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Can We 'Solve' Anonymity in Economic Experiments? Virtual Humans in High-Immersive Environments as a Method of Identification

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Abstract
The objective of this paper is to explore the potential of using virtual humans in Virtual Reality environments as a method to ensure participant anonymity while at the same time maintaining the dynamics of face-to-face interactions. Anonymity is a fundamental principle in experimental design, applied to avoid external pressures such as social desirability bias, concerns about social image, social sanctions, and attraction - or behavior - based preferences. It is essential to allow subjects' decisions to reflect their true preferences in private circumstances. However, increased anonymity has been associated with a rise in the perceived social distance between players. While previous identification methods—such as showing a photograph or sharing a participant's name—have proven effective in encouraging contributions, they often compromise anonymity and deviate from established experimental protocols. In contrast, in our daily lives, we can seldom ensure complete anonymity in our actions. The study proposes the use of interactive avatars within highly immersive VR environments as an identifier providing anonymity while simultaneously reducing social distance by mimicking the nuances of real-world human engagements. Furthermore, virtual humans provide control over the social connectedness within interactions as their appearance and behavior can be adapted to isolate effects that are difficult to study in real-life settings.

JEL Classification: C90, D91, H41

Keywords
anonymity — cooperation — immersive technologies — social distance — virtual reality

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Introduction

Experiments in economics have been established as a legitimate tool for gaining insights into individual decision-making since the mid-20th century, with Chamberlin's pioneering work (Chamberlin, 1948). Today, two main methods dominate experimental economics: laboratory and field experiments, both of which have distinct advantages and disadvantages (Harrison and List, 2004; Levitt and List, 2007a, b, 2009). While laboratory experiments allow experimenters to exert a high degree of control over the environment in which human subjects make decisions, which is referred to as 'internal validity', a recurring question by experimenters is how to achieve 'external validity' comparable to field experiments without losing control and replicability (Duffy, 2011).

A common practice in laboratory experiments is to provide participants with anonymity (Charness & Gneezy, 2008) to attenuate external influences on their decision-making. Nevertheless, increased anonymity has also been associated with reduced prosocial behavior due to heightened social distance (Haruvy et al., 2017). On the other hand, field experiments provide naturalistic settings where it is less feasible to fully conceal identities (Yu et al., 2015). Conventional experimental methods struggle to effectively balance experimental control and external validity while maintaining participant anonymity and facilitating naturalistic face-to-face interactions.

Virtual Reality (VR) offers new possibilities for conducting experiments in economics (Innocenti, 2017). Historically, the application of VR immersive technologies was financially costly and restricted to specialized fields such as medical simulations and military training. However, advancements in performance and increased financial accessibility to a larger public over the past decade, combined with the need for alternative communication solutions during the COVID crisis, have reshaped a range of sectors, including gaming and entertainment, education, and remote working environments.

Virtual worlds are computer-mediated online environments (Fiedler et al., 2011) where individuals interact through digital representations known as avatars (Graff et al., 2011), which can take human-like forms or other shapes (Greiner et al., 2014). Virtual environments can be categorized as low-immersive (LIVE), such as 2D computer interfaces, and high-immersive (HIVE), including Virtual Reality (VR), Augmented Reality (AR), or Mixed Reality (MR). High-immersive VR requires specialized technical equipment, including room-mounted immersive environments like CAVEs or Head-Mount-

ed Displays (HMDs), often accompanied by hand controllers and movement trackers to enhance the immersive experience (Fiore et al., 2009).

VR has been recognized as a method that combines the advantages of both laboratory and field experimental approaches (Fiore et al., 2009; Innocenti, 2017; Gürerk et al., 2019; Mol, 2019). In this paper, I explore the advantages of VR in maintaining participant anonymity while facilitating naturalistic, human-like interactions with confederates (Fiedler & Haruvy, 2009; Graff et al., 2021), setting a social situations' stage (Reaney, 1999, cited in Horky, 2023), where people can express emotions and adopt heuristics, responding to virtual stimuli as if they were real (Innocenti, 2017), which is not fully possible in a 2D computer simulation. By doing so, VR has the potential to reduce social distance compared to abstract laboratory settings, offering a more ecologically valid framework for experimental research. Furthermore, this paper provides a discussion on the possibility of controlling social settings and modifying the level of social distance within VR to enhance psychological connectedness among individuals, mimicking real-life dynamics.

