Collective and Individual Decisions
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Decision Making in Virtual Reality: A Domain of Choice and a Method for Decision Research

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Abstract

Virtual reality (VR) lets a researcher place a participant in a supermarket, a burning building, or a moral dilemma and observe the decision-making process from within the situation. Work on such environments is scattered across domains such as experimental economics, consumer research, or safety training, each asking what VR can do within its own domain rather than when immersion matters for a decision as such. First, this article argues that VR is both a domain in which decisions are made and a method for studying them. Second, it identifies four features of a decision situation through which immersion works: spatial context, the body and viewpoint from which a person acts, the emotions carried by the situation itself, and social context. Third, it proposes a diagnostic: what matters is not the realism or vividness of VR but whether such features can be brought into the task. The article draws on studies in which a virtual environment serves as the decision environment, each chosen for what it shows about one of these features. Immersion earns its place when any of them is part of the decision under study; by contrast, standard tasks are sufficient when the formal structure exhausts the research question.

Keywords: virtual reality, decision making, immersion, presence, embodiment, process tracing

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Introduction

In Aldous Huxley's *Brave New World* (1932), people go to the "feelies", a cinema where the audience grips metal knobs on the armrests and feels a bearskin rug while a love scene plays on screen. Three decades later, Stanisław Lem (1964/2000), writing as a philosopher rather than a novelist, worked out the engineering logic of such experiences in *Summa Technologiae*: one should place a person in a room where turning the head changes what is seen, and have a computer respond to every shift in position.

What Huxley imagined and Lem specified is now real, and, for the study of decision making, it has two roles. People already make choices and cooperate in virtual worlds, so virtual reality (VR) is itself a domain of decision making. It is also a method in which the experimenter controls the decision environment while keeping it close enough to a real situation. As such, a VR study shares the logic of a framed field experiment (Harrison & List, 2004), in which the field context is built into the task, but the experimenter maintains control. Immersion challenges a standard laboratory assumption that a decision remains the same when removed from its surroundings (Innocenti, 2017). People spend real money in virtual environments, cooperate with strangers, and bargain over outcomes they care about (Castronova et al., 2009; Füllbrunn, et al., 2011; Greiner et al., 2014). The decisions are real, although the surroundings are computed. This raises the question of whether virtual-world decisions correspond to decisions outside VR.

Existing reviews usually stay within one field. Experimental economics uses VR to drop context into otherwise abstract games (Innocenti, 2017). Consumer researchers track presence and what the body gives away (e.g., heart rate, skin conductance) as people move through virtual stores (Alcañiz et al., 2019). Similarly, the training literature has a narrower focus: whether practising an evacuation using a headset prepares people better than a slideshow does (e.g., Scorgie et al., 2024). The broader question is to what extent immersion changes decisions and whether specific VR characteristics – space, embodiment, emotions, and social presence – make VR a distinct decision domain. This article treats each in turn as a feature of the decision situation, and argues that immersion is warranted when one of them is part of the decision under study.

Immersion, presence, and embodiment

Experimental tasks usually trade realism for control. According to Brunswik (1956), if a task is meant to represent a real situation, it should sample the stimuli and environmental conditions it targets, as well as participants. The cost of this trade-off depends on the experiment's aim. When the sampling is too narrow, external validity and generalisation suffer. For instance, behaviour in stylised gambles does not always predict behaviour in the situations those gambles represent (Dhami et al., 2004), and risk attitudes measured in abstract scenarios correlate only weakly with actual risky choices across life domains (Tyszka & Domurat, 2004). One response is to bring the task, objects, or setting into the laboratory while retaining control (Harrison & List, 2004; Schram, 2005). Abstraction can change the choice itself. The same gamble is evaluated differently depending on whether its odds are read from a description or learned from experience (Hertwig et al., 2004): described odds lead to overweighting of rare events, whereas sampled odds lead to underweighting of rare events. Similar differences appear in judgments of low-probability and high-consequence risks, where small probabilities may be either overweighted or underweighted depending on the event, affect, experience, and information search (Idzikowska et al., 2017).

Virtual reality can stage the same decision in both immersive and non-immersive forms while holding other elements constant. The argument for using immersive setups this way has been made in experimental economics (Innocenti, 2017), social psychology (Blascovich et al., 2002; Pan & Hamilton, 2018; Mol, 2019), and affective neuroscience (Parsons, 2015). What, then, does the equipment change about the participant's situation? Three constructs characterise the VR environment: immersion, presence, and embodiment.

