

-RESEARCH ARTICLE-

THE DISTANCE THAT MONEY HIDES: A TANGIBILITY-EFFECT ACCOUNT OF WHY PAYMENT FORM SHAPES SPENDING

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—Abstract—

This study examines how different forms of money produce distinct psychological effects through a new concept termed the tangibility effect, which refers to the

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psychological distance between the subject and the object. Although previous literature links higher cashless spending to the pain of paying, it provides limited explanation of why this effect occurs. Drawing on converging evidence from five domains, namely time framing, the IKEA effect, the Ring of Gyges, the trolley dilemma, and spectator absence in sport during COVID-19, the study argues that psychological responses vary inversely with subject-object distance. A tangibility gradient is established across cash, cheques, and electronic money, while a dilemma experiment demonstrates that changes in distance alone can reverse judgement. The findings indicate that different forms of money possess different levels of tangibility, which shape individuals' psychological responses and spending behaviour. Accordingly, credit and debit cards are more likely to encourage spending than cash and cheques. The tangibility effect is distinguished from proximity, which is unidirectional and limited to material objects, whereas tangibility is bidirectional and can also apply to non-material objects. Although the study considers neurological, economic, and psychological perspectives, its primary focus is psychological, concluding that the dematerialisation of money is fundamentally a problem of distance before it becomes a technological one.

Keywords: Tangibility; Proximity; Psychological Distance; Pain of Paying; Payment Form; Spending Behaviour.

INTRODUCTION

Three main perspectives examine the relationship between the shift from cash and cheques to credit and debit cards and changes in spending behaviour: neurological, economic, and psychological. Each addresses a different level of the same phenomenon and has accumulated substantial empirical support, yet none provides a unified explanation of the mechanism underlying the effect. From a neurological perspective, evidence supports the existence of a pain of paying when individuals purchase goods with money, with some studies identifying similarities between neural responses to monetary payment and physical pain. [Banker et al. \(2021\)](#), for example, used functional magnetic resonance imaging to compare real credit and cash purchase opportunities and reported differences in activation within the striatum and anterior cingulate cortex. Their findings suggest that credit cards may not simply reduce the aversive response associated with payment but may also increase reward anticipation. This distinction is important because it indicates that the psychological effects of payment methods cannot be explained solely by the reduction of payment-related discomfort.

From an economic perspective, the dematerialisation of payment systems generates both efficiency benefits and potential risks. Electronic payments can reduce the social costs associated with paper-based transactions, while evidence indicates that electronic payment methods can increase household consumption of discretionary goods ([Li et al., 2023](#)). Mobile payment adoption has likewise been associated with a greater likelihood of overspending, with financial knowledge providing only a partial buffer ([Ahn & Nam,](#)

2022). Emerging payment mechanisms extend this pattern. Buy-now-pay-later arrangements can influence spending by separating the timing of payment from the acquisition of goods (Ashby et al., 2025), while gamified digital interfaces can alter investor behaviour through design features absent from physical transactions (Grant et al., 2024). Thus, economic research establishes that payment methods have meaningful behavioural consequences but provides limited explanation of the psychological mechanism underlying them.

From a psychological perspective, extensive research shows that payment cards can increase spending under specific conditions, influence the recall of previous payments, and increase willingness to pay when consumers use cards rather than cash. Schomburgk et al. (2024) synthesised four decades of evidence through a meta-analysis of 392 effect sizes from 71 studies across 17 countries and confirmed the robustness of the cashless effect, whereby consumers tend to spend more when using cashless payment methods than cash. Reshadi and Fitzgerald (2023) further examined the pain-of-payment construct by distinguishing between immediate and anticipated payment pain. However, replication studies have complicated this explanation. Liu and Dewitte (2021) replicated the credit card effect but found no reliable evidence that self-reported payment pain mediated the relationship between mobile payment and willingness to pay. Similarly, Boden et al. (2020) found comparable levels of payment pain for mobile and card payments despite differences in willingness to pay. Ma et al. (2024) reached a related conclusion, suggesting that mobile payments may encourage purchasing through implicit pleasure and selective attention rather than pain reduction alone.

These findings reveal a central limitation in the existing literature. The pain of paying remains the dominant explanatory concept, yet its mediating role varies across payment instruments. More importantly, payment pain is itself an outcome requiring explanation rather than a fundamental mechanism. Stating that cash produces greater pain than cards describe the observed difference but does not explain which underlying property of cash produces that response. The literature has therefore identified the symptom without fully identifying its cause. A further limitation is the separation of the three research traditions. Neurological studies identify patterns of brain activation without clearly specifying which characteristics of the payment instrument generate those responses. Economic studies document behavioural and aggregate consequences without fully explaining the individual-level mechanism. Psychological studies identify affective responses without deriving them from a more fundamental construct. Consequently, the three perspectives describe different levels of the same process but remain insufficiently integrated. What is therefore required is a construct that can be experimentally manipulated, psychologically experienced, and applied beyond the specific context of monetary transactions.

