Investigating Trust and Generosity in Adolescents through Standard Economic Games: Incorporating Socioeconomic Status as a Factor

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by

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CERTIFICATE

It is certified that the work contained in this thesis, titled "Investigating Trust and Generosity in Adolescents through Standard Economic Games: Incorporating Socioeconomic Status as a Contributing Factor" by Narsapur Tanvi Sanjeev, has been carried out under my supervision and is not submitted elsewhere for a degree.

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Date Adviser: Kavita Vemuri

To My Family and Friends

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Abstract

This thesis discusses two research studies based on decision-making in a financial context. Both studies use different frameworks to understand the behavioural impact on monetary decision-making. The first study focused on understanding the variation in trust and generosity in Indian adolescents as a function of their socioeconomic status using standard economic games.

Human prosocial behaviour is predominantly shaped by the socio-cultural environment. Trust and generosity are integral behavioural characteristics that sculpt our interactions within the social frameworks and experience significant changes during adolescence. Considering the complex socioeconomic strata in India, young Indian adolescents serve as a relatively unexplored demographic for examining behavioural characteristics relative to socioeconomic status (SES). We use four standard economic games to explore the dynamics of trust, generosity, and reciprocity dynamics in 13- to 16-year-old individuals. Results show generosity in the Ultimatum game positively correlated to SES, with no clear trend observed in the Dictator game. Across SES groups, the majority of the participants demonstrated non-trusting behaviour in the Centipede and Trust games. We identified a mid-SES group with an atypical decline in trust and sharing behaviour, which we attribute to higher competitiveness in real life by this cohort. This unique behaviour requires deeper analysis from a socio-economic understanding of this particular group.

The second study is based on analysing visual gaze and underlying information processing in stock market investments. Investors rely on judgmental heuristics and comparative analysis for future stock price prediction based on specific components of information in hand. Through an eye-tracking experiment, we aim to understand the perceived significance of various formats of information, particularly focusing on graphical and numerical components, and to explore the influence of complex time-varying patterns in stock price line plots. Results show that graphical components capture higher visual attention. Participants are not always loss-averse and prominently exhibit disposition effects for investment decisions in profitable scenarios. The visual gaze analysis provided behavioural insights into complex decision-making processes.

Structure of the Thesis

Chapter 1 sketches the outline of our research work by briefly describing the frameworks used to study the influence of behavioural traits on decision-making in an economic context and the role of an individual's socioeconomic status on their sharing and trusting tendencies. Additionally, the chapter states the aim and scope of the research study.

Starting with a description of the field of behavioural economics, social cognition, and the theory of mind, **Chapter 2** goes into a detailed description of generosity, trust, and altruism. We discuss the dynamic nature of behaviour, the role of reciprocity and the transformation in social perception during adolescence. The chapter provides an extensive literature review of the influence of social and cultural background and economic status on trusting and sharing tendencies in a monetary context. **Chapter 3** describes the economic games employed and reviews previous research conducted with these games. It also elaborates on how the game mechanics facilitate the analysis of desired behavioural traits.

In **Chapter 4**, we offer an in-depth overview of the participant demographics, outlining the socioeconomic backgrounds of the students who volunteered for the study. We also elaborate on the experimental methodology, highlighting the procedures used to gather data. Furthermore, we mention details about the schools visited for data collection.

We talk about various analytical methodologies applied to understand the behavioural patterns in collected data in **Chapter 5**. The chapter thoroughly explains the results obtained from these analyses, offering a detailed interpretation using graphical visualisations. We discuss the interpretations drawn from the results obtained, compare our results with those of similar prior studies, and see what kind of similarities and differences are present. We also provide explanations about the behavioural anomalies observed from a social science perspective.

Chapter 6 describes the conclusions drawn and limitations of the study.

Chapter 7 describes the study titled - **Visual Voyage of Stock Market Strategies** based on understanding investor's information processing using the eye-tracking technique. The chapter provides a literature overview, prior studies done using eye-tracking, methodology, analysis, and findings of the current study.