Immersion is on the experimenter's side. It refers to the extent to which the system replaces the participant's real surroundings and lets them act within the virtual scene (Steuer, 1992; Slater & Wilbur, 1997). Immersion varies by degree. At the low end are desktop 3D worlds where interaction happens through a screen and keyboard – platforms like *Second Life* (Innocenti, 2017). At the high end, head-mounted displays (HMDs) with spatial tracking put the participant inside the scene (Mol, 2019). These formats differ enough that findings may not transfer between them. Desktop findings should not be treated as headset findings, or vice versa.

Presence is on the participant's side. It is the sense of occupying the scene rather than watching it, and treating what happens there as real enough to act on (Lombard & Ditton, 1997; Sanchez-Vives & Slater, 2005). Better graphics do not guarantee presence (Wilson & Soranzo, 2015), but bodily responses can reveal it. For instance, participants wearing a head-mounted display who stood at the edge of a virtual pit – a twenty-foot drop in the floor of an ordinary room – showed increased heart rates. Knowing that the drop was virtual did not cancel the physiological response (Meehan et al., 2002). Slater (2009) splits presence into *place illusion* – the sense of being in the location – and *plausibility* – the sense that events are happening. Of the two, plausibility appears to decide whether participants fully engage with the choices.

Embodiment concerns the body through which the participant acts. A participant can be given a virtual body that moves with them, or one quite unlike their own, and that choice shapes behaviour. People adjust their behaviour to fit the avatar they wear – the *Proteus effect* (Yee & Bailenson, 2007). A separate distinction is between avatars, driven by people, and agents, driven by software. This distinction matters because software-driven partners can now take part in trust or bargaining tasks. When a decision turns on who the participant feels they are, or what body they act through, the avatar is part of the design. Immersion is set before the session; presence and embodiment are inferred from behaviour and reports.

The effect of immersion on a decision

When a decision problem is presented in VR, the choice may or may not match what the same person would do outside VR. The answer depends on the task, the level of immersion, and what the participant actually does: reaches for a product, approaches a ledge, or reads a screen. A gamble on a card gives the formal structure of the decision: options, payoffs, and odds. For some decisions, that skeleton is the whole task. A lottery between two numbered bets is the same problem on a card, in a spreadsheet, or in a headset; VR adds little when the formal structure is the whole task. Other choices depend not only on odds and payoffs, but also on setting, body, stakes, and social presence. In such cases, a card or screen shows only part of the task. VR can add the surrounding space, bodily viewpoint, felt pressure, and other people in the scene.

The spatial context

In a typical non-VR study, a participant usually receives a task in the form of a written vignette or a set of gambles as choice options. However, decisions outside the laboratory have their own dynamics. In a supermarket aisle, at a street crossing, or in a smoke-filled corridor, a person takes action to determine what the decision space is and which options are available. Some options are visible; others must be found or inferred. A product on a high shelf, a moving vehicle, or a way to arrange a holiday has some cues that are easy to notice and others that are hard to read, easy to ignore, or easy to miss. While the decision-maker identifies the relevant elements, availability or other conditions may change. Standard tasks do not account for such dynamic changes in the decision-making environment.

The strongest evidence for studying this dynamic in HMD-based VR comes from marketing rather than decision research. However, the mechanism appears relevant here. A review of VR shopping research shows that the field now includes experiments with stores, shelves, products, navigation, input devices, and simulated retail environments (Xi & Hamari, 2021). For instance, in virtual shelf tasks, consumers choose differently when formally the same options appear in a high-immersion headset rather than on a low-immersion desktop display: they choose a wider variety of products and become less price-sensitive (Meißner et al., 2020). In a virtual store, shoppers bought more products from higher shelves and spent less time inspecting familiar brands. Unplanned purchases, that is, items outside the listed categories, also formed a noticeable share of purchases (Schnack et al., 2020). On the shelf, visibility mattered. A healthier product that stood out was chosen more often, and rushing shoppers did not add to this effect (Blom et al., 2021). A less immersive example points in the same direction: in a 3D supermarket shown on a computer screen, people still moved through aisles, chose products, and filled a cart; 79% said the experience resembled shopping in real life (Waterlander et al., 2011).

This matters more when the object of choice is difficult to evaluate on paper. A numerical table of coastal land-use options requires respondents to translate hectares and categories into environmental change. When the same information appears as a VR visualisation, valuations become less variable, and the gap between willingness to pay for gains and willingness to accept losses becomes smaller; the gain/loss asymmetry shrinks (Bateman et al., 2009). Another study compared hypothetical choices with choices that could oblige participants to make an actual purchase. Participants were instructed to choose among a regular yoghurt, a light yoghurt, and a no-buy option, with the product presented as text, a picture, or in a virtual grocery store. In the purchase-consequential condition, one of the participant's choices could become binding, and the participant then had to buy the chosen product at the stated price. The virtual grocery store produced the smallest gap between declared choices and purchase-consequential choices, especially for those with less simulator discomfort (Fang et al., 2021). Similar effects also appear in non-consumer problems. Street-crossing and evacuation decisions depend on spatially dynamic attributes: traffic, pedestrian flow, distance, crowding, exit size, and signage. In an immersive environment, these dynamic spatial attributes become easier to represent than in the text-and-picture version of the same choice task; the attributes a paragraph leaves vague become legible once participants can look around (Arellana et al., 2020).

