivations, as well as sending reminders at moments when participants are both motivated and capable of taking action may offer avenues for achieving this. Finally, for continued usage over time, it is important to ensure that users are enjoying themselves. Ensuring variety in suggested actions and facilitating social interactions are possible ways in which this could be supported. While further studies are necessary to understand this research area in more detail, the exploratory findings of this study provide some first insights into ways in which technology can be designed to support prosocial behavior change over time. Together, progression in this research area will hopefully lead to a greater understanding of how we can design technology to benefit individuals, communities, and, ultimately, societies.

Acknowledgements

Many thanks to Melanie Svab for her valuable support - her record-breaking speed at learning LaTeX wizardry helped get this manuscript out the door.

References

1. Calvo RA, Peters D. Positive computing: technology for wellbeing and human potential. Cambridge, Massachusetts: MIT Press; 2014.

2. Fogg B. Persuasive Technology. Morgan Kaufmann; 2003.

3. Shriram K, Oh SY, Bailenson J. Virtual reality and prosocial behavior. In: Social signal processing. Cambridge, UK: Cambridge University Press; 2017. p. 304–316.

4. Reinecke L, Eden A. Media use and recreation: Media-induced recovery as a link between media exposure and well-being. In: The Routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects. New York, NY, US: Routledge; 2016. p. 106–117.

5. Orji R, Moffatt K. Persuasive technology for health and wellness: State-of-the-art and emerging trends. Health informatics journal. 2018;24(1):66–91.

6. Hermsen S, Frost J, Renes RJ, Kerkhof P. Using feedback through digital technology to disrupt and change habitual behavior: A critical review of current literature. Computers in Human Behavior. 2016;57:61–74.

7. Kreis R. # refugeesnotwelcome: Anti-refugee discourse on Twitter. Discourse & Communication. 2017;11(5):498–514.

8. Kowalski RM, Limber SP, McCord A. A developmental approach to cyberbullying: Prevalence and protective factors. Aggression and Violent Behavior. 2019;45:20–32.

9. Petersen JM, Prichard I, Kemps E. A Comparison of Physical Activity Mobile Apps With and Without Existing Web-Based Social Networking Platforms: Systematic Review. Journal of Medical Internet Research. 2019;21(8):e12687.

10. Bandura A. Self-efficacy: The exercise of control. New York, NY, US: W. H. Freeman & Company; 1997.

11. Caprara GV, Fida R, Vecchione M, Del Bove G, Vecchio GM, Barbaranelli C, et al. Longitudinal analysis of the role of perceived self-efficacy for self-regulated learning in academic continuance and achievement. Journal of educational psychology. 2008;100(3):525–534.

12. Bandura A. Perceived self-efficacy in the exercise of control over AIDS infection. Evaluation and program planning. 1990;13(1):9–17.

13. Huang H. Media use, environmental beliefs, self-efficacy, and pro-environmental behavior. Journal of Business Research. 2016;69(6):2206–2212.

14. Chen G, Gully SM, Eden D. Validation of a new general self-efficacy scale. Organizational research methods. 2001;4(1):62–83.

15. Bandura A. Self-Efficacy. In: The Corsini Encyclopedia of Psychology. Hoboken, NJ, US: John Wiley & Sons, Inc.; 2010. p. 1–3.

16. Patrick RB, Bodine AJ, Gibbs JC, Basinger KS. What Accounts for Prosocial Behavior? Roles of Moral Identity, Moral Judgment, and Self-Efficacy Beliefs. The Journal of genetic psychology. 2018;179(5):231–245.

17. White K, MacDonnell R, Ellard JH. Belief in a just world: Consumer intentions and behaviors toward ethical products. Journal of Marketing. 2012;76(1):103–118.

18. Sargeant A, Ford J, West DC. Widening the appeal of charity. International Journal of Nonprofit and Voluntary Sector Marketing. 2000;5(4):318–332.

19. Bekkers R, Wiepking P. A literature review of empirical studies of philanthropy: Eight mechanisms that drive charitable giving. Nonprofit and voluntary sector quarterly. 2011;40(5):924–973.

20. Sargeant A, Ford JB, West DC. Perceptual determinants of nonprofit giving behavior. Journal of Business Research. 2006;59(2):155–165.

21. Pollak J, Gay G, Byrne S, Wagner E, Retelny D, Humphreys L. It's Time to Eat! Using Mobile Games to Promote Healthy Eating. IEEE Pervasive Computing. 2010;9(3):21–27. doi:10.1109/MPRV.2010.41.

22. Domingo MG, Garganté AB. Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. Computers in Human Behavior. 2016;56:21–28.

23. Spohr SA, Nandy R, Gandhiraj D, Vemulapalli A, Anne S, Walters ST. Efficacy of SMS Text Message Interventions for Smoking Cessation: A Meta-Analysis. Journal of Substance Abuse Treatment. 2015;56:1–10.