Anonymity in Economic Experiments

Definition

Anonymity is a term that has been coined to designate the concealment of a participant's identity, which is distinct from 'privacy', referring to the disclosure of information about a person's actions or decisions (Piazza & Bering, 2008). While these two concepts refer to different phenomena and can exist independently, there are cases where we can observe a simultaneous breach of privacy and anonymity in certain conditions. We can distinguish between three types of anonymity: subject-to-subject, subject-to-experimenters and reputation formation (Fielder & Haruvy, 2009). Anonymity in experimental economics laboratory settings between subjects can be ensured by conforming to recruiting procedures regarding the sample of participants, such as random sampling and seating arrangements. On the other hand, anonymity between subjects and the experimenter can be provided by methods such as randomized response techniques. However, since recruited participants in the laboratory are primarily students (Atlas & Putterman, 2011), the possibility of participants knowing each other and the experimenters cannot be completely excluded, compromising anonymity (Fiedler et al., 2011).

Identification methods and the need for anonymity

Common methods for identifying participants in the laboratory include displaying a photograph, revealing their names, or arranging a meet-and-greet (Butz & Harbring, 2021). However, unless specifically required by the experimental objective, these identification methods compromise conditions of anonymity, which could have consequences on participants' behavior. By ensuring that participants' decisions cannot be linked directly to their identities, anonymity provides a means of eliciting behavior under private circumstances, reducing external effects (Winking, 2014) for which it is difficult to control and eliciting 'true preferences'. Anonymity allows for the attenuation of external effects including social desirability bias (Norwood & Lusk, 2011), social image concerns (Bursztyn & Jensen, 2017), social sanctions (Andreoni & Petrie, 2004; Anderson and Putterman, 2006; Rege & Telle, 2004) physical appearance (Solnick & Schweitzer, 1999; Wilson & Eckel, 2006; Rosenblat, 2008) or facial cues from the other (Scharlemann et al., 2001).

The downside of anonymity

Nevertheless, anonymity in the laboratory can create an artificial environment that fails to replicate real-world dynamics. Real-life decision-making rarely occurs in truly anonymous settings (Winking, 2014) as in non-laboratory negotiations, people are aware of their counterpart's identity. In most face-to-face interactions—such as encountering someone on the street or meeting friends for dinner—individuals are identified by their physical person. While anonymity in experimental design eliminates social confounds inherent in face-to-face interactions, it also removes valuable information about the partner that typically arises through communication (Fiedler et al., 2011).

Anonymity is believed to significantly alter the behavior of participants (Charness & Gneezy, 2008; Piazza & Bering, 2008; Winking, 2014; Butz and Harbin, 2021). Research publications show that stronger anonymity often results in antisocial and anti-normative behavior, where participants prioritize personal gain, while greater public disclosure of identities tends to reduce it, leading to a rise in contribution levels. Numerous experimental studies have demonstrated that revealing participants' identities and providing visibility or disclosing their names or pictures while linking their actions to their identity leads to higher contributions or prosocial behaviors. This effect has been examined in: public goods games (Andreoni & Petrie, 2004; Rege & Telle, 2004; Samek & Sheremeta, 2014; Christens et al., 2019; Butz & Harbing, 2021; Sampaio, 2023), dictator games (Charness & Gneezy, 2008; Burnham, 2003; Winking, 2014), ultimatum games (Charness & Gneezy, 2008), Prisoner's Dilemma games (Bohnet & Frey, 1999; Fox & Guyer, 1978), or also charitable giving scenarios (Soetevent, 2005; Alpizar et al., 2008; Ariely et al., 2009; Samek & Sheremeta, 2017).

Social distance as a result of anonymity

Construal level theory outlines several dimensions of psychological distance, including temporal, spatial, social, and hypothetical distance (Trope & Liberman, 2010). Several studies have linked anonymity to an increase in the perceived social distance (Charness & Gneezy, 2008; Dufwenberg & Muren, 2006; Fielder & Haruvy, 2009). The concept of social distance is described in the literature as the perceived closeness between individuals in an interaction (Dufwenberg & Muren, 2006). Factors such as nationality, occupation, race, and religion commonly influence social distance (Charness

& Gneezy, 2008), which in turn affects prosocial behaviors. Under anonymity, individuals often lack identifying features, which reduces the emotional richness of interactions. According to Construal level theory, increased social distance leads individuals to perceive others in more abstract terms when information is limited, focusing on generalized traits rather than specific details, which can significantly impact behavior in anonymous laboratory settings. Conditions of anonymity simplify interactions between individuals to neutral economic transactions, where participants might have difficulty establishing a meaningful human connection. Furthermore, when anonymity is preserved, another important aspect besides the identification of individuals affecting face-to-face interaction and which can influence the levels of social distance is the presence of social cues. Social cues are non-verbal signals such as facial expressions, body language, personal space and proxemics which affect our social connection. For instance, the presence of 'watching eyes' has been related to increased prosocial behaviors, promoting more generous actions in a dictator game as the sense of being observed leads to a decrease in social distance (Rigdon et al., 2009).