Immersion changes the relation between the formal choice and the situation in which it is encountered. While a standard task on a screen or on paper gives the participant a ready-made set of options, virtual space allows us to examine how a person orients themselves to what is available, what they notice, and what they ignore. VR can therefore capture the decision space itself: how alternatives are encountered and which never enter consideration.

Embodiment: the acting body

Some decisions depend on the body and the viewpoint from which they are made. A screen cannot provide either; a headset can. Hershfield et al. (2011) asked whether people save more when their future self becomes easier to treat as their own. Participants in their studies wore an HMD and saw an age-progressed avatar of themselves in a virtual mirror, with head movements and body position tracked in the virtual room. After leaving VR, they made financial choices about whether to prioritise money now or later, or how much to allocate to retirement. Those who had met their older self in VR made choices that favoured the future. The results were explained in terms of temporal self-continuity: the future self became less like a stranger and more like someone whose welfare entered the present choice. The same logic can apply to taking another person's perspective. In another study, Polish late bilinguals watched a 9-minute 360° VR film about a fictional intercultural misunderstanding at a university. The scenario involved two student characters, Damian from Poland and Zhiqiang from China, working on a joint project. The viewer first saw the university scene from outside. Later, the same situation was shown from the perspectives of the two characters, with their thoughts and short explanations of the misunderstanding added to the scene. When Polish participants went through the scenario in English rather than Polish, cognitive empathy increased and ethnocentrism decreased. The change in empathy persisted after two weeks. The change in ethnocentrism appeared mainly after the VR experience (Hekiert et al., 2026).

Moral dilemmas show more clearly how action matters in VR. In the trolley problem, where a vehicle is heading towards several people, a decision-maker can redirect it onto another track, so one person dies instead of many (a utilitarian response), or allow it to continue on its original course (interpreted as a deontological response; Foot, 1967; Greene et al., 2001). VR versions of the dilemma tend to produce more utilitarian choices (Pucci & Gagliardi, 2025). VR also allows comparison between acting within a dilemma and judging it from outside. In a study by Francis et al. (2017), participants faced a moral dilemma either by acting in an immersive scene or by making a more detached judgment. It turned out that utilitarian responses occurred more often when participants had to act in the situation rather than only evaluate it from outside. In modified trolley dilemmas, participants were placed in the driver's position of a virtual train and repeatedly had to steer it onto one track or another (Skulmowski et al., 2014). In the 10-against-1 version, they sacrificed the single avatar in about 96% of trials. In the 1-against-1 versions, the number of lives no longer determined the choice, so avatar features could enter the mix: male avatars were sacrificed more often than female ones. Because the study used eye tracking, it also showed that pupil diameter rose after the decision, suggesting arousal or cognitive load at that moment.

Some decisions can be studied experimentally only in this way because real-life versions would be dangerous, rare, or unethical. In a VR earthquake evacuation, what came through most clearly was how much people took their cues from others, especially those in authority, and how often they wanted to evacuate with others rather than alone (Feng et al., 2020). In a VR burglary, participants playing burglars assessed entry points and visibility while walls and sightlines remained experimentally controlled (Park & Lee, 2021). A virtual flood prompted participants to take the risk more seriously and invest more in protection for the virtual home. It did not, however, make them feel more able to deal with the flood or reduce its consequences (Mol et al., 2022).

Text-based methods omit the body; VR specifies it and lets a researcher manipulate factors such as perspective, identity, or physical engagement, including age, position, or capacity to act. Effects can also be measured after the participant leaves the scene. In the waste-sorting study, students sorted items and received feedback on their choices in a VR simulation. They later reported higher self-efficacy and response efficacy (Stenberdt & Makransky, 2023). Similarly, later outcomes were measured in a dietary study, in which participants had a lower dietary footprint one week after the VR intervention, though their intentions and self-efficacy did not change significantly (Plechatá et al., 2022). What these studies add is the time span: a choice staged in VR can be followed up outside it.