Scope of the Study

This study focuses specifically on the psychological dimension of payment behaviour. It does not seek to evaluate competing neurological models of payment processing or examine the macroeconomic consequences of payment substitution; these are treated as boundary conditions rather than primary objects of analysis. The study adopts a conceptual and integrative approach by introducing the tangibility effect, defined as the relationship between the distance separating a subject from an object and the magnitude of the subject's psychological response to that object. The proposed relationship is inverse: as the distance decreases, the psychological effect increases. The construct is then applied to different forms of money. To examine its broader applicability, evidence is drawn from five diverse domains: time framing, the IKEA effect, the Ring of Gyges, the trolley dilemma, and spectator absence in sport. These domains are intentionally heterogeneous, as a general construct should be observable across settings that differ in subject matter, methodology, and disciplinary tradition. The empirical component is limited to a single classroom dilemma study in which distance is manipulated while the consequences remain constant.

Significance of the Study

The significance of the study is threefold. Theoretically, it provides the missing causal antecedent in the literature on payment behaviour. If tangibility determines the intensity of psychological response, then the pain of paying should be understood as a downstream consequence of psychological distance rather than as a fundamental mechanism. This perspective explains why payment pain may reliably mediate the difference between cash and cards but do so less consistently between cards and mobile payments. The difference in payment pain arises because the instruments differ in their degree of distance, and when this distance differential is small, the corresponding difference in pain may become negligible even though behavioural differences continue through other mechanisms. The construct therefore accommodates the replication anomalies identified in the existing literature ([Boden et al., 2020](#); [Liu & Dewitte, 2021](#)).

Conceptually, the tangibility effect differs from the established concept of proximity as well as from construal-level theory. Proximity, as conventionally understood, is generally associated with material objects and represents a uni-directional influence from the object towards the subject. Tangibility, by contrast, applies to both material and non-material objects and operates in a bi-directional manner. Its distinction from construal-level theory is more nuanced but equally important. Construal-level theory proposes that psychological distance influences the level of abstraction through which an object is mentally represented ([Adler & Sarstedt, 2021](#); [Trobe et al., 2021](#)). Tangibility, in contrast, concerns the magnitude of affective and behavioural responses rather than the level of representational abstraction. It also allows transformations through which non-material objects can acquire greater tangibility, such as valuing time in monetary terms.

Practically, the framework has implications for monetary policy and consumer protection, particularly as central banks increasingly develop retail digital currencies. If the behavioural consequences of payment dematerialisation arise primarily from psychological distance rather than convenience or access to credit, payment instruments could potentially restore some degree of spending restraint by re-tangibilizing the settlement process. Such design interventions should therefore be evaluated according to their capacity to reduce psychological distance. Evidence that financial knowledge buffers but does not eliminate payment-induced overspending (Ahn & Nam, 2022) further suggests that financial education alone may be insufficient and that the architecture of payment instruments represents a potentially stronger policy lever.

The contribution of the study is therefore conceptual rather than instrumental. The paper does not claim to have directly measured tangibility, nor does it attempt to provide a new estimate of the cashless effect, which has already been established through meta-analytic evidence. Instead, it proposes a reordering of the existing explanatory hierarchy. Constructs currently treated as parallel explanations of payment behaviour may instead occupy different positions within a causal structure, with subject-object distance forming the foundational mechanism and pain, salience, attention, and mental accounting operating as subsequent consequences. If this argument is supported, the replication difficulties observed in previous research may not primarily reflect measurement failures but may instead result from treating a derived construct as though it were a fundamental explanatory variable.

Research Objectives

In line with the results reported in Section 4, the study pursues four objectives. The first objective is to formally define the tangibility effect and distinguish it from proximity and construal-level explanations of psychological distance. The second is to establish the general applicability of the construct by demonstrating its operation across five substantively unrelated evidence domains. The third is to examine, through a controlled dilemma in which the outcomes remain constant while only the subject-object distance is manipulated, whether distance alone is sufficient to reverse judgement. The fourth is to arrange the principal forms of money along a tangibility gradient and derive the corresponding predicted pattern of psychological response and spending behaviour, thereby making explicit the underlying mechanism that remains implicit in the pain-of-paying literature.

LITERATURE REVIEW

The Cashless Effect and Its Consolidation

The proposition that payment form influences expenditure is among the more firmly established findings in consumer research, with its empirical consolidation emerging more clearly in recent years. Schomburgk et al. (2024) conducted a meta-analysis

covering four decades of research and confirmed a reliable cashless effect while also identifying the conditions under which this effect is moderated. Specifically, the magnitude of the effect depends on characteristics of the payment instrument, the nature of the consumption situation, and the contextual environment in which the transaction takes place. The effect should therefore not be regarded as an invariant characteristic of a particular payment method but rather as a function of the circumstances in which it is used. This finding further challenges the assumption that a single affective mechanism can universally account for the effect.

[Reshadi and Fitzgerald \(2023\)](#) provided a corresponding conceptual consolidation by defining pain of payment as the negative effect experienced when consumers become aware that they have relinquished financial resources, while distinguishing between immediate and anticipated payment pain. This distinction is particularly relevant to the present argument because it places emphasis on cognizance and the salience of financial loss rather than on the loss itself. Thus, payments of identical monetary value can generate different affective responses depending on how perceptible the loss is, which closely corresponds to the role of psychological distance proposed by the tangibility effect.