Avatatars in Virtual Reality as a solution to anonymity

Virtual Reality: Facilitating Realistic Interactions in Controlled Settings

This paper's specifically focuses on the study of High-Immersive Virtual Environments (HIVE), as the level of immersion they provide closely resembles realistic settings found in the real world. VR enables the creation of experimental conditions unattainable in traditional laboratory or field settings. Virtual experiences offer a naturalistic environment (Fox et al., 2009) that participants are familiar with, where realistic interactions can be observed while simultaneously maintaining the control and replicability characteristic of laboratory experiments. Unlike the abstract tasks often employed in laboratory experiments, VR enables real effort tasks and actions performed in the real world, providing a more immersive and ecologically valid experimental framework (Gürerk et al., 2019; Mol, 2019). Changes in the virtual environment settings can affect emotions and empathy felt towards others which in turn can affect prosocial behaviors as Horky et al. (2003) have demonstrated through a dictator game.

These environments enable individuals to embody digital representations of themselves or interact with other virtual humans, with movements mirroring real body motions and gestures, all while preserving anonymity from others. VR worlds are solutions allowing for virtual interactions among several individuals at the same time (Tarnec et al., 2023). Furthermore, VR facilitates the collection of novel types of data that are inaccessible in traditional anonymous laboratory conditions during interaction tasks, such as body movements and proxemics behaviors (Gürerk et al., 2019).

Researchers distinguish between two types of virtual humans: those controlled by real individuals (avatars) and those driven by preprogrammed algorithms (agents) (Graff et al., 2021). Virtual agents can be programmed to behave consistently across all interactions (Gürerk et al., 2019), enabling researchers to establish controlled yet realistic experimental settings that are challenging to replicate in the field. Previous studies have found that humans react to a digital agent in a similar way as they would to a human, allowing researchers to draw conclusions about interactions between real people. VR settings provide the means to control virtual agents' performance in realistic working situations in order to study peer effects and address the reflection problem when a real person is in the presence of the computer-generated virtual humans (Gürerk et al., 2019, Graff et al., 2021).

Digital Representation as a form of identification

Avatars are a form of digital identifiers (Guo, 2023) that allow a person to mask their physical identity and make it difficult to attribute digital actions to the physical person, even when the actions are observed. There is an extensive literature on low-immersive virtual settings such as Second Life and the use of avatars to explore effects on behavior in economic games (Atlas and Putterman, 2011; Chesney et al., 2009; Fiedler, 2009; Fiedler and Haruvy, 2009; Spann et al., 2010; Fiedler et al., 2011; Füllbrunn et al., 2011; Greiner et al., 2014). By simulating human interaction without revealing identity, VR avatars allow researchers to capture genuine behavioral tendencies while preserving the methodological rigor of anonymity.

HIVE significantly expands the possibilities of low-immersive environments by providing a deeper level of immersion, where participants can engage in more realistic interactions while remaining anonymous. This combination of anonymity and realism creates a unique opportunity to study behaviors in conditions that closely resemble face-to-face interactions (Baccon et al., 2019, Fiedler et al., 2011). By providing anonymity through digital representation, VR eliminates biases related to physical appearance and identity, while maintaining naturalistic interactions.

Furthermore, progress in technology allows for higher animation and visual realism , which affects perception and engagement (Mol, 2019; Fraser et al., 2024). Animation realism refers to the perception of the virtual human's movements as resembling real life, whether controlled by a real or programmed human, thereby improving the immersive experience. Sensoric systems such as motion-tracking equipment, eye-gaze detectors, and VR gloves can capture the user's physiological data affecting trust in the virtual human (Sun and Botev, 2021). Visual realism implies that the virtual human has a high resemblance to a real human, which can be more relatable during interactions in a social setting (Nowak & Rauh, 2005, as cited in Fraser et al., 2024), although this does not affect anonymity's excellence. Virtual humans with high human resemblance, also called anthropomorphism, and natural movements are key features for improving the quality

of the interaction in VR (Brown et al., 2022, pp. 255–264, as cited in Fraser et al., 2024). However, scholars have pointed out that natural looks need to be accompanied by human-like behavior to avoid for virtual humans to appear unappealing (Kätsyri et al., 2015). Gürerk et al. (2019) state that in order for virtual humans to be perceived as human, they should not only resemble humans in appearance, but also act and move like them.