Emotions accompanying a choice

Choices involve more than calculation. They also evoke emotions: fear, anger, excitement, guilt, relief, disappointment. For decision research, the source of affect matters. Sometimes the affect comes from what has to be decided. A collapsing building evokes fear and the need to escape. In a bar fight, the conflict makes people feel anger. In a trolley dilemma, the moral cost comes from redirecting harm onto one person. This affect is integral because it comes from the decision object and differs from incidental affect (a bad mood, background noise, or arousal carried over from another task or situation; Loewenstein & Lerner, 2003; Västfjäll et al., 2016). The same problem appears in VR environments, which can increase arousal. Researchers must determine whether the arousal comes from VR itself or from the decision-making process. For example, lottery tasks work best when the real decision can be reduced to outcomes and probabilities. Many risky choices are less compact. They belong to domains such as health, finance, employment, gambling, farming, or crime, each with its own cues, losses, habits, temptations, and fears. Risk-taking in one domain therefore does not automatically predict risk-taking in another (Tyszka & Domurat, 2004). In a Dutch panel study, laboratory risk measures predicted other laboratory risky choices better than they predicted actual financial, health, and employment behaviours (Charness et al., 2020). Among farmers in eastern Uganda, an experimental investment game predicted one concrete farming investment, buying fertiliser, but not broader choices such as growing cash crops or becoming more market-oriented (Verschoor et al., 2016). In a gambling experiment, Anderson and Brown (1984) recorded heart rate and betting among experienced gamblers who played blackjack in a real casino and in an artificial casino. Formally, both venues involved the same game: blackjack. However, their heart rates were higher in the real casino, indicating a different experience of the same game.

Virtual reality can reproduce such environments under greater experimental control. Laycock et al. (2024) translated the logic of the Iowa Gambling Task (IGT) into VR. In this study, participants stood in a virtual building and chose doors. The doors had the same function as decks in the ordinary IGT: some paid off better over time, whereas others were attractive at first and worse later. The payoff was not money but distance from danger. In the threat version, the building slowly collapsed. Each door choice moved the participant closer to or farther from danger. Under threat, participants learned the better doors more slowly and reacted more to short-term rewards (Laycock et al., 2024). A similar approach was employed in criminal decision making. Participants either read a bar-fight scenario or experienced it as a 360° VR scenario. The VR version placed participants in the situation instead of asking them to imagine it. It produced a stronger sense of presence, higher perceived realism, and a greater intention to aggress; presence and anger helped explain the effect (van Gelder et al., 2019). Here, the emotion came from the scene itself.

Other VR studies use emotion more narrowly. In a gambling study conducted by

Dickinson and colleagues (2020), participants played the same Five Card Draw game on a laptop and on a virtual gaming machine inside a simulated betting shop. The shop had betting slips, stools, tables, racing screens, other machines, and betting-shop sounds. In VR, participants reported higher levels of immersion, higher arousal, and higher physical workload. The game outcomes, however, were arranged around a target balance, so the study says more about gambling experience than about unconstrained gambling choice.

Fear and anger have also been induced through VR before a risk task. In Susindar et al. (2019), emotional stimuli were presented on a desktop display or in VR, and participants then completed the Balloon Analogue Risk Task. Fear and anger were both negative emotions, but they pushed risk in different directions: fear towards caution, anger towards risk. Participants in the fear condition took about a second longer to pump each balloon than participants in the anger condition. Here, VR elicited emotion rather than serving as the decision environment.

An earlier immersive Iowa Gambling Task seemed to impair decision making. Oberdörfer et al. (2021) tested whether the problem was actually immersion or the task's visual presentation. They compared a desktop version, a virtual laboratory, and a virtual forest while holding the visual angle of the IGT constant. With the visual angle controlled, immersion and virtual-environment design did not significantly change IGT performance or positive and negative affect. The earlier impairment, therefore, looks less like a general effect of immersion and more like an effect of the task's visual presentation.

The source of affect therefore matters. Fear in a collapsing building, anger in a bar fight, or excitement in a betting shop comes from the decision itself. This is different from using VR to put a participant in a mood – frightening or angering them first, then giving them an unrelated risky choice. In the first case, the emotion is part of the choice; in the second, it is a preceding manipulation.

Making decisions in groups

When a decision-maker solves a problem, someone may be watching, talking, waiting, competing, or simply sitting nearby. Another person may be a partner or a witness who appears in a study as a participant or an avatar, or who follows a script set by the experimenter. Decisions made with others include variables absent from individual tasks.