Empirical research involving newer payment instruments has further complicated the established explanation in productive ways. [Park et al. \(2021\)](#) proposed a decision-risk inattention hypothesis to explain why cashless payment methods increase unhealthy consumption, arguing that the mechanism operates through reduced attention to the risks associated with the decision rather than through reduced payment pain. [Yu et al. \(2023\)](#) reported that mobile payment shifts consumer preferences towards hedonic options. [Ma et al. \(2024\)](#) similarly found that payment pain does not fully explain the purchase-promoting effect of mobile payment and identified implicit pleasure operating through selective attention as a complementary mechanism. Collectively, these studies indicate that the affective account remains incomplete and that attention and salience perform important explanatory functions that cannot be fully captured by the pain-of-payment construct alone.

Neurological Evidence

From a neurological perspective, evidence indicates that payment methods are associated with differences in brain activation during purchasing decisions involving real credit and cash. [Banker et al. \(2021\)](#) provide a particularly direct examination of this relationship. Their neuroimaging findings suggest that credit cards do not merely reduce an aversive response associated with payment; they are also linked to increased activity in reward-related brain regions during purchase decisions, with the intensity of this activation predicting subsequent purchasing behaviour. The neurological evidence therefore supports a dual-process interpretation in which the form of payment influences both the aversive and appetitive components of the decision. From the

perspective of the tangibility effect, this finding is complementary rather than contradictory, because a reduction in subject-object distance should strengthen whichever valuation signal is most salient in a given situation, whereas greater distance should attenuate that signal.

Economic Consequences of Dematerialization

The economic literature has documented the aggregate consequences associated with payment substitution. [Li et al. \(2023\)](#), using household finance survey data, found that electronic payment significantly increases discretionary household consumption, demonstrating that the spending effect observed in controlled settings persists at the aggregate level. [Ahn and Nam \(2022\)](#), analysing a sample of 21,457 consumers, reported that mobile payment users face substantially greater risks of overspending across consumption, money management, and credit card behaviour. They further found that financial knowledge moderates this relationship but does not eliminate it. [Sui et al. \(2021\)](#) associated overspending with mental accounting processes, while [Meyll and Walter \(2019\)](#) reported that the adoption of mobile payment technologies is associated with increased credit card borrowing.

Continued innovation in payment instruments has further extended the proposed tangibility gradient. [Ashby et al. \(2025\)](#) examined by-now-pay-later arrangements and found that this payment method influences spending decisions by shifting the timing of settlement away from the moment of acquisition. [Abikari et al. \(2023\)](#) demonstrated that negative emotions influence behavioural intentions to adopt emerging e-banking technologies, while [Alkhwaldi et al. \(2024\)](#) found that uncertainty avoidance conditions the acceptance of digital payment systems. [Shah et al. \(2026\)](#) bring these strands together through a mental accounting perspective, conceptualising digital payment biases as systematic departures from the fungibility assumed by conventional economic theory. [Toccafondi et al. \(2025\)](#) provide a particularly informative boundary case: the use of virtual currencies in online gaming increases willingness to pay for loot boxes. This finding closely reflects the tangibility argument because the intermediate currency effectively increases the psychological distance between the player and the underlying monetary expenditure.

Psychological Distance and Construal

The most closely related theoretical tradition is construal-level theory, which proposes that psychologically proximal objects are represented in concrete and context-specific terms, whereas psychologically distant objects are represented at a more abstract level. The theory identifies four principal dimensions of psychological distance: temporal, spatial, social, and hypothetical. [Trope et al. \(2021\)](#) extended the framework to regulatory scope, while [Adler and Sarstedt \(2021\)](#) provided a bibliometric mapping of the field, documenting both its breadth and its fragmentation. The relationship between

construal-level theory and tangibility is therefore one of partial overlap. Construal-level theory primarily explains the level of abstraction at which an object is mentally represented, whereas the tangibility effect concerns the magnitude of the psychological and behavioural response to that object. The two perspectives may converge when greater abstraction reduces affective engagement, but they diverge when an object is represented in concrete terms while remaining behaviourally remote. Electronic money provides a relevant example: its monetary value may be clearly displayed and cognitively understood on a screen, yet the act of transferring it can remain experientially distant.

Loss Aversion and the Perceptibility of Loss

A parallel line of enquiry addresses the asymmetry between losses and gains. [Gächter et al. \(2022\)](#) estimated individual-level loss aversion across both riskless and risky choices and found that the parameter is substantial but heterogeneous across individuals. This finding is directly relevant to payment behaviour because every purchase involves a riskless monetary loss exchanged for a gain in goods or services. However, if loss aversion were sufficient to explain the payment effect, the magnitude of the monetary loss, rather than the form through which it is incurred, should determine the psychological response. Identical amounts paid through different instruments would therefore be expected to generate comparable levels of aversion. The fact that they do not represents the central puzzle in the payment literature. Loss aversion therefore establishes that losses receive disproportionate psychological weight, but it does not explain why this weighting changes according to the instrument through which the loss occurs. The missing element is perceptibility, which varies as a function of psychological distance.

