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EMPIRICAL ARTICLE

Virtual reality for philanthropy: A promising tool to innovate fundraising

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Abstract

Philanthropic organizations experience difficulties in obtaining support from younger generations, highlighting the need for modern fundraising strategies. Advances in technology provide a potential solution by offering alternatives to traditional fundraising practices. In an experimental study in collaboration with the International Committee of the Red Cross (ICRC), we investigated whether virtual reality (VR) could be harnessed to innovate fundraising. We customized a VR module developed by the ICRC and tested its effectiveness at eliciting donations compared to that of an on-screen version of the experience. In addition, we explored mechanisms that might drive this effect, namely the level of interactivity (active/passive) and the type of affect elicited by the module (positive—happy ending/negative—tragic ending), as well as subjective perceptions and emotions related to the experience. Our findings showed that VR, compared with an on-screen experience, led to both an increase in incentivized donations and a larger reported propensity to become regular donors. Investigating the mechanisms that might drive the effect, we found that the VR experience led to stronger emotional feelings (notably being moved and sadness) and improved quality of the experience (e.g., level of interest and vividness). We further found physiological evidence showing a significant increase in arousal for the VR condition compared with the on-screen condition, although this was not correlated with an increase in donations. Taken together, our study provides evidence that VR could be a viable tool to innovate fundraising and identifies some of the features that may make this medium more effective than traditional practices.

1. Introduction

Many nonprofit organizations face the complex challenge of attracting younger donors to engage with their projects and contribute to their activities (Crawford & Jackson, 2018). However, gaining repeat donors from younger generations is crucial to the sustainability of nonprofit organizations, especially given that a large wealth transfer between generations is imminent (Wilson, 2020). Recent studies on (primarily U.S. American) millennials (i.e., people born between 1980 and 1999) have shown that they desire purposeful work, value emotional engagement and seeing the impact of their actions (Gorczyca & Hartman, 2017), and prefer to support causes rather than institutions (Feldman et al., 2013). Moreover, they appreciate experiential learning (McCurry & Martins, 2009) and prefer to connect using technology (Feldman et al., 2013). In this context, virtual reality (VR) could be an ideal medium for attracting younger donors as it has both technological appeal and allows users to experience the impact they can make with their donations. VR is rapidly gaining popularity in western countries,

with the number of VR headsets owned in the United States estimated at 37.7 million in 2022 (or 1.1% of the population; Cureton, 2023), numbers which are predicted to continue growing to 7% in the United States and 3.2% in Europe in 2023 (Statista, 2022).

VR is a richer medium than most used in fundraising strategies, such as email campaigns or videos. Richer media generally induce stronger feelings of immersion and social presence (Waterworth & Waterworth, 2003), a more vivid sense of being in and interacting with the stimuli. They change the scenario from one that must be imagined to one that is experienced, tapping into the 'body loop' rather than the 'as-if body loop' (Damasio, 1999) and eliciting a greater sense of presence, emotions, and physiological arousal. VR studies have shown increases in affect, immersion, social presence, perspective-taking, and awareness of consequences, which in turn influence subsequent behavior (Diemer et al., 2015; Hasler et al., 2021; Meuleman & Rudrauf, 2018; Mol et al., 2022). Thus, VR holds promise as a means of innovating fundraising, bridging the gap between donor and recipient by immersing donors in the causes they are supporting and potentially increasing donations. However, VR initiatives also require a higher initial financial investment to develop and cost more to disseminate, as VR experiences require expensive equipment, which most people do not have, meaning that fundraisers must procure the equipment and set up in-person initiatives. This highlights the need for data on the extent of the effectiveness of VR incentives compared to cheaper media.