Economic games were among the first social decision-making activities to move into virtual space. *Second Life* is a desktop virtual world accessed through an on-screen avatar: users move through shared locations, meet other users, communicate, and exchange goods or money. This allowed standard economic games to include a visible counterpart. In a trust game, one participant decided how much money to send to the other, and the recipient decided how much to return. In *Second Life*, trustors sent less money than in a comparable campus treatment, but receivers returned more. The virtual setting made investors more cautious, while receivers behaved more generously in return (Füllbrunn et al., 2011). Greiner et al. (2014) used the same world to run an ultimatum game, in which one person proposed a split and the other could accept or reject it. The study compared bargaining in a physical laboratory and in *Second Life*, with and without pre-play communication. In the laboratory, face-to-face communication was associated with higher offers and more agreements than the no-communication condition. In *Second Life*, allowing avatars to talk to each other changed little, because cooperation was already high when no communication was allowed. On a larger scale, transaction records from the commercial multiplayer game *EverQuest II* were detailed enough to yield macroeconomic indicators – production, consumption, price levels, and money supply (Castronova et al., 2009). Economic behaviour in these worlds went beyond anonymous lab clicks: participants met, bargained, trusted, returned money, and exchanged goods through visible characters.

Group decisions require a shared understanding of the object of choice before agreement is possible. For instance, when choosing an apartment, multiple attributes must be taken into account. In one study, three-person teams chose an apartment from identical spatial information presented in three ways: a 2D floor plan, a static 3D model viewable from several angles, or a first-person environment they could walk through. The 3D formats helped each person grasp the apartments as spaces, but the group did better with the static model than with the walk-through: teams reached a better shared understanding and made better group decisions. Walking through the environment gave each participant more to process while the team still had to compare impressions and agree. The most useful display clarified the space without overwhelming the discussion (van der Land et al., 2013).

Headsets show a related limit. Moser et al. (2020) used a hidden-profile task, a setup in which no single member holds all the facts needed for the best answer. Some facts are shared by everyone; others are known only to one person. The group succeeds only if those unique facts are included in the discussion. In this case, the task was a fictional personnel-selection problem. Groups worked in one of three formats: immersive VR with head-mounted displays, video conferencing, or face-to-face discussion. In the VR condition, members met as avatars in one virtual room. They selected the right candidate about as often as groups in the other two formats. However, the bias towards shared information persisted. In all three formats, participants spent more time on facts that everyone already knew than on unique facts that could have solved the problem. A lower level of social presence was observed in virtual reality than in face-to-face meetings. Thus, VR provided a shared meeting space but did not eliminate the biased sampling of information typical of hidden-profile tasks.

Other studies replaced the unscripted partner with an experimenter-scripted counterpart. In a high-immersion VR cheating game, participants could raise their payoff by cheating, with the cheating observed by either an active avatar standing close and looking at them, a passive avatar in the corner using a phone, or no one. Cheating dropped under the active avatar but not the passive one: direct gaze carried a reputational cue that mere presence did not (Mol et al., 2020). The same control extends to peers. In a CAVE – a room-sized projection system with stereoscopic display and motion tracking – participants sorted defective cubes beside a computer-controlled co-worker whose pace was fixed in advance, so influence ran one way only: the peer shaped the participant; the participant did not affect the peer. Overall productivity held steady, but competitive participants worked faster when paired with a highly productive peer (Gürerk et al., 2019). A tournament version set the avatar's ability relative to the participant's own – lower, equal, or higher – and performance peaked against an equally able rival, pointing to social comparison rather than the formal incentives alone (Graff et al., 2021). Precise control does not guarantee an effect: avatar mimicry increased rapport in an exploratory study, but this effect did not replicate in a preregistered follow-up (Hale & Hamilton, 2016).

Virtual environments offer richer social environments than laboratory tasks, with more controllable variables. Desktop worlds can host exchange; headsets can place remote group members in one space; CAVEs can fix a co-worker's pace. An avatar can watch, ignore, mimic, or compete at a set level. Gaze, work pace, rival ability, communication, and bare presence each become variables the experimenter sets and holds steady. This makes group decision-making tractable, one factor at a time.