24. Ubhi HK, Michie S, Kotz D, Wong WC, West R. A mobile app to aid smoking cessation: preliminary evaluation of SmokeFree28. Journal of medical Internet research. 2015;17(1).

25. Iacoviello BM, Steinerman JR, Klein DB, Silver TL, Berger AG, Luo SX, et al. Clickotine, a personalized smartphone app for smoking cessation: initial evaluation. JMIR mHealth and uHealth. 2017;5(4):e56.

26. Geelan B, Zulkifly A, Smith A, Cauchi-Saunders A, de Salas K, Lewis I. Augmented exergaming: increasing exercise duration in novices. In: Proceedings of the 28th Australian Conference on Computer-Human Interaction. ACM; 2016. p. 542–551.

27. Direito A, Jiang Y, Whittaker R, Maddison R. Apps for IMproving FITness and increasing physical activity among young people: the AIMFIT pragmatic randomized controlled trial. Journal of medical Internet research. 2015;17(8):e210.

28. Street TD, Lacey SJ, Langdon RR. Gaming Your Way to Health: A Systematic Review of Exergaming Programs to Increase Health and Exercise Behaviors in Adults. Games for Health Journal. 2017;6(3):136–146. doi:10.1089/g4h.2016.0102.

29. Michie S, Atkins L, West R. The behaviour change wheel. A guide to designing interventions. Great Britain: Silverback Publishing; 2014.

30. García Botero G, Questier F, Zhu C. Self-directed language learning in a mobile-assisted, out-of-class context: do students walk the talk? Computer Assisted Language Learning. 2019;32(1-2):71–97.

31. Koivisto J, Hamari J. Gamification of physical activity: A systematic literature review of comparison studies. In: GamiFIN Conference; 2019.

32. Stawarz K, Cox AL, Blandford A. Beyond self-tracking and reminders: designing smartphone apps that support habit formation. In: Proceedings of the 33rd annual ACM conference on human factors in computing systems. ACM; 2015. p. 2653–2662.

33. Batson CD, Powell AA. In: Millon T, Lerner MJ, Weiner IB, editors. Altruism and prosocial behavior. John Wiley & Sons, Hoboken, New Jersey; 2003. p. 463–484.

34. Eisenberg N, Spinrad TL. Multidimensionality of prosocial behavior. In: Prosocial development: A multidimensional approach. New York, NY, US: Oxford University Press; 2014. p. 17–39.

35. Weinstein N, Ryan RM. When helping helps: Autonomous motivation for prosocial behavior and its influence on well-being for the helper and recipient. Journal of personality and social psychology. 2010;98(2):222–244.

36. Layous K, Nelson SK, Kurtz JL, Lyubomirsky S. What triggers prosocial effort? A positive feedback loop between positive activities, kindness, and well-being. The Journal of Positive Psychology. 2017;12(4):385–398. doi:10.1080/17439760.2016.1198924.

37. Nelson SK, Layous K, Cole SW, Lyubomirsky S. Do unto others or treat yourself? The effects of prosocial and self-focused behavior on psychological flourishing. Emotion. 2016;16(6):850–861.

38. Ko K, Margolis S, Revord J, Lyubomirsky S. Comparing the effects of performing and recalling acts of kindness. The Journal of Positive Psychology. 2019; p. 1–9.

39. Aknin LB, Broesch T, Hamlin JK, Van de Vondervoort JW. Prosocial behavior leads to happiness in a small-scale rural society. Journal of Experimental Psychology: General. 2015;144(4).

40. Rowland L, Klisanin D. Cyber-kindness: Spreading kindness in cyberspace. Media Psychology Review. 2018;12(1).

41. Steinemann ST, Mekler ED, Opwis K. Increasing donating behavior through a game for change: The role of interactivity and appreciation. In: Proceedings of the 2015 annual symposium on computer-human interaction in play. ACM; 2015. p. 319–329.

42. Ahn SJG, Le AMT, Bailenson J. The Effect of Embodied Experiences on Self-Other Merging, Attitude, and Helping Behavior. Media Psychology. 2013;16(1):7–38.

43. Rosenberg RS, Baughman SL, Bailenson JN. Virtual superheroes: Using superpowers in virtual reality to encourage prosocial behavior. PloS one. 2013;8(1).

44. Konrath S, Falk E, Fuhrel-Forbis A, Liu M, Swain J, Tolman R, et al. Can text messages increase empathy and prosocial behavior? The development and initial validation of text to connect. PLoS One. 2015;10(9).

45. Gardner B, Smith L, Lorencatto F, Hamer M, Biddle SJ. How to reduce sitting time? A review of behaviour change strategies used in sedentary behaviour reduction interventions among adults. Health Psychology Review. 2016;10(1):89–112.