Previous studies have examined the effectiveness of VR in eliciting donations or the intention to donate compared to videos. Kandaurova and Lee (2019) found that VR was a catalyst for empathy and social responsibility, thereby increasing the intention to donate both money and time. Yoo and Drumwright (2018) found that VR increased donation intention compared with video and identified social presence as a mediator of this effect. Nelson et al. (2020) found that full VR eliciting negative emotions (compared with video and positive emotions) elicited the most donations to an environmental conservation cause. Kahn and Cargile (2021) tested the effects of eliciting awe in VR (compared with both a 360° and noninteractive video) and found that VR increased both awe and willingness to donate compared with both video conditions (which did not significantly differ from each other). These results are promising, offering evidence that VR can indeed be a useful tool in eliciting donations; however, they have several limitations. First, with the exception of Nelson et al. (2020), previous studies examined the intention/willingness to donate, rather than donations themselves (in an incentive compatible way, i.e., entailing a real financial cost to the participant). A substantial gap between intentions and actions has been well documented in the literature (e.g., Sheeran & Webb, 2016), so that establishing a change in people's intentions does not necessarily predicate a change in behavior. Furthermore, VR experiences were mostly passive, with no opportunities for participants to interact with their environments. Interactivity is a key feature of VR, and evidence shows that higher levels of interactivity enhance the experience and contribute to immersion (Mütterlein, 2018); thus, a passive VR experience may not be capturing its full effects. While Kahn and Cargile (2021) included varying interactivity in their video conditions, this interactivity included only the ability to direct gaze within the environment, and did not differ in the VR condition (in which participants could always explore the environment via head movements). Thus, little is known on how interactive features such as handling objects and choosing when to move through the scenario might impact experiences and subsequent donations.

Here, we propose a novel experimental design that allows us to both measure the effectiveness of using VR for fundraising and address the aforementioned limitations, thus providing a more complete picture of VR's potential as a tool for fundraising. In collaboration with the International Committee of the Red Cross (ICRC), we used a customized VR module (compared with an on-screen video with the same content) to investigate whether VR would lead to an increase in donations, and whether such an effect was mediated by (a) scenarios inducing negative (vs. positive) emotions—as was the case for Nelson et al.'s (2020)—and (b) a context in which participants had a more active (vs. passive) role. The literature on prosocial giving has found evidence that appeals which provoke affective responses through focus on a single victim tend to be the most effective, and may be diminished by numerical facts or prolonged deliberation (see, e.g., Moche et al., 2022; Slovic, 2007). Based on this, our VR

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experiences focused on the rescue of an unconscious child in a war zone and elicited donations immediately following the experience to avoid deliberation. In addition, participants' subjective reports on intention to donate regularly were collected for comparison with the previously mentioned studies. Furthermore, to examine the mechanisms that drive this effect, our research combined self-report measures of affect and immersion with physiological measures of arousal—namely heart rate and skin conductance—as previous studies on VR have shown correlations between higher physiological arousal and immersion and emotional responses (e.g., Higuera-Trujillo et al., 2017; Marín-Morales et al., 2018). These measures contribute to further elucidating the interplay between objective measures of arousal, self-reported perceptions of the experience, and donations.

We analyzed the main effect of VR on donations, as well as the main effects of interactivity and affect. We also examined the effect of VR on physiological arousal compared to an on-screen medium. Specifically, based on the evidence above, we tested the predictions captured by the following hypotheses (based on previous findings) and research questions.

1.1. Hypotheses and research questions

H1: VR conditions will elicit higher donations than on-screen conditions.

H2: Arousal will be higher during VR conditions than during on-screen conditions.

RQ1: Will active conditions elicit higher donations than passive conditions?

RQ2: Will the negative ending elicit higher donations than the positive ending?

In addition, participants completed a series of psychometric questionnaires on elements that potentially enhance VR experiences or affect donations such as perceptions of the experience and anticipatory guilt. These factors were used in exploratory analyses to examine whether they shed additional light on how VR impacts donations.

2. Methods

2.1. Participants

For a between-participants experimental design, we recruited 270 participants (14 more than the 256 required) based on our power analysis for the main effect of medium on donations (G*Power 3 (Faul et al., 2007), $\alpha = 0.01$, power = 0.95, effect size = 0.25) to account for attrition and possible incomplete data. Participants were recruited from a list of people who expressed previous interest in participating in studies and via flyers posted around the University of Geneva campuses. Three participants chose to withdraw from the study when they found the scenes of conflict too disturbing, resulting in 267 participants being included in our analyses (172 women, 95 men, mean age = 22.7 [SD = 5.27, min/max = 18/65], 244 students). The study was approved by the University of Geneva ethics committee.