The added value of immersion

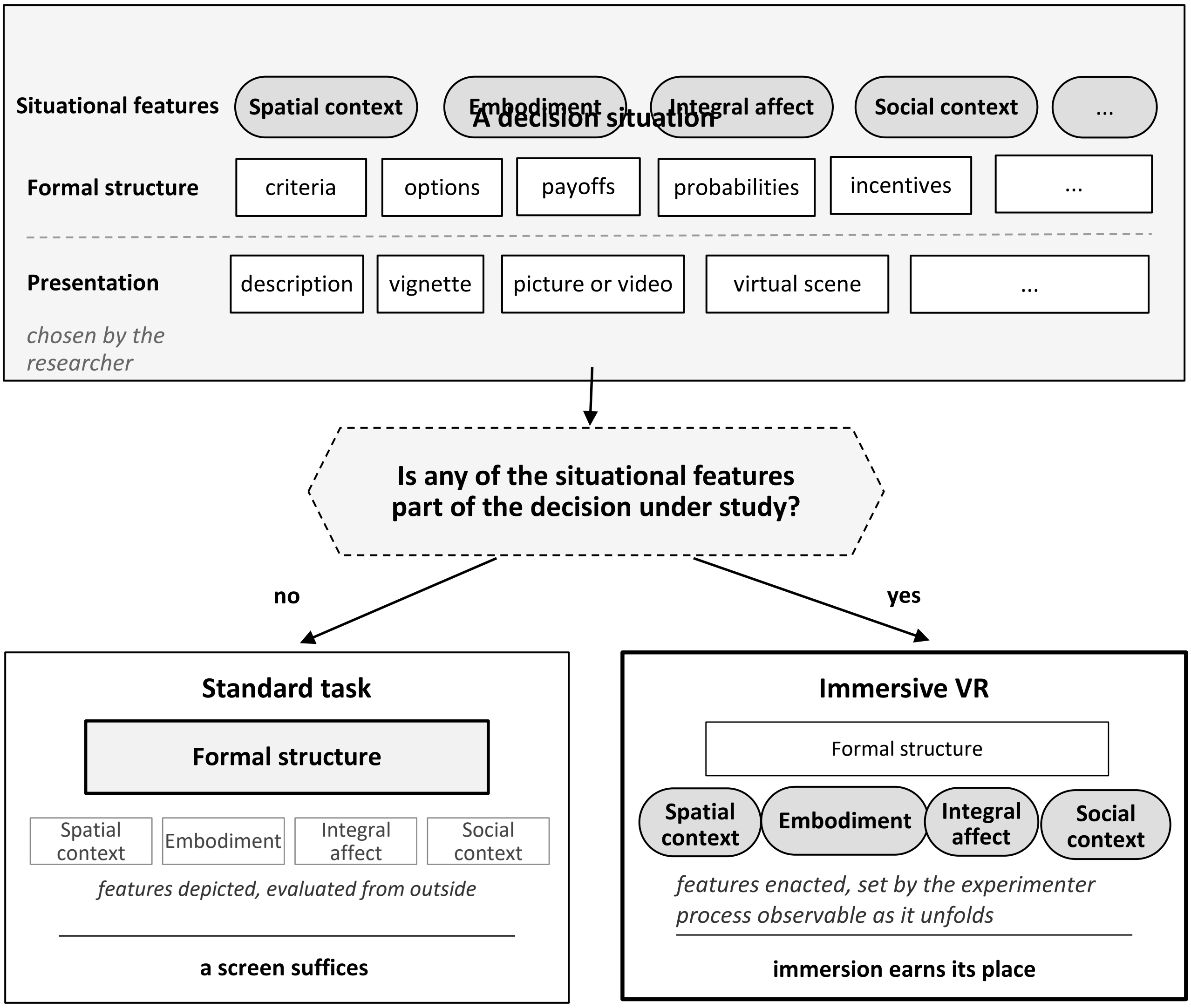
Many experimental tasks and questionnaire vignettes specify exactly the relevant information about the alternatives and their attributes. The options, or the goals of the choice, are already stated in the instructions. Multi-attribute utility (MAU) analysis is a clear example of this arrangement: each option is scored on listed attributes, and the scores are combined into an overall value (Tyszka, 2010). This works when the study concerns the formal comparison itself.

It leaves aside how options were found, which cues were noticed, from what position they were seen, and whether the body, the stakes, or other people shaped the choice.

Decision situations also differ in how much is given before choosing begins. Under certainty, risk, uncertainty, and ambiguity, what changes is the decision-maker's knowledge about states of nature and their probabilities (Białek et al., 2021). Kozielecki (1977) described decision situations as either *closed*, with relevant states given in advance, or *open*, in which the decision-maker must first determine what matters. The situations may be *narrow* or *wide*, depending on the number of options. They may also remain static or change while the decision is being made. The lottery on a card is closed, narrow, and static. The cases in which immersion becomes interesting usually contain something more: options have to be found, the scene has to be read, and different kinds of uncertainty characterise the problem (Domurat & Zieliński, 2013).

The preceding sections describe these added features: space, body and viewpoint, affect, and other people. A flat task often fixes these elements in advance, removes them, or leaves them uncontrolled. VR is useful when one of them is part of the decision. Table 1 states the framework proposed here: the four features, the decision mechanism each engages, what the decision-maker does with them, and what the researcher gains by staging them in VR. Figure 1 shows the same framework in schematic form.

Figure 1. *Two ways of staging a decision situation*



Note. The four features discussed in Sections 3.1–3.4 are those for which the evidence is currently strongest. The open rows "…" indicate that neither the list of features nor the forms of presentation is closed.