46. Roth C, Vermeulen I, Vorderer P, Klimmt C. Exploring replay value: shifts and continuities in user experiences between first and second exposure to an interactive story. Cyberpsychology, Behavior, and Social Networking. 2012;15(7):378–381.

47. Tannenbaum PH. Play it again, Sam: Repeated exposure to television programs. University of California; 1981.

48. Hamari J, Koivisto J, Sarsa H, et al. Does Gamification Work?-A Literature Review of Empirical Studies on Gamification. In: 47th Hawaii International Conference on System Sciences (HICSS). vol. 14; 2014. p. 3025–3034.

49. Oliver MB, Bartsch A. Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. Human Communication Research. 2010;36(1):53–81.

50. Weiser P, Bucher D, Cellina F, De Luca V. A taxonomy of motivational affordances for meaningful gamified and persuasive technologies. 2015;.

51. Munson SA, Consolvo S. Exploring goal-setting, rewards, self-monitoring, and sharing to motivate physical activity. In: 2012 6th international conference on pervasive computing technologies for healthcare (pervasivehealth) and workshops. IEEE; 2012. p. 25–32.

52. Akin-Little A, Little SG. Effect of extrinsic reinforcement on "intrinsic" motivation: Separating fact from fiction. 2019;.

53. Shin J, Kim MS, Hwang H, Lee BY. Effects of intrinsic motivation and informative feedback in service-learning on the development of college students' life purpose. Journal of Moral Education. 2018;47(2):159–174.

54. Nafcha O, Higgins ET, Eitam B. Control feedback as the motivational force behind habitual behavior. In: Progress in brain research. vol. 229. Elsevier; 2016. p. 49–68.

55. Luo Y, Zelenika I, Zhao J. Providing immediate feedback improves recycling and composting accuracy. Journal of environmental management. 2019;232:445–454.

56. Adams AT, Costa J, Jung MF, Choudhury T. Mindless computing: designing technologies to subtly influence behavior. In: Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing; 2015. p. 719–730.

57. Bandura A. Guide for constructing self-efficacy scales. Self-efficacy beliefs of adolescents. 2006;5(1):307–337.

58. Field AP, Miles J, Field Z. Discovering statistics using R. London, UK: Sage; 2012.

59. All A, Castellar EPN, Van Looy J. Towards a conceptual framework for assessing the effectiveness of digital game-based learning. Computers & Education. 2015;88:29–37.

60. Finstad K. The usability metric for user experience. Interacting with Computers. 2010;22(5):323–327.

61. Topp CW, Østergaard SD, Søndergaard S, Bech P. The WHO-5 Well-Being Index: a systematic review of the literature. Psychotherapy and psychosomatics. 2015;84(3):167–176.

62. Clarke V, Braun V, Hayfield N. Thematic analysis. In: Qualitative psychology: A practical guide to research methods. 3rd ed.; 2015. p. 222–248.

63. Fugard AJ, Potts HW. Supporting thinking on sample sizes for thematic analyses: a quantitative tool. International Journal of Social Research Methodology. 2015;18(6):669–684.

64. Mason M. Sample size and saturation in PhD studies using qualitative interviews. In: Forum qualitative Sozialforschung/Forum: qualitative social research. vol. 11; 2010.

65. Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. Field methods. 2006;18(1):59–82.

66. R Core Team. R: A Language and Environment for Statistical Computing; 2018. Available from: https://www.R-project.org/.

67. Pinheiro J, Bates D, DebRoy S, Sarkar D, R Core Team. nlme: Linear and Nonlinear Mixed Effects Models; 2018. Available from: https://CRAN.R-project.org/package=nlme.

68. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006;3(2):77–101.

69. Steinemann ST, Iten GH, Opwis K, Forde SF, Frasseck L, Mekler ED. Interactive Narratives Affecting Social Change. Journal of Media Psychology. 2017;.

70. Brown VA, Harris JA, Russell JY. Tackling wicked problems through the transdisciplinary imagination. London, UK: Earthscan; 2010.

71. Abras C, Maloney-Krichmar D, Preece J, et al. User-centered design. Bainbridge, W Encyclopedia of Human-Computer Interaction Thousand Oaks: Sage Publications. 2004;37(4):445–456.

72. Wood W, Rünger D. Psychology of habit. Annual review of psychology. 2016;67:289–314.

73. Feng L, Hu Y, Li B, Stanley HE, Havlin S, Braunstein LA. Competing for attention in social media under information overload conditions. PloS one. 2015;10(7).

74. Fogg BJ. A behavior model for persuasive design. In: Proceedings of the 4th international Conference on Persuasive Technology. ACM; 2009. p. 40.

75. O'Brien HL, Toms EG. What is user engagement? A conceptual framework for defining user engagement with technology. Journal of the American society for Information Science and Technology. 2008;59(6):938–955.