2.2. Procedure

2.2.1. Real-effort task

As our aim was to solicit real donations from people, we first needed to ensure that all participants had money available to donate. Previous research (Luccasen & Grossman, 2017; Thaler & Johnson, 1990) found that participants change their behavior during financially incentivized tasks if they earn their money compared to when they receive the money as a gift from the experimenter—a phenomenon referred to as the house money effect. In order to ensure that participants' ability to make donations depended on their own effort, we implemented the translation task, a 2-minute, real-effort task, where they earned money depending on their performance. The task, designed by Bernardic and Lascombes

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(2023), based on a similar task by Erkal et al. (2011), involved translating letters into numbers using a table (Data Availability Statement, Figure S1). For each letter translated, they earned one point, with an extra 20 points given as a bonus for every 10 letters translated (see Data Availability Statement, Figure S1 for payment chart). Earnings in this task varied from 3 to 18 Swiss francs (CHF) (mean = 10.6).

2.2.2. Multimedia experience

Following the real-effort task, participants experienced 1 of 4 versions of the scenario 'The Escape' (active with a happy ending, active with a sad ending, passive with a happy ending, or passive with a sad ending) in either VR (viewed through a headset) or on a computer screen (viewed as either a video or an interactive experience). The computer was placed on a high table so that participants were standing in all conditions, to control for increased physiological activity caused by standing. In the 5–6-minute, first-person perspective experience, participants were immersed in a war zone where they found a wounded child and had to get themselves and the child safely to an aid station (see Data Availability Statement, Figure S2 for stills or watch a video of the full experience at https://osf.io/4e9vr/?view_only=8549825983b14fd1b71a91320b232349). Throughout the experience, participants were in communication with an ICRC delegate who helped them navigate the city through the debris and active combat. At the end, they reached the aid station, and the paramedic began performing cardiopulmonary resuscitation on the child. In the happy ending version, they were reassured that the child was safe, while the sound of the child's strong heartbeat was heard in the background. In the sad ending, they received no such reassurance, and the scene faded to black to the sound of the child flatlining. In the active version of the experience, participants could freely explore the scenario visually, using their head (VR condition) or a mouse (on-screen condition) to look around. In addition, they had to find and activate the arrows that allowed them to proceed from one stage of the experience to another and could interact with some objects along the way. In the passive version, participants watched the avatar move through the same scenario and interact with the same objects but had no control over what they did. In all scenarios, participants chose the sex of their avatar. At the end of the multimedia experience, participants were asked how much of their earnings from the first task they wished to contribute to the ICRC. Participants were free to donate additional funds as well.

2.2.3. Physiological recording

Physiological measures—namely skin conductance and heart rate—were recorded throughout the multimedia experiences via 2 electrodes placed on the index and middle fingers and a photoplethysmogram (PPG) sensor on the ring finger of the left hand. From these, measures of heart rate frequency (BPM), heart rate amplitude, and electrodermal activity (using the area under the curve [AUC]) were extracted and used in our models. Means from three key time periods of the experience (baseline and at two low-movement time points in the scenario) were used for analysis. These time periods were chosen as stages that had high emotional and narrative significance but required no actions, reducing movement artifacts.

2.2.4. Psychometric questionnaires

After the multimedia experience was completed, participants were asked to fill out a short questionnaire. This included demographic questions on their gender, age, socioeconomic status, previous interactions with the ICRC, and whether they had previously experienced VR. Questions directly related to the experience included measures on various emotions, questions on how the experience was perceived, and key factors found to influence donations/intention to donate (Table 1). Key questions were taken from previously validated questionnaires: social presence was measured using a 3-item scale adapted from Jin (2009) (Data Availability Statement, Section 2), empathy and attachment to the avatar, as well as guilt/social responsibility, maladaptive responses and self-efficacy were measured using a questionnaire adapted and expanded from Basil et al. (2008) (Data Availability Statement, Section 2), and 3 questions measuring immersion were taken from the Temple Presence Inventory (Lombard et al.,

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Table 1. *List of elements identified in the existing literature that were measured in self-reported questionnaires. All factors were measured using a 5-point Likert scale.*

Emotions	Perceptions of experience	Other key factors
Angry	Immersive	Empathy
Afraid	Level of social presence	Moral obligation
Excited	Embodiment of avatar	Anticipatory guilt
Disgusted	Stimulating	Maladaptive responses
Sad	Enriching	Self-efficacy
Stressed	Pleasant	Nationalism
Moved	Vivid	
Bored	Moving	
Calm	Engaging	
Proud	Educational	
Joyful	Interesting	