Table 1. *A diagnostic framework for the methodological value of immersive VR*

Feature	What it involves	What the decision-maker does	Decision mechanism	What the researcher gains	Example domains and studies
Spatial context	layout, proximity, height, visibility, the path through a scene	moves through the space, discovers, narrows down, or evaluates options by looking around	pre-decisional search: which options enter consideration and which never do	control over the pre-decisional stage: which options are encountered, in what order, and from what position	• consumer choice (Schnack et al., 2020; Meißner et al., 2020); • environmental valuation (Bateman et al., 2009); • wayfinding and evacuation (Arellana et al., 2020)
Embodiment	body, viewpoint, identity, the avatar through which one acts	acts from a particular body or viewpoint; behaviour can shift with the body, identity, or actions available	self-representation and viewpoint enter the evaluation acting rather than judging	the body, perspective, or identity as an independent variable rather than an uncontrolled constant	• moral dilemmas (Skulmowski et al., 2014; Francis et al., 2017); • intertemporal choice (Hershfield et al., 2011); • health and forensic behaviour (Stenberdt & Makransky, 2023; Park & Lee, 2021)
Integral affect	threat, temptation, moral cost, arousal arising from the situation itself	feels the stakes as part of the choice, not as a mood induced from outside	affect from the decision object enters the evaluation of options	emotional load built into the task rather than added as ambient arousal	• risk under threat (Laycock et al., 2024); • criminal decisions (van Gelder et al., 2019); • gambling context (Dickinson et al., 2020)
Social context	presence, gaze, pace, ability, communication with others	decides while being watched, paced by others, or matched against them	reputation, social comparison, and information sharing when others are	social interaction staged in a virtual setting; in agent studies, one social cue can be varied while the rest is	• strategic games (Füllbrunn et al., 2011; Greiner et al., 2014); • group decisions (van der

Feature	What it involves	What the decision-maker does	Decision mechanism	What the researcher gains	Example domains and studies
			present	held fixed	Land et al., 2013; Moser et al., 2020); • peer and observer effects (Gürerk et al., 2019; Mol et al., 2020)
Formal structure only	options, payoffs, probabilities, and criteria exhaust the research question	evaluates given options against given criteria; nothing is left to discover	comparison of given options on stated attributes and probabilities	little or none: a screen already shows everything there is to show	• studies with lotteries, monetary incentives, probability judgments, tabularised options and attributes, etc.

Note. The first four rows are the decision features; the fifth row describes the boundary case in which none of them is engaged. The table is diagnostic, not evaluative, and asks which part of a decision situation is active and whether immersion is relevant.

Which feature is engaged depends on the task: a trolley problem with physical action engages embodiment. In contrast, the same dilemma under felt pressure engages integral affect. The social row also combines two cases: desktop games show that interaction can be moved into virtual worlds, whereas agent and observer studies isolate specific social cues. A lottery between two numbered gambles is a simple case. The options are already given, the probabilities are shown, and the participant only has to compare them. The same is true for an Ellsberg urn presented in table form or for a multi-attribute choice with all criteria listed. In such tasks, the screen already shows the relevant part of the decision. A headset becomes relevant only when bodily action, felt stakes, or another person's presence may change the choice.

Opportunities and limitations

Immersive VR is useful here in three practical ways: it allows the researcher to record the decision as it unfolds, stage situations that cannot be run safely in real life, and control selected features of the decision environment. First, the researcher can follow the decision while it happens: movement through the scene, gaze, bodily arousal, or response to another person, together with the final choice. Second, situations that are too dangerous, rare, or unethical for a real-life study can still be presented to the participant. Third, researchers can set situational features and manipulate layout, viewpoint, threat, gaze, pace, or rival ability. Table 2 summarises these uses.

Table 2. *Methodological capabilities of virtual reality*

Capability	Specifics	Example studies
Process tracing	• pupil dilation, eye movements • gaze path, fixations • gaze-based strategy classification • EEG, cardiac activity, and arousal indices	• forced-choice trolley dilemma (Skulmowski et al., 2014) • choice in an immersive shelf task (Meißner et al., 2019) • search behaviour in physical and virtual shops (Pfeiffer et al., 2020) • emotion recognition during immersive tasks (Marín-Morales et al., 2019)
Access to unreachable decisions	• evacuation under threat • participant's assessment of a property as a burglary target • protective response to disaster	• behaviour during a virtual earthquake (Feng et al., 2020) • residential burglary from the burglar's perspective (Park & Lee, 2021) • investment against a virtual flood (Mol et al., 2022)
Experimental control	• co-worker's pace, fixed in advance • rival's ability, set relative to the participant • observer's gaze, attentive versus indifferent • shelf layout and product position • format of the same information	• sorting beside a virtual peer (Gürerk et al., 2019) • tournament against a virtual rival (Graff et al., 2021) • cheating under a watching avatar (Mol et al., 2020) • choice in a virtual store (Schnack et al., 2020) • land-use valuation as a table versus a VR scene (Bateman et al., 2009)
Reproducibility	• the environment specified in shareable code	• exact replication of a social-interaction setup (Pan & Hamilton, 2018; de la Rosa & Breidt, 2018)