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Chapter 1

Introduction

An individual's behaviour is deeply rooted in the cultural and socioeconomic group to which they belong. Citizens of a society valuing trust and generosity tend to share more [1]. Previous research has observed the effect of culture on prosocial behaviour, by inequality aversion and valuing fairness ([2], [3]), the tendency to help strangers [4], and cooperative behaviour [5]. Specific to the economic context, like lending, bargaining, and investing, the amount offered is influenced by the individual's behavioural traits, which are shaped by various demographic factors such as age, gender, and socioeconomic background.

Researchers use various methodologies like questionnaires, field studies and economic games to understand the association between behavioural traits and demographic factors of interest. Empirical evidence underscores the efficacy of standard economic games as tools for gaining insights into real-life behaviour, employing a straightforward setup to associate game dynamics with the decision-making processes [6]. The Dictator and Ultimatum games capture unconditioned and conditioned generosity, while Trust and Centipede games delve into the establishment and evolution of trust. These games are meticulously designed to encapsulate the subtleties inherent in the individual attributes of generosity, fairness, reciprocity, and trust as pro-social behaviour. With a novel experimental design, we administer all four games to the same set of participants, examining the dynamic nature of the behavioural states. Importantly, both players assume the role of first movers in subsequent turns, introducing a novel element to the study to examine reciprocity effects on decision-making. The study also considers age (adolescents) and SES (urban/rural population) as factors.

In the ambit of financial decision-making, adults engage in transactions, encountering situations necessitating bargaining and interpersonal trust, whereas children and adolescents are less frequently exposed to real-life financial negotiations or investments. Additionally, there exists a rural-urban divide in economic perspectives, with an observed difference indicative of the influence of socio-ecology ([7], [8]) or one's immediate social, physical, economic, and political environment, likely impacting decisions and behaviours [9]. Children are aware of their socioeconomic identities. Sutton (2009) observed that children in the age group of 8 to 13 years do not classify themselves as rich or poor [10]. However, they

have an idea of their economic standing relative to others. The subsequent experiences significantly shape strategic decision-making.

In consideration of SES as a factor, contrasting findings in the literature are pertinent to our study, as some experiments suggest a general perception that higher SES groups are selfish ([11], [12]) and hence display lower prosocial behaviour. Others dispute this notion ([13], [14], [15], [16]), asserting that the lower the SES, lower the level of trust and generosity. The explanation for this contrast lies in the fact that higher SES groups raised with access to resources and lower environmental stressors have the 'luxury' to share and display trustworthy behaviour and are also more conscious of social reputation [17].

Our research aims to contribute to this body of knowledge by considering adolescents studying in schools with varying fee ranges as an indirect indicator of family SES. We focus on studying differences across strata to enhance understanding of the variation in behavioural patterns as a function of a non-binary classification of socioeconomic groups.

1.1 Aim and Scope

Through this study, we explore the dynamicity of trust and altruism in children (13-16 years) influenced by their family SES. Extending previous reports ([18], [19], [20]) on economic games administered to children, our study's unique experimental design additions are –

a) The use of 4 standard economic games.
b) Both the players take turns being the first movers or proposers.

The experimental design involves each game being played twice (both players get a turn) in a sequential manner. The dynamic strategic choice data can provide insights into the variation in reciprocity by the impact of prior gameplays. To the best of our knowledge, no prior study has used multiple economic games to understand the dynamic nature of trust and generosity across socioeconomic groups. Given the intricate economic and social fabric of Indian society, our aim is to discern the predominant influence between social background (collectivism and individualism) and economic status (including resource availability) on an adolescent's trusting and sharing tendencies.

Our experimental setup is grounded on the basis that behavioural traits such as trust, altruism and reciprocity are complex; hence, an explanation from the dynamic systems theory perspective is more suitable. That is, the observed responses are influenced by factors like contextual setting, prior interactions between players, personal relationships, and dynamic cognitive empathy, as informed by the Theory of Mind ([21], [22]). Consequently, an experimental setup comprising four standard economic games played sequentially and tailored to elicit dynamic behavioural responses was considered to be

ecologically more valid. This approach acknowledges that strategic decision-making in real-life scenarios is intricately linked to accumulated experiences, the current contextual milieu, evolving interpersonal dynamics, and social confirmation based on future aspirations while also understanding the limitations of a game interface or a lab experiment.