2009). In addition, we added one question on moral obligation ('I have a moral obligation to help those in need') and nationalism ('I do not see why I should donate money to international aid while I am surrounded by people in need in my own country'), as the initiative was to collect donations to help those in other countries. Finally, as sensation-seeking could be a factor that influences people's appreciation of the experience, we included the Brief Sensation-Seeking Scale (Hoyle et al., 2002). Data were collected on a 5-point Likert scale and used to further explore elements that may contribute to the effectiveness of the scenarios.

3. Results

Data analysis was conducted using R version 4.0.0. The first step was to ensure that the randomization of group assignment was effective. We looked at the variables age, gender, sensation-seeking tendencies, and earnings from the first task, as well as familiarity with and previous donations to the ICRC and sensation-seeking and found no differences across conditions (all p-values > 0.35; Data Availability Statement, Section 3). Money earned on the day of the experiment also did not differ significantly between conditions (VR: mean = 10.48 CHF, min/max = 3.9/15.9; Screen: mean = 10.72 CHF, min/max = 3/18). Socioeconomic status was significantly higher in the on-screen condition compared with the VR condition (mean = 2.44 vs. 1.97, $p = 0.009$, Cohen's $d = 0.32$). To control for potential bias introduced by this, we analyzed the effect of socioeconomic status on earnings donated, and found no significant effect (coef = 0.12, SE = 0.17, $p = .48$). We then included socioeconomic status in our full model with all the condition variables (medium, interactivity, and ending) and found that it did not reduce the effect of medium (Table 3). We thus proceeded to analyze our data to test for main effects.

3.1. Effect of condition

Table 2 shows the descriptive statistics for donations by condition. A 2 (medium) + 2 (interactivity) + 2 (ending) linear model was used to explore the effect of condition on donations (model 2 in Table 3). As shown, only medium trended toward having a significant effect (a 71-cent increase, $p = 0.075$). These effects remained relatively unchanged when interactivity and ending were excluded as covariates (model 1 in Table 3) or when socioeconomic status was added (model 3).

3.2. Behavioral hypothesis and research questions

We next ran Mann–Whitney tests for each hypothesis and research question, beginning with medium (H1), as our linear model showed support for its effect. As shown in Figure 1, both the VR and on-

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Table 2. *Mean and standard deviation for donations by conditions.*

Condition (*N*)	Donation mean (SD)
VR (134)	**4.62(.36)**
Active, happy (33)	4.89 (3.27)
Active, sad (34)	4.64 (4.18)
Passive, happy (33)	3.18 (3.24)
Passive, sad (34)	5.76 (5.23)
Screen (133)	**3.92 (.34)**
Active, happy (33)	4.01 (4.12)
Active, sad (33)	3.7 (3.15)
Passive, happy (34)	4.57 (4.74)
Passive, sad (33)	3.38 (3.49)

Table 3. *Output for linear models including medium only, all conditions, or all conditions plus socioeconomic status. Values correspond to donations made. Significance levels are 1-tailed predicting that VR > Screen. P = 0.051 – 0.1 = ●, P ≤ 0.05 = *, P ≤ 0.01 = **, P = ≤ 0.001 = ***.*

	(1)	(2)	(3)
Intercept	3.92***	3.8***	3.45**
	(0.39)	(0.49)	(0.64)
Medium	0.71●	0.71●	0.78●
	(0.49)	(0.49)	(0.5)
Interactivity		0.074	0.093
		(0.49)	(0.5)
Ending		0.098	0.046
		(0.49)	(0.5)
Socioeconomic status			0.16
			(0.17)
N	267	267	267
R^2	0.008	0.008	0.011
Adj. R^2	0.004	−0.003	−0.004

screen conditions were successful in eliciting donations. More importantly, we found that participants in the VR condition donated on average 70 cents more compared with those experiencing the screen condition (Mann–Whitney test on donation by medium: $p = 0.065$, Wilcox effect size = 0.09). These results provide evidence supporting H1. We then proceeded to test if this effect of VR to increase incentivized donations was further reflected in an increase in intentions (non-incentivized) to become regular donors. A Kendall's Tau test run on participants' intentions to donate regularly showed that participants in VR conditions were also significantly more likely to say that this experience would motivate people to become regular donors (tau = 0.198, and $p < 0.001$, 2-tailed).