76. Nicholson S. A recipe for meaningful gamification. In: Gamification in education and business. Chem, CH: Springer; 2015. p. 1–20.

77. Rapp A. Designing interactive systems through a game lens: An ethnographic approach. Computers in human behavior. 2017;71:455–468.

78. Du H, Youngblood GM, Pirolli P. Efficacy of a smartphone system to support groups in behavior change programs. In: WH '14 Proceedings of the Wireless Health 2014 on National Institutes of Health. ACM; 2014. p. 1–8.

Curriculum Vitae

Name: Sharon Therese Steinemann

Higher Education

2015–2020 PhD Dissertation at the Human-Computer Interaction Research Lab, Department for General Psychology and Methodology, Faculty of Psychology, University of Basel, Switzerland.

2011–2015 Master of Science in Psychology, Project & Thesis in Human-Computer Interaction, University of Basel, Switzerland.

2008–2011 Bachelor of Science in Psychology, University of Basel, Switzerland.

Internships

2013-2014 User Research Assistant Position in the YouTube Viewer UX Team, YouTube, San Bruno, USA

2012 User Research Internship in the Google Privacy UX Team, Google Zurich, Switzerland

2011 Research Internship at the Human-Computer Interaction Research Lab, Department for General Psychology and Methodology, Faculty of Psychology, University of Basel, Switzerland.

Publications

2019 **Steinemann, S. T.**, Geelan, B. J, Zaehringer, S., Mutuura, K., Wolkow, E., Frasseck, L., & Opwis, K. (submitted). Potentials and Pitfalls of Increasing Prosocial Behavior and Self-Efficacy over Time Using an Online Personalized Platform.

Munsch, S., Wyssen, A., Vanhulst, P., Lalanne, D., **Steinemann, S. T.**, & Tuch, A.. (2019). Binge-eating disorder treatment goes online - feasability, usability, and treatment outcome of an internet-based treatment for binge-eating disorder: study protocol for a three-arm randomized controlled trial including an immediate treatment, a waitlist, and a placebo control group. *Trials, 20 (1)*, 128.

2018 Iten, G. H., **Steinemann, S. T.**, & Opwis, K. (2018, April). Choosing to help monsters: A mixed-method examination of meaningful choices in games. In *Preceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 341-354). New York, NY: ACM.

Steinemann, S. T., Geelan, B., Sachithananthan, K., Frasseck, L., Iten, G. & Opwis, K. (2018). Simple Acts - A gameful system to increase justice restoration self-efficacy and civic engagement. In *Games Everywhere, Gaming Everywhere: On the Edge of Ubiquity, from Mobile to Augmented Reality Games and Beyond. Pre-Conference to the 68th International Communication Association (ICA) Annual Conference.*

Lerch, V. R., **Steinemann, S. T.**, & Opwis, K. (2018). Understanding fitness app usage over time: Moving beyond the need for competence. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*. New York, NY: ACM.

2017 **Steinemann, S. T.**, Iten, G. H., Opwis, K., Forde, S. F., Frasseck, L., & Mekler, E. D. (2017). Interactive narratives affecting social change: A closer look at the relationship between interactivity and prosocial behavior. *Journal of Media Psychology 29*(1), 54-66.

Iten, G. H., **Steinemann, S. T.**, & Opwis, K. (2017, October). To save or to sacrifice?: Understanding meaningful choices in games. In *Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play* (pp. 495-502). New York, NY: ACM.

Steinemann, S. T., Geelan, B., de Salas, K., & Opwis, K. (2017). Simple acts for a better world: A gameful system for prosocial behavior: Preliminary design and research plan. In *Proceedings of the 2017 Annual Symposium on Computer-Human Interaction in Play companion extended abstracts* (pp. 305-313). New York, NY: ACM.

2016 **Steinemann, S. T.**, Mekler, E. D., & Opwis, K. (2016). The winner gives it all: Preliminary results on the role of game outcome on the effectiveness of a game for change. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction*

in Play Companion Extended Abstracts (pp. 291-298).
New York, NY: ACM.

Mekler, E. D., Rank, S., **Steinemann, S. T.**, Birk, M. V.,
& Iacovides, I. (2016). Designing for emotional complexity in
games: The interplay of positive and negative affect. In *Proceedings
of the 2016 Annual Symposium on Computer-Human Interaction
in Play Companion Extended Abstracts* (pp. 367-371).
New York, NY: ACM.

2015 **Steinemann, S. T.**, Mekler, E. D., & Opwis, K. (2015). Increasing
donating behavior through a game for change: The role of interactivity
and appreciation. In *Proceedings of the 2015 Annual Symposium on
Computer-Human Interaction in Play* (pp. 319-329). New York, NY: ACM.