Mental accounting provides a partial connection between these explanations. [Sui et al. \(2021\)](#) demonstrated empirically that mental accounting processes contribute to overspending, while [Shah et al. \(2026\)](#) conceptualised digital payment biases as systematic violations of the fungibility principle. From this perspective, payment instruments may differ because they are assigned to different mental accounts and because the boundaries separating these accounts are more permeable for certain instruments than for others. However, the reason why these account boundaries become more or less permeable remains insufficiently explained. The tangibility account proposes that such boundaries become less distinct as psychological distance increases: when a payment is not perceptibly experienced, it is less likely to be clearly incorporated into the relevant mental account, and an expenditure that is not firmly registered provides a weaker constraint on subsequent spending. Mental accounting therefore captures the bookkeeping consequence of low tangibility rather than constituting an independent underlying cause.

Adoption, Emotion and Instrument Design

A third strand of research examines how consumers adopt low-tangibility payment instruments in the first place. [Abikari et al. \(2023\)](#) found that anticipated negative emotions influence behavioural intentions to adopt emerging e-banking technologies, while [Alkhwaldi et al. \(2024\)](#) demonstrated that uncertainty avoidance shapes the acceptance of digital payment systems across different cultural contexts. These findings are indirectly but importantly relevant to the present argument. If low-tangibility instruments are disproportionately adopted by individuals who are less affected by the absence of perceptible settlement, observed differences between cash and card users may combine an instrument effect with a selection effect. Experimental studies that assign payment modes, such as those conducted in the replication literature ([Boden et al., 2020](#); [Liu & Dewitte, 2021](#)), are therefore essential for establishing causality. The convergence between experimental findings and survey-based estimates further strengthens the causal interpretation.

Payment instrument design has also increasingly become a subject of empirical investigation. [Grant et al. \(2024\)](#) demonstrated that design features such as colour and swipe-to-trade mechanics in mobile trading applications can influence investor decisions, while [Ghaharian et al. \(2023\)](#) used payment transaction data to characterise gambling-related harm, showing that digital settlement records can both facilitate and reflect behavioural risk. [Toccafondi et al. \(2025\)](#) found that inserting a virtual currency between players and real money increases willingness to pay for randomised rewards. Each of these examples can be interpreted as an intentional manipulation of psychological distance. The gaming context is particularly informative because the intermediary virtual currency provides no intrinsic convenience advantage; instead, it separates the individual from the underlying monetary expenditure, with spending increasing as a consequence. This provides relatively direct evidence of the tangibility parameter operating beyond conventional payment contexts.

Taken together, Sections 2.1 to 2.4b describe a literature that has established a robust empirical regularity while leaving its underlying explanation comparatively unsettled. The cashless effect is supported by extensive evidence ([Schomburgk et al., 2024](#)). However, the affective mechanism proposed to explain this effect appears more reliable at the extremes of the payment gradient than among adjacent payment instruments. Related constructs, including loss aversion, mental accounting, construal level, and decision-risk inattention, each explain a particular aspect of the phenomenon without providing a comprehensive account of the others. The present paper proposes that these should not necessarily be regarded as four independent mechanisms, but rather as consequences that may arise from a common underlying factor: the distance separating the paying subject from the money being surrendered. One methodological implication follows from this review. Because the proposed mechanisms are highly correlated under ordinary payment conditions, distinguishing among them requires research designs in

which psychological distance is manipulated while alternative explanatory factors are held constant. The adjacent domains reviewed below provide such conditions more effectively than conventional payment studies, which is the principal rationale for incorporating them as supporting evidence.

Corroborating Evidence from Adjacent Domains

Four bodies of literature outside the payment domain provide independent tests of the proposed relationship between distance and psychological response. The first concerns effortful production. The IKEA effect refers to the increased value consumers assign to objects they have partially created. [Brunner et al. \(2023\)](#) showed that this effect extends to financial portfolios, demonstrating that investors place greater value on self-constructed holdings than on identical holdings they did not assemble, while ([Tiehen, 2022](#)) argued that the effect can also emerge in relation to epistemic goods. Conventional explanations attribute this phenomenon to effort justification, endowment, or competence signalling. The present account offers an alternative interpretation: the act of assembly transforms labour time, which is otherwise abstract and imperceptible, into a tangible object, and this increased tangibility generates the observed valuation premium.

The second body of evidence concerns moral judgement under different levels of physical involvement. [Bago et al. \(2022\)](#) replicated the personal-force and intention effects in trolley-type dilemmas across 45 countries, confirming that both factors broadly influence judgement while also demonstrating variation in their magnitude across cultures. [Klenk \(2022\)](#), through a review of 53 studies, identified 36 situational factors capable of shifting utilitarian judgement without changing the consequences considered relevant by utilitarian reasoning. The fact that such factors alter judgement while the outcomes remain constant provides strong evidence that psychological responses depend on factors beyond consequences themselves. Among the most consistently implicated factors is the degree of physical directness in the agent's involvement.