Having detected these effects of VR on donations, we then investigated some of the potential mechanisms that could be driving them. Our data do not show ($p > 0.15$, 1-tailed test; Data Availability Statement, Section 4) that being in active conditions elicited higher donations than passive conditions (RQ1). Furthermore, we did not replicate the findings by Nelson et al. (2020) that negative affect,

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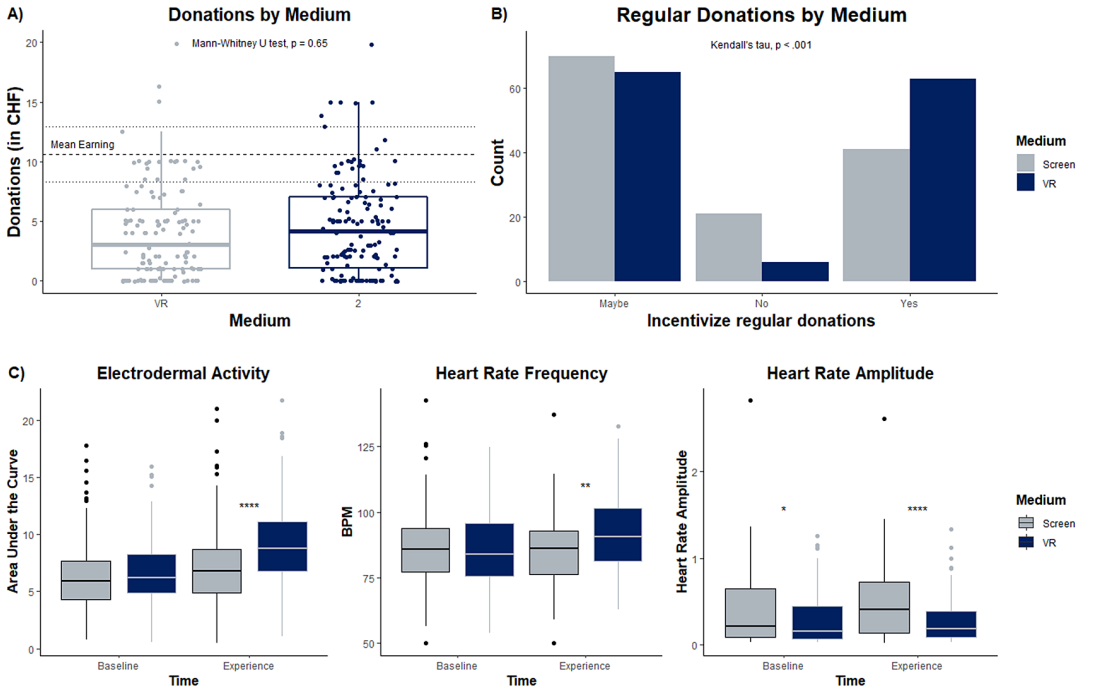

Figure 1. *(A) Effects of medium on donations. (B) Participants' responses to whether the experience would incentivize regular donations. (C) Physiological responses by time and medium. Error bars show standard error. Significance markers show differences between conditions.*

elicited by the ending in our experience, resulted in higher donations than positive affect (RQ2) ($p > 0.5$; Data Availability Statement, Table S2).

3.3. Physiological hypothesis

The EDA channel was preprocessed using the AcqKnowledge software (BIOPAC) (see Data Availability Statement, Section 6 for details), and AUC was calculated as a general EDA measure of arousal. One-tailed Mann–Whitney tests show that delta measures (differences from baseline) for participants in the VR condition were significantly higher than those for participants in the on-screen condition (Table 4). PPG data were preprocessed using the AcqKnowledge software (BIOPAC) and MATLAB (Mathworks) (see Data Availability Statement, Section 6 for procedure) and both heart rate frequency (BPM) and amplitude were extracted, which, respectively, increase and decrease during physiological arousal. One-tailed Mann–Whitney tests for both these measures indicate that participants in the VR condition were significantly more physiologically aroused than those in the on-screen condition (Table 4), as predicted in H2. However, only lower heart rate amplitude compared to baseline showed a trend toward increasing donations ($p = 0.055$, coef = −1.84 [1.16]), suggesting that increases in arousal were not the main driver of larger donations.