The four decision features from Section 3 indicate possible extensions. Spatial tasks make attention measurable as part of the decision. Built-in eye tracking can record which objects, exits, warnings, faces, or products were fixated on, skipped, or revisited. Gaze data can reveal part of the pre-decisional stage: what entered into comparison before the choice was made. The point here is simply that the participant's search of the scene can be measured as it unfolds. Integral affect raises a similar issue. Physiological recording is useful when the task is meant to contain threat, temptation, or moral cost. It provides a second trace of whether the scene was actually felt during the choice. In VR studies, this trace may come from heart rate, skin conductance, pupil dilation, brain activity, or similar measures recorded while the participant acts in the scene (Laycock et al., 2024; Marín-Morales et al., 2019; Patil et al., 2014; Skulmowski et al., 2014).

The social counterpart remains the most open case. In the studies above, the researcher usually had to choose between a human confederate and a scripted avatar (Section 3.4). A confederate can respond naturally but brings variation from session to session. A scripted avatar gives control but repeats the script. Large-language-model (LLM) agents sit between these two solutions. Their role, knowledge, and general disposition can be set before the study, and they can still respond to the participant during the interaction. Social VR has already used such agents as conversational characters (Wan et al., 2024). The more freely the agent can respond, the more its behaviour must be logged, constrained, and reported to ensure that participants still face comparable social stimuli. An agent within the scene is part of the decision environment, whereas a language model standing in for the participant is a synthetic respondent – with its own validity issues (Horton et al., 2023; Xie et al., 2024).

Augmented reality (AR) is useful when the real surroundings should remain part of the task. A participant may stand in a real street or workspace while digital elements (warnings, photos, routes, product information, etc.) are overlaid on the physical environment. In Milgram and Kishino's (1994) terms, AR occupies another region of the reality–virtuality continuum. The shop need not be simulated. The participant can remain in the physical setting while the experimenter changes the virtual information layer. AR preserves the real-world setting of the task and makes selected cues editable, as consumer studies have shown (Qin et al., 2021; Barta et al., 2023).

Lower equipment costs make these studies easier to conduct, but do not solve validity problems. Samples are often small and self-selected because participants have to agree to wear a headset or enter an immersive room. The medium may also change behaviour. Some participants become more engaged; others feel observed in an unfamiliar setting; still others treat the task as a game (Fiore et al., 2009; Duffy, 2011; Innocenti, 2017). For that reason, perceived realism, simulator discomfort, and task interpretation should be checked alongside the main choice (Fang et al., 2021). Otherwise, the researcher may record a response to the medium rather than a response to the decision situation.

Two constraints are specific to VR equipment: cybersickness (Rebenitsch & Owen, 2016) and visual fatigue (Souchet et al., 2023). Both can shorten sessions and interact with the very signals a study records, confounding discomfort with arousal. Comparable findings are hard to accumulate when headsets, engines, and environments differ across labs. Because virtual environments are software, scenes and task code can be shared and reused, making exact replication more practical.

A last limitation follows from the method's strength. More vivid scenes can also be disturbing. A scene realistic enough to elicit a genuine decision may also be distressing, especially when moral or emotional material is embodied. The field has begun to set out the ethical obligations that this entails (Madary & Metzinger, 2016; Slater et al., 2020).

Conclusion

This article has argued that virtual reality is a domain in which people make choices and a method that promises experimental control and ecological validity. Both matter when virtual choices correspond to choices outside VR. Classic phenomena of risk, valuation, bias, and social choice carry over to immersive environments, though not exactly, and the departures are often where the interest lies. Such departures are known in decision-making research. Risk attitude varies with the form in which it is expressed; for example, a person who calls themselves cautious can behave boldly in practice (Tyszka & Domurat, 2004), and odds read from a description are weighted differently from those learned through experience (Hertwig et al., 2004). Immersion seems to be one more such form. A flat decision task and an embodied VR task are not two measurements of the same fixed quantity. They reveal different aspects of the choice, so shifts between them are part of what VR measures.

Virtual reality is one form in which decisions are made, alongside descriptions, ratings, or real behaviour, each of which can elicit a different response. The practical question is therefore which form fits the decision under study. When the question concerns only the formal choice structure, a screen suffices, and immersion adds only costs. A headset is justified when the decision depends on something a flat task omits: space, bodily action, emotion, or other people, which can then be staged and varied without sacrificing experimental control. Lem's perfect illusion has become a laboratory: participants are placed within it, turning the head changes what they see, and a computer responds to changes in position.

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