Modification of Social Connection by customization of Virtual Humans

Virtual environments allow for precise customization of virtual humans, facilitating the study of interactions (Fiedler et al., 2011), making them therefore an effective tool for controlling social distance in experimental settings. The use of digital representations conceals personal identity and masks personal features tied to physical appearance, gender, age, ethnicity, status, or other identifiable traits. It can remove biases associated with these traits, which can otherwise influence behavior during face-to-face interactions. During face-to-face interactions, it would be of importance to control for all these features of partners, but it could require a lot of resources. However, the absence of these features in experimental conditions could also increase social distance, as observed in anonymous laboratory settings, where participants may struggle to establish a meaningful connection with others. In VR we can modify the features of the avatar, while holding others constant (Abraham et al., 2023).

Furthermore, customization of virtual humans also enables researchers to isolate specific not only physical but also behavioral effects. Fiedler and Haruvy (2009) recognize virtual worlds as ideal to study social distance and suitable to send social cues without compromising anonymity. Nonverbal language cues in VR immersive environments, such as body and hand gestures, eye movements, facial expressions, and proxemic behavior, are crucial for the effectiveness of social interactions and allow for the transmission of information about internal emotional states, enhancing collaboration (Tarnec et al., 2023). Non-verbal cues have been stressed by researchers as significant to connect with others on a psychological level (Biocca et al., 2003, cited in Kang, 2013). Adding them is of importance since the realism of the virtual human is determined not only by the visual but also by the behavioral realism in the virtual setting (Kang, 2013). According to Construal Level Theory, people perceive human-like avatars with similarities in appearance and behavior as closer (Trope and Liberman, 2000, cited in Kim et al., 2023). Therefore, having more detailed information on humanlike features would reduce psychological distance (Trope et al., 2007, cited in Kim et al., 2023), compared to appearance realism only (Kim et al., 2023). Data on non-verbal cues, which could be expressed in a virtual setting and be used to understand and affect behavior, include the following:

Eye gaze

Images of eyes in economic games have proven efficient in boosting cooperative behavior (Ernest-Jones et al., 2011), even when anonymity is provided in the experimental conditions. In a VR experiment, Mol et al. (2019) studied the effect of a virtual observer on cheating behavior, demonstrating that an active (virtual) observer was more effective than a passive one watching a smartphone, despite the decision-maker being aware in both cases that it was not a real person.

Facial expressions

Researchers have provided evidence that human facial expressions such as smiling can influence cooperative behaviors (Scharlemann et al., 2001). Higher graphical resolutions allow for more detailed representation of facial features. Luo et al. (2022) demonstrated that the presence of facial expressions - whether positive or negative - contributed to trust building in decision-making behaviors.

Body gestures and movements

Motion capture of the virtual human's body affects perceptions of realism (Fraser et al., 2024), and consequently mimicking behavior such as head movement can increase an agent's trustworthiness (Sun and Botev, 2021).

Proximity

Research has also focused on the study of interpersonal distance between virtual humans (proxemics) (Kyriakou et al., 2016), crucial for shaping social interactions and intimacy. In VR, reduced interpersonal distance combined with directed gaze enhances perceived intimacy, while increased distance and averted gaze weaken engagement (Kolkmeier et al., 2016).

Conclusion

This paper contributes methodologically by offering a critical discussion on the question of anonymity in experimental economics and proposes Virtual Reality as a unique platform allowing to address this challenge. VR combines the replicability and control of laboratory experiments with the ecological validity of field experiments, enabling researchers to simulate real-world interactions. By utilizing virtual humans as a method of identification, this approach allows to maintain anonymity while manipulating social distance, which is challenging in traditional settings. The ability to control factors such as appearance and body language while minimizing social distance provides insights into their influence on prosocial behaviors and decision-making. These advancements open new avenues for investigating economic questions that were previously difficult to explore.

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