3.4. Exploratory analyses

3.4.1. Effects of earnings on donations

Interestingly, we found no correlation between earnings in the real-effort task and donations ($r = -0.049$, $p = 0.43$); however, 19 participants donated more than their earnings, and we explored whether these generous donors were driving our effects. We first examined how medium influenced whether people gave more than the amount earned and found that 14 participants in the VR condition

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Table 4. *Mean and standard error for the delta of physiological responses (compared to baseline) by medium (on-screen vs. VR). Significance effects show the results for 1-tailed Mann–Whitney tests. Effect sizes were calculated using the wilcox_effsize function from the rstatix package in R.*

	Screen	VR	*p*-Value	Effect size
△EDA: area under the curve	0.89(.1)	2.37(.15)	1.56E-13	0.457
△BPM	−0.176(.399)	5.47(1.11)	2.50E-07	0.332
△Heart rate amplitude	0.091(.018)	−0.008(.019)	7.05E-06	0.28

donated more than their earnings, compared with only 5 participants in the screen condition (Mann–Whitney test: $p = 0.03$, Wilcox effect size = 0.13). Additionally, when we include a variable coding for those who donated extra in the linear model with medium, the effect of medium is no longer significant (coef = 0.1 (0.41), $p = 0.4$), whereas the effect of donating extra is highly significant (coef = 9.03 (0.79), $p < 0.001$), indicating that the effect of medium may indeed be driven by those who felt motivated to give their own money.

3.4.2. Effects of the novelty of the VR experience

One possible explanation for the effect of VR on donations is that VR is a relatively novel technology which most have not yet had the opportunity to experience; thus, it may be that it is the novelty of VR, rather than its intrinsic properties, driving the effects. To explore this, we asked participants whether they had experienced VR before and tested whether this influenced donations in the VR conditions only (as experience of VR should have no bearing on the screen conditions). Of the participants in our study who were in the VR condition, 47 had never experienced VR before, 79 had experienced it between one and a few times, and only 6 had used VR many times. A Mann–Whitney test examining the effects of at least one previous experience with VR (vs. no experience) on donations found no significant effect (Donation mean (SD) no experience = 4.61 (4.69), experience = 3.54 (3.38), effect size = 0.07, $p = 0.198$, 1-tailed). While this does not provide evidence that novelty is driving the effect of VR, it is important to note that only a handful of our participants had many experiences with VR; thus, it could arguably still have been a novel experience for most of them. In addition, this analysis was run on only half of our sample ($n = 133$), and, as such, is underpowered.

3.4.3. Effects of VR on emotions and perception of experience

One participant failed to complete the questionnaire, and their data were excluded from this analysis, which then included 266 participants.

VR increased scenario-related emotions compared with on-screen experiences, as measured by Likert-type scales. Participants in VR conditions reported significantly higher feelings of fear, excitement, stress, sadness, and being moved, and lower feelings of boredom and calmness (Data Availability Statement, Table S3). An increase (or decrease for boredom and calmness) of these emotions was expected considering participants experienced an active war zone. No significant differences were found for anger, disgust, pride, and joy. Of note, linear regressions show that levels of sadness and being moved had a significant effect on donations, with higher levels of both emotions marginally increasing donations (sadness: coef = 0.46 (0.21), $p = 0.013$, 1-tailed; being moved: coef = 0.54 (0.21), $p = 0.005$, 1-tailed), but as these emotions were correlated ($r = 52$, $p > 0.001$), only the effect of being moved remained significant when both emotions were included in the model (sad: coef = 0.25 (0.24), $p = 0.16$, 1-tailed; moved: coef = 0.41 (0.25), $p = 0.051$, 1-tailed). An effect of being moved may signify a deeper connection to the story being told, which was also augmented by the VR condition. None of the high arousal emotions (fear, excitement, and stress) had a significant effect on donations, which is

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in line with our findings that while VR engenders higher physiological arousal, and correspondingly high arousal emotions, they do not appear to be the driving factors of increased donations.