Chapter 2

Behavioral Traits and their Influence on Decision-making

2.1 Role of Psychological Factors in Decision making

Decision-making is a complex cognitive process influenced by various psychological factors. Behavioural economics captures the influence of human psychology on decision-making in the financial domain. Economic theories consider all individuals as 'Homo economicus' and expect them always to choose a utility maximisation strategy. However, human behavioural traits cause deviation from what is considered rational (logically expected) behaviour. Heuristics and biases often influence the decisions [23] taken in real-life scenarios, and individuals exhibit bounded rationality. The two systems (system 1 and system 2) structures proposed by Kahneman and Tversky efficiently explain choices made by individuals in different scenarios. Behavioural studies done by many researchers have shown that no particular behaviour is guaranteed to be followed by everyone in a given situation. Factors like emotions, social interactions, habits and instincts impact financial decisions [24]. Behavioural traits are difficult to analyse and quantify because of the numerous variations observed in behaviour followed by different people in the same scenario and the dynamic nature of these traits.

2.1.1 Social Cognition

Our interactions with others are profoundly influenced by our behavioural traits, perceptions, and evaluations of others' actions. Social cognition is an umbrella term that captures the cognitive processes of perception, attention, memory, and decision-making that enable us to understand and engage with the social environment. Analysing the behavioural characteristics and mental states of others is the core of social cognition. Social cognition guides how we perceive ourselves and others, understand social cues and norms and shape the social interactions accordingly. It enables us to assess and forecast others' behaviour in specific situations, allowing us to develop strategies and decisions based on these expectations. As the evaluation of social cues is an important aspect of social cognition, the nature of social cues guides individual behaviour in a social environment. That is why an individual's interactions with others are significantly influenced by their society's cultural, social, and economic framework. This

understanding of social cues and norms is deeply connected to an individual's ability to develop and maintain trust, generosity, and cooperative behaviour in various social contexts.

2.1.2 Theory of Mind

Theory of Mind (ToM) refers to attributing mental states (such as beliefs and desires) to others and recognising that their beliefs and intentions can differ from our own [25]. This cognitive ability is essential for analysing and predicting the behaviour of others and is an important part of social cognition. Developed ToM leads to enhanced social cognition, empathy, cooperation, trust and capacity to participate in complex social interactions. ToM allows individuals to anticipate others' strategies and adjust their own strategies accordingly. Additionally, it assists in foreseeing the impact of our decisions on others, thereby facilitating moral decision-making.

ToM is closely linked with generosity and trust. Through this cognitive skill, individuals can empathise with others, recognise their needs, and be motivated to assist and share resources. Takagishi et al. (2010) observed that the development of ToM influences fairness behaviour where participants with developed ToM abilities made less selfish offers [21]. Thus, considering other's perspectives enhances generosity. As trust involves relying on someone else's actions to maximise payoffs, understanding and predicting their probable actions could help design our strategy. ToM assists individuals in judging the trustworthiness of an individual, facilitating prediction-making. Consequently, ToM plays a crucial role in shaping the dynamics of trust and strategic decision-making in social interactions.

Along with ToM, reciprocity plays an important role in shaping our interactions. Individuals exhibit dynamic behaviour, adjusting their strategies with different people and changing their interactions with the same individual based on previous experiences and contexts. Additionally, cultural and economic background influences an individual's behaviour, and social perceptions undergo major transformations during adolescence. The subsequent chapter examines how these factors impact decision-making, describes the transformation in social cognition during adolescence, highlights the significance of studying the Indian population, and presents our contributions to the current literature.

2.2 The Interactions of Generosity, Trust, and Altruism

Trust and generosity (altruism) are pivotal factors for decision-making in social or interpersonal interactions, particularly in financial transactions, where the inclination to share and trust significantly impacts the extent of resource allocation.