The third concerns the presence of an audience. The suspension of spectator attendance during the COVID-19 pandemic provided a natural experiment for examining the effects of social presence. [Wunderlich et al. \(2021\)](#) analysed European top-flight matches played without spectators and found that home advantage declined, although it did not disappear entirely. [Scoppa \(2021\)](#) similarly found that the absence of crowd support influenced agents' behaviour, particularly the decisions of referees. [Sedeaud et al. \(2021\)](#) documented changes in home and away victories across soccer and rugby union, while [Fischer and Haucap \(2021\)](#) attributed a substantial proportion of the effect to crowd-induced officiating bias. Collectively, these findings indicate that the physical co-presence of an audience, where psychological distance approaches zero, can measurably influence performance and judgement. Removing the audience attenuates

this effect without eliminating it, as organisers introduced visual representations and recorded crowd sounds precisely to preserve some degree of social presence.

The fourth concerns anonymity. The Ring of Gyges, Plato's thought experiment in which invisibility removes accountability, anticipates the modern observation that being observable can constrain behaviour. Its relevance to the present framework lies in the social dimension of distance: an agent who cannot be observed is psychologically and socially more distant from those affected by the action, potentially weakening the psychological constraints that would otherwise regulate behaviour. Taken together, these bodies of literature cover substantially different subject areas, yet they reveal a common pattern: as the distance between an acting subject and the object of the action decreases, the intensity of the psychological response increases. The present paper identifies this recurring relationship as the tangibility effect and applies it to the domain of money.

METHODOLOGY

Research Design

The study adopts a conceptual-analytical design supplemented by a within-subject dilemma experiment. This design is appropriate because the primary contribution is definitional and integrative, proposing that a single construct underlies recurring patterns observed across otherwise unrelated domains. Such a proposition is best evaluated by demonstrating convergent applicability across different contexts rather than by estimating a single parameter within one population. The analytical strategy therefore proceeds through three stages: formally specifying the construct, systematically evaluating five evidence domains in relation to the proposed framework, and experimentally testing whether changes in subject-object distance can alter judgement when the consequences remain constant.

Formal Specification of the Construct

Let d denote the perceived distance between a subject and an object, and R the magnitude of the subject's psychological response. The tangibility effect asserts $R = f(d)$ with $f'(d) < 0$: response declines monotonically as distance grows, reaching its maximum as d approaches zero. Tangibility τ is defined as the inverse of distance, so that R rises with τ . Two properties distinguish the construct. First, the range of admissible objects extends beyond material entities, as non-material entities can acquire tangibility through transformation; for example, time becomes tangible when it is assigned a monetary value.

Table 1: Conceptual Differentiation between Proximity, Construal-Level Distance and the Tangibility Effect

Property	Proximity	Construal-Level Distance	Tangibility Effect
Admissible Objects	Material Only	Material and Abstract	Material and Non-Material
Direction of Influence	Uni-Directional (Object → Subject)	Uni-Directional (Distance → Construal)	Bi-Directional
Outcome Predicted	Attention and Preference	Level of Abstraction	Amplitude of Response
Transformation Admitted	No	No	Yes (Valuation Renders Abstract Objects Tangible)
Limiting Case	Contact	Concrete Construal	$d \rightarrow 0$, Response Maximal

Note: Compiled by the authors. Construal-level properties summarized from [Trope et al. \(2021\)](#) and [Adler and Sarstedt \(2021\)](#).

Second, as illustrated in [Figure 1](#), the relationship is bi-directional: the subject not only responds to the object but can also act upon it. [Table 1](#) presents the resulting distinction between tangibility and proximity.

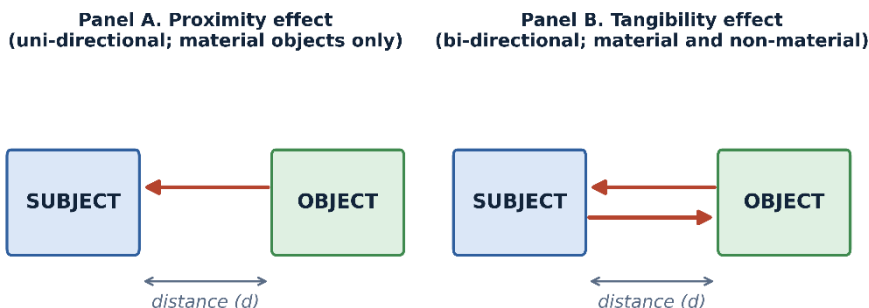


Figure 1: Structural Contrast Between the Proximity Effect and the Tangibility Effect

Note: Panel A depicts the uni-directional influence assumed by proximity accounts. Panel B depicts the bi-directional influence posited by the tangibility effect. Prepared by the authors.

Evidence Appraisal Procedure

Five evidence domains were selected according to the criterion of substantive independence. Each domain concerns a distinct object of study, employs different methodological approaches, and originates from a different disciplinary tradition, thereby reducing the likelihood that convergence across the domains can be attributed to shared assumptions. For each domain, the analysis identifies the relevant dimension of distance, the direction of the observed psychological response, and whether the consequences remain constant while distance varies. The resulting assessment is presented in [Table 2](#).