VR also had significant effects on participants' perceptions of the experience on most criteria measured. Those in VR conditions saw the experience as more stimulating, enriching, vivid, interesting, moving, engaging, and educational (Data Availability Statement, Table S3). The only criteria that did not receive significantly different ratings from participants was pleasantness. Linear regressions show that higher measures of enriching, interesting, and moving had small but significant positive effects on donations (enriching: coef = 0.52 (0.21), $p = 0.007$, 1-tailed; interesting: coef = 0.53 (0.25), $p = 0.019$, 1-tailed; moving: coef = 0.6 (0.21), $p = 0.002$, 1-tailed); Data Availability Statement, Figure S4). There was a significant positive correlation between these perceptions (enriching/interesting: $r = 0.64$; moving/enriching: $r = 0.49$; moving/interesting: $r = 0.5$; all p-values < 0.001).

Participants in VR conditions also rated their experience significantly higher on measures of immersion, embodiment of the avatar, social presence in the scenario, and empathy (Data Availability Statement, Table S3). Linear regressions showed that all of these factors significantly increased donations (immersion: coef = 0.47 (0.25), $p = 0.03$; embodiment: coef = 1.7 (0.91), $p = 0.03$; social presence: coef = 0.46 (0.25), $p = 0.03$; empathy: coef = 0.44 (0.25), $p = 0.039$, 1-tailed) and were all significantly correlated (Data Availability Statement, Figure S5). Participants in the VR condition also reported feeling a significantly higher moral obligation to donate (coef = 0.29 (0.12), $p = 0.01$). Interestingly, however, feeling a higher moral obligation to donate did not have a significant effect on donations.

3.4.4. Correlation between arousal, emotions, and perception of experience

Among the emotions elicited by the experience, we found a significant positive correlation for most emotions related to the experience, with the exception of sadness and excitement, which were positively correlated with the other emotions, but not each other (Data Availability Statement, Figure S5). Moreover, emotions were positively correlated with perceiving the experience as more stimulating, enriching, vivid, moving, engaging, educational, and interesting. The only exception was perceiving the experience as pleasant, which was negatively correlated with feelings of stress and sadness, but still significantly positively correlated with most other perceptions.

As expected, the 3 physiological measures of arousal (electrodermal AUC, BPM, and heart rate amplitude) were also significantly correlated, and positively (or negatively in the case of heart rate amplitude) correlated with most of the aforementioned emotions and perceptions (Data Availability Statement, Figure S5). These correlations were stronger for skin conductance measures than heart rate measures, and as expected strongest for the emotions of fear, excitement, and stress, which are all traditionally linked to high arousal, as well as finding the experience vivid and interesting. Curiously, finding the experience stimulating was not correlated with higher skin conductance responses and only weakly correlated with increased BPM. Being moved or finding the experience pleasant or educational were only weakly correlated with arousal, which is to be expected from these low-to-mid arousal emotions. Empathy, immersion, and social presence were also significantly positively correlated with physiological arousal and increased emotions, as, to a lesser degree, was the sense of embodiment of the avatar.

In short, we find positive correlations between key emotions connected to the experience and better overall subjective perceptions of and engagement with the experience, which are in turn underlain by increased physiological measures of arousal. The majority of these key emotions and perceptions were also significantly correlated with donations (Data Availability Statement, Figure S5), albeit more weakly. In particular, being moved and finding the experience moving showed a more robust effect on donations ($r = 0.16$, $p = 0.01$; and $r = 0.17$, $p = 0.005$, respectively). These results contribute to characterizing the physiological and subjective experience of the scenario and can provide insights for future research investigating how scenarios used to share organizations' activities with individuals could motivate them to donate or engage in other ways.