Given the myriad interpretations and definitions of trust, the most widely accepted definition states, 'Trust is a psychological state comprising the intention to accept vulnerability based upon the positive

expectations of the intentions or behaviour of another' [26]. As per this definition, decisions involving dependency on another person's actions to achieve a gain depend on the trust between the two individuals. Trust involves an asymmetric dependency with incomplete or no information about others' future actions and the trust-giver's anticipation of the desired future. That is, it refers to the vulnerability of relying on someone and the assurance felt by this dependency [27]. We consider someone trustworthy if the probability of beneficial (or at least not unfavourable) actions is high enough for us to cooperate with them [28]. The existing literature describes different types of trust ([29], [30]). Irrespective of the type, trust formation always follows a sequence: assessment of beliefs, making a decision, a risk-taking act, and feedback from the outcomes [31]. The individual predisposition or trait for trust to understand three aspects of trusting behaviour – trustfulness (are some people more likely to trust than others?), trustworthiness (are some people more likely to be trusted than others?), and context (variation in trust level with change in stakes involved) found context as the strongest influencing factor [32].

In addition to trust, a behaviour that benefits others and is primarily motivated by benefitting others is termed 'Prosocial behaviour' [33]. All prosocial behaviour acts are performed with the aim of other's welfare but can contain varying degrees of voluntariness. A pro-social behaviour is 'Generosity', which conveys the concept of freely given assistance. One perceives generosity as rooted in the individual rather than solely associated with the action [34]. The extent of the generous nature is also context-dependent and found to be higher in non-monetary compared to monetary contexts [35]. Altruism, which promotes pro-social interaction, is thought to have biological roots based on phylogenetic [36] and ontogenetic understanding [37]. Developmental studies show human behaviour's deviation from theoretical economic models and sketch developmental patterns to explain results obtained by experimental economists [38].

Through years of development, infants learn to trust or distrust their caregivers based on their interactions. These perceptions are further amplified to build a picture of the surroundings in terms of trustworthiness [39]. Prosocial behaviour in children also evolves with age [40]. Preschool children display a sense of equality and fairness. 4-year-old children can decide whether to trust an informant based on their experience with the informant and their prior knowledge [41]. The preferences for fairness also evolve with age [42]. It was observed that 5-year-old children recognise that dividing the endowment equally is a fair offer[43]. By the age of 13, children are conscious of their social and economic status, have aspirations, and, in most cases, plan to achieve the same. However, there would be a gender factor based on imposed socio-cultural constraints; for example, some girls have fewer choices in many rural and urban poor communities for higher education or career prospects. Maximising or satisficing [44] will be behaviour based on this understanding.

Standard economic games like the Trust and Centipede games (details in sections 3.3 and 3.4) help us understand the establishment and evolution of trust in monetary interactions. In the Trust game, the subgame perfect equilibrium suggests the proposer should share nothing with the receiver [45], while the

subgame Nash equilibrium for the Centipede game indicates that adopting a defection strategy in the initial round is the rational approach to maximise utility [46]. However, several studies found that this approach is seldom employed, and individuals commonly display cooperative and trusting behaviour ([47], [48], [49], [50]). The deviation from theoretically expected behaviour is because of players' altruistic (deriving utility from both parties' payoffs) or selfish (deriving utility solely from their own payoff) tendencies [48]. Players in the Centipede game with altruistic tendencies are consistently expected to pass their pile and rely on their opponents to reciprocate, aiming to maximise the overall payoff for everyone. In both games, trust becomes relevant due to the reliance on the opponent to maximise the collective payoff.

Ultimatum and Dictator games (refer sections 3.2 and 3.1) used for analysing generosity are based on resource allocation tasks, where the Ultimatum game provides the receiver with the authority of rejection, and the Dictator games involve free sharing. The subgame perfect equilibrium for the Ultimatum game suggests that the proposer shares the minimum possible non-zero amount, and the receiver accepts the proposal as something is better than nothing [51]. The proposed offers can be because of a combined effect of concern for fairness and fear of rejection [52]. For the Dictator game, the theory expects the proposer to offer nothing. Although a significant percentage of individuals are observed to deviate from theoretical speculation [53]. The offer amount proposed helps us understand the tendency of individuals to share.

2.3 Prosocial Behaviour in Adolescents

According to the United Nations, individuals between 10 and 19 years are considered adolescents. As children develop and transition through adolescence, they undergo various biological and psychological changes [54]. During this period, social interactions grow more intricate as individuals increasingly interact beyond their families, engaging in relationships with peers [55]. In the initial phases of adolescence, individuals tend to prioritise self-