Experimental Procedure

Experiments were conducted with the authors' undergraduate and postgraduate students to examine the trolley problem and determine how variations in distance influence moral judgement. The study employed a within-subject design, in which each participant responded to both variants of the dilemma in a fixed order. In the switching variant, participants were asked whether they would divert a runaway trolley onto a side track, resulting in the death of one person instead of five. In the footbridge variant, participants were asked whether they would push a person from a bridge to stop the trolley, again sacrificing one person to save five. The consequential structure was identical in both variants, with one life lost and five lives preserved, meaning that any difference in responses could be attributed to the manipulated factor: the physical directness of the participant's involvement and, consequently, the subject-object distance. Responses were recorded as binary accept-or-refuse judgements.

RESULTS

Appraisal of the Evidence Domains

Table 2 summarises the five domains according to the criteria specified in Section 3.3. Across all five domains, the direction of the relationship remains consistent: a reduction in distance is associated with a stronger psychological response. In three of the five domains, the consequences are held constant while the degree of distance varies, providing the strongest basis for inferring the proposed relationship.

Table 2: Appraisal of Five Evidence Domains against the Tangibility Criterion

Domain	Operative Distance Dimension	Consequences Held Constant	Direction of Response	Representative Evidence
Time Framing	Abstract → Material (Valuation)	Yes	Response rises when time is monetized	Sui et al. (2021)
IKEA Effect	Labour Materialized in Object	No	Valuation rises with self-assembly	Brunner et al. (2023) ; Tichen (2022)
Ring of Gyges	Social (Observability)	Yes	Restraint falls as visibility falls	Klenk (2022)
Trolley Dilemma	Physical (Personal Force)	Yes	Refusal rises as contact rises	Bago et al. (2022)
Sport and COVID-19	Spatial (Audience Presence)	No	Performance shifts with co-presence	Wunderlich et al. (2021) ; Scoppa (2021)

Note: Compiled by the authors from the sources cited. 'Consequences held constant' indicates that the manipulation altered distance without altering the outcome at stake.

Experimental Results

Participants were asked whether they would switch the gear to save five lives at the cost

of one. More than 97% of the participants indicated that they would do so. However, when asked whether they would push a person from the bridge to stop the trolley, more than 97% stated that they would not. Some participants described the act as a criminal offence, while others considered it morally unacceptable or described it as a disgusting act. Table 3 presents the distribution of responses. The reversal is almost complete: an action that receives overwhelming approval becomes overwhelmingly condemned when the agent is required to exert personal force, despite the fact that the number of lives saved and lost remains identical in both scenarios.

Table 3: Response Distribution Across the Two Dilemma Variants

Variant	Distance Condition	Would Act (%)	Would not Act (%)	Net Shift (pp)
Switching (Divert Trolley)	Impersonal; d Large	> 97	< 3	,
Footbridge (Push Person)	Personal; d $\rightarrow$ 0	< 3	> 97	$\approx$ 94
Consequential Outcome	Identical	1 Lost, 5 Saved	1 Lost, 5 Saved	0

Note: Percentages as reported by the authors from classroom administration; the exact sample size was not recorded in the original protocol. Net shift denotes the percentage-point change in the proportion willing to act. pp = percentage points.

Sensitivity Analysis

Because the original protocol did not record the exact sample size, the statistical robustness of the observed reversal was evaluated across a range of plausible cohort sizes rather than based on a single assumed value. Table 4 presents, for each candidate N, the exact binomial probability of obtaining a 97% endorsement rate under the null hypothesis of indifference, together with the McNemar statistic for the within-subject reversal. This analysis is intended to identify the threshold beyond which the conclusion remains robust and is not materially affected by uncertainty regarding the unknown N.

Table 4: Sensitivity of the Observed Reversal to Unrecorded Sample Size

Assumed N	Endorse Switching (n)	Endorse Footbridge (n)	Binomial p (Two-Tailed)	McNemar χ^2 (1 df)
30	29	1	< .001	26.0
50	49	1	< .001	44.1
100	97	3	< .001	88.2
150	146	4	< .001	132.4
200	194	6	< .001	176.5

Note: Derived by the authors. Binomial test evaluates $H_0: p = .50$ for the switching variant. McNemar χ^2 computed as $(|b - c| - 1)^2 / (b + c)$ for discordant pairs. The reversal attains significance at $p < .001$ for every candidate N at or above 30, indicating that the substantive conclusion does not depend on the unrecorded value. The exact N should nonetheless be supplied before publication.

The Tangibility Gradient of Money

The evidence discussed above demonstrates a strong positive relationship between tangibility and psychological response. The tangibility of money decreases

progressively as the form of payment moves from cash towards electronic money, which helps explain why agents may experience a weaker psychological response when purchasing goods with electronic money. The psychological effect reaches its lowest level when the distance between the subject and the object is greatest. By contrast, agents tend to exercise greater caution when paying with cash because the distance between the subject and the object approaches zero, causing the psychological effect to reach its highest level. Table 5 formalises this ordering, while Figure 2 illustrates the underlying relationship.

Table 5: Tangibility Gradient of the Principal Forms of Money and Predicted Behavioural Consequences

Form of Money	Physical Transfer	Subject to Object Distance	Tangibility (τ)	Predicted Psychological Effect	Predicted Spending
Cash	Complete	Minimal ($d \rightarrow 0$)	Highest	Maximal	Lowest
Check	Partial (Written Act)	Intermediate	Intermediate	Intermediate	Intermediate
Debit Card	Absent	High	Low	Low	High
Credit / e-Money	Absent; Settlement Deferred	Maximal	Lowest	Minimal	Highest

Note: Compiled by the authors. The predicted ordering of spending is consistent with the meta-analytic finding of a robust cashless effect reported by Schomburgk et al. (2024).

This relationship is illustrated in Figure 3. In Panel A, the horizontal axis represents the psychological effect, while the vertical axis represents the different forms of money.

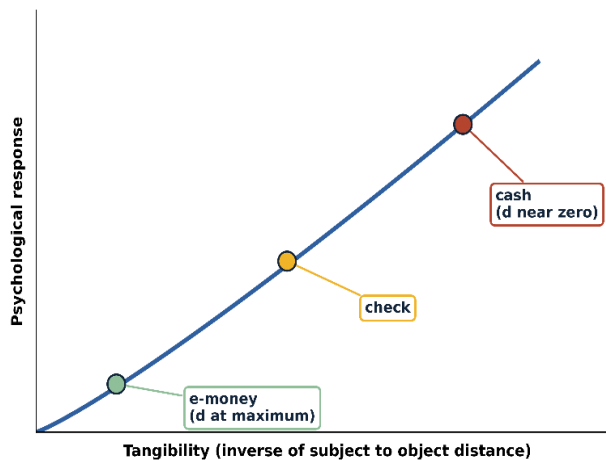


Figure 2: The Tangibility to Response Relationship, With the Forms of Money Located on the Gradient

Note: Prepared by the authors. The curve depicts $R = f(d)$ with $f'(d) < 0$, expressed against tangibility rather than distance.

The figure demonstrates a positive relationship between the tangibility of a payment form and the magnitude of its psychological effect. Accordingly, as the payment form moves from electronic money to cheques and then to cash, its psychological effect progressively increases. Panel B, which is derived from Panel A, illustrates the inverse relationship between the forms of money and spending behaviour.

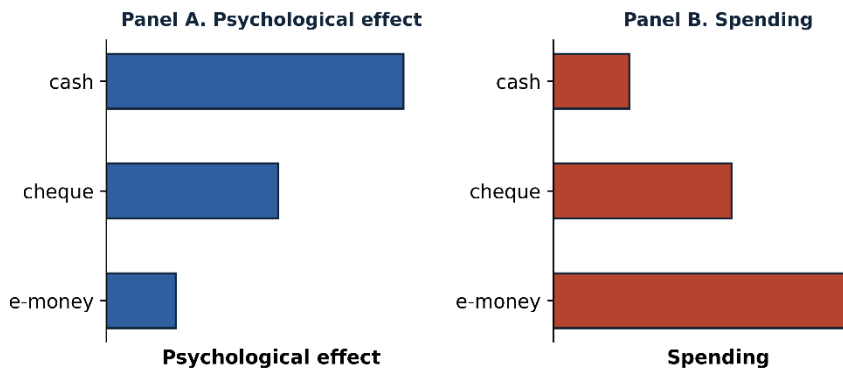


Figure 3: Form of Money, Psychological Effect and Spending Behaviour

Note: Panel B is derived from Panel A by inversion. Prepared by the authors.

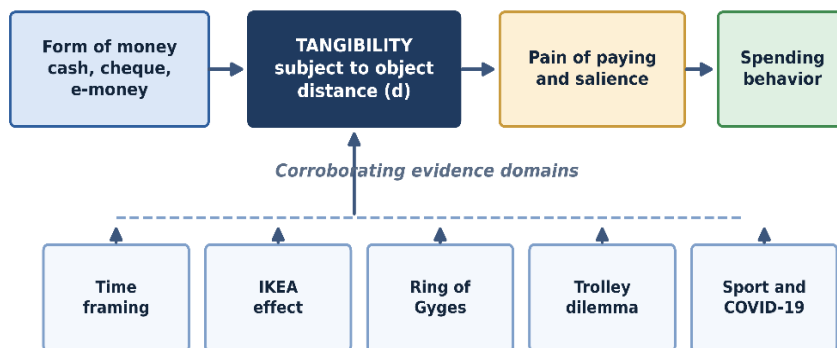


Figure 4: Integrated Conceptual Framework of the Tangibility Effect

Note: The framework positions tangibility as the antecedent of the pain of paying rather than as its synonym, and shows the five corroborating domains that establish the generality of the distance to response relation. Prepared by the authors.

DISCUSSION

This study focuses on the psychological dimension, which has received considerable attention in previous research. However, existing studies have largely overlooked the causal mechanism linking the form of money to the behaviour of economic agents. Although the pain of payment has been widely used to explain this phenomenon, the underlying reason for this pain remains unclear. The tangibility effect addresses this gap by identifying distance as the antecedent. Pain is therefore not an inherent property of cash but a consequence of the reduced distance between the payer and the act of payment.

Three implications follow. First, the construct helps explain replication anomalies that challenge the affective account. [Liu and Dewitte \(2021\)](#) found no reliable mediation of the mobile payment effect through self-reported pain, while [Boden et al. \(2020\)](#) found similar levels of pain for card and mobile payments despite differences in willingness to pay. From a tangibility perspective, these findings are expected rather than anomalous. Card and mobile payments occupy relatively close positions on the tangibility gradient, producing only small differences in psychological distance and, consequently, payment pain. However, behavioural differences may persist because other consequences of low tangibility, such as reduced attention to decision risk ([Park et al., 2021](#)) and implicit pleasure through selective attention ([Ma et al., 2024](#)), continue to operate. The pain construct therefore becomes less explanatory at higher levels of dematerialisation because it functions as a proxy for distance rather than its underlying cause.

Second, the framework reconciles the apparently opposing neurological findings presented in [Figure 4](#). If credit cards merely reduced an aversive payment signal, the appetitive activation reported by [Banker et al. \(2021\)](#) would be difficult to explain. However, if distance determines the intensity of the valuation signal that becomes salient, greater distance can reduce the aversive component of payment while leaving the appetitive component relatively intact. This produces the observed neurological asymmetry. The tangibility account therefore predicts a dissociation between aversive and appetitive responses that the pain-based explanation must treat as an exception.

Third, the convergence of evidence across the five domains is difficult to explain through a common confounding factor. The trolley dilemma provides particularly strong evidence because the consequences remain constant by design. [Bago et al. \(2022\)](#) demonstrated the personal-force effect across 45 countries, while [Klenk \(2022\)](#) identified numerous situational factors that influence judgement without changing outcomes. When the present experiment produces an approximately 94 percentage-point reversal under identical consequences, the primary difference is the directness of contact. Applied to monetary transactions, this suggests that the behavioural difference between cash and cards does not arise from differences in what is surrendered, but from how directly and perceptibly the loss is experienced.

The account also has a clear boundary. It is a theory of response amplitude rather than representation and therefore predicts the intensity of a response rather than the content of a judgement. When an instrument reduces psychological distance and the dominant signal is appetitive rather than aversive, tangibility predicts increased spending rather than reduced spending. This is consistent with evidence that virtual gaming currencies increase willingness to pay ([Toccafondi et al., 2025](#)) and that gamified trading interfaces influence investor behaviour ([Grant et al., 2024](#)). The construct is therefore directional in its mechanism but not in the valence of the resulting response.

CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

This paper examines the reasons why the form of money influences spending behaviour through neurological, economic, and psychological perspectives, with particular emphasis on the psychological approach and the proposed tangibility effect. Tangibility refers to the physical and psychological distance between a subject and an object. Evidence drawn from time framing, the IKEA effect, the Ring of Gyges, the trolley dilemma, and sport during COVID-19 consistently indicates that psychological responses become stronger as the distance between the subject and object decreases. The study therefore concludes that different forms of money possess different levels of tangibility, which are reflected in spending behaviour. Cash generates a stronger psychological effect than electronic money because the latter involves less tangibility.

Three recommendations emerge. For instrument design, issuers and central banks developing retail digital currencies should consider retangibilization as a design objective. Salience cues that restore a perceptible sense of monetary outflow, such as displaying running balances at the point of settlement, providing haptic confirmation, and clearly disclosing deferred settlement, can directly reduce the psychological distance associated with payment rather than relying solely on financial knowledge. For consumer protection, financial education should be regarded as a buffer rather than a complete remedy, given evidence that financial knowledge moderates but does not eliminate payment-induced overspending ([Ahn & Nam, 2022](#)). Accordingly, greater attention should be given to the design and regulation of payment instruments. For future research, the tangibility construct generates testable predictions: psychological response should vary systematically with measured distance across payment instruments, while interventions that increase tangibility without changing prices or credit conditions should reduce expenditure.

The implications extend beyond payment systems. If psychological response is influenced by subject-object distance, the same principle may apply wherever an intermediary separates individuals from the consequences of their actions, including algorithmic decision-making, remote warfare, and the delegation of moral responsibility through institutional structures. The dematerialisation of money may therefore represent one instance of a broader phenomenon, and one in which its behavioural consequences can be measured particularly clearly.

From a policy perspective, assessing payment modernisation solely in terms of transaction-cost savings provides an incomplete picture. Although the social cost of payment systems declines as settlement becomes increasingly dematerialised, the behavioural costs experienced by households may increase, meaning that these two effects can move in opposite directions. A comprehensive assessment should therefore consider the documented increases in discretionary consumption and overspending risk ([Ahn & Nam, 2022](#); [Li et al., 2023](#)) alongside the efficiency gains, while recognising

that the overall balance may differ across populations according to their financial resilience. The study has several limitations that point towards future research. The experimental component was based on a single classroom cohort whose exact sample size was not recorded, and although the sensitivity analysis in Table 4 demonstrates robustness to this omission, it cannot substitute for precise sample reporting. Moreover, tangibility currently represents a theoretical ordering rather than a directly measured construct. A validated measurement scale is therefore required to test the proposed monotonic relationship empirically. Future studies should develop such an instrument and estimate the relationship between subject-object distance and psychological response across the full contemporary payment gradient.

DECLARATIONS

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