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4. Discussion

Our findings show that the VR experience impacted donation behavior on 2 levels: first, we replicated previous findings in the literature showing that VR significantly increased the self-reported likelihood of giving, in particular showing that participants in the VR group indicated an increased intention of becoming regular donors; second, and most importantly, we also provided novel evidence showing that VR increases actual donations of money participants earned through exerting effort, a finding which highlights VR's potential as a new fundraising tool. Furthermore, based on the literature, we tested a number of potential mechanisms that could be driving this effect, and found that increases in sadness and being moved, as well as finding the experience enriching, interesting, and moving, were both increased by VR experiences, and increased donations in turn, with a more robust effect of being moved. These results point to the importance of good storytelling regardless of medium and the need to create experiences that are not only emotionally salient, but are also perceived as enriching and interesting, and have the power to create memorable connections between donors and causes. This is also in line with Gorczyca and Hartman's (2017) theory that while millennials want to do good, they also want to benefit from the process. Participants who felt they got something back from the experience were more willing to give. VR also significantly increased physiological arousal, which was correlated with increases in subjective reports of high-arousal emotions linked to the experience, as well as better perceptions of the experience overall.

One limitation to our study is that the VR experience used was originally developed for training and adapted for fundraising purposes. It is possible that an experience created specifically around the cause for which funds are being solicited would be more effective, allowing participants to better visualize the effects of their contributions. Future studies could also explore whether different scenarios, with varying intensity and emotional engagement, produce similar results. The war zone scenario used in this study was intense and sometimes shocking, and, as such, may have impacted participants regardless of medium. Moreover, while we found no significant effect of ending valence, the overall experience elicited mostly negative emotions with different affective endings. Thus, this finding does not necessarily negate previous findings in the literature that predominantly negative solicitations are more effective at eliciting donations than predominantly positive ones (e.g. Nelson et al., 2020). Likewise, interactivity effects, which were not significant in our study, may yet prove to be significant with a different scenario and/or different degrees of interaction. Participants in the passive VR condition still had control over their gaze, and interactivity changed only with regard to picking up/moving some objects and advancing through the scenario. Thus, it is possibly that participants in the passive VR condition already benefited from some interactivity and the difference between conditions was not sufficient to elicit an effect. Future studies could examine whether increasing the number of interactive objects or modifying the type of scenario (e.g., having a scenario where the outcome is based more strongly on how one interacts with the environment) affects the importance of interactivity. Another possible avenue for future research is that, anecdotally, participants in our study demonstrated high levels of enthusiasm and interest in participating in the study, additional indications that VR could be an effective tool in attracting younger generations to engage with nonprofit organizations. Thus, while the current study only examined whether people are more likely to donate after experiencing the scenario in either VR or on-screen, an interesting research question could be whether VR is more effective at getting people in the door and willing to engage with and learn about nonprofits, which would also be a means of increasing donations.

Another interesting finding was that increased levels of interest were also correlated with donations, indicating that VR may hold potential to increase awareness and donations through mechanisms other than heightened affective engagement. A recent study found that a well-elaborated rational appeal can be just as effective as an emotional one in motivating giving (Lindauer et al., 2020). Another study demonstrated that to give effectively, one must be both motivated to donate to the cause (e.g., through emotional engagement) and informed on which causes use their resources effectively (Caviola et al., 2020). An interesting direction for future studies could be to examine whether VR is also effective at

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increasing the persuasiveness of appeals based on rationality and effectiveness, rather than affect, for example, through experiences that engage participants in problem-solving games of effective resource management. This being the case, VR could then be used as a tool not only to innovate fundraising via philanthropic organizations, but also to motivate and inform citizens to vote on policies that affect their social and environmental contexts.

Finally, participants in our experiment were largely young adults, so conclusions on how VR initiatives would affect other age groups is beyond the scope of this study. However, pilot studies using this scenario with mixed age groups showed widely positive reactions to the experience, so it is possible that VR could be an effective fundraising tool across multiple generations, especially given that familiarity with this technology is likely lower in older age groups, which would strengthen potential novelty effects. Another avenue to explore further is how effective this medium is at securing repeat donors, as our results indicate it could be.

In conclusion, in line with previous studies, VR shows potential as a viable fundraising tool, and we provide some insight into the mechanisms that drive its effects and the importance of storytelling. Furthermore, information on effect sizes and the predicted amount of donation increase can inform practitioners in both developing effective scenarios and considering the costs of development and dissemination in determining whether/how it should be used.

Data availability statement. The following link contains the supplementary information file with details on the material used in the study, specifics on data preprocessing, and additional tables and figures. Additionally, a csv file with the raw data collected as well as a full video of the multimedia experience are made available. https://osf.io/4e9vr/?view_only=8549825983b14fd1b71a91320b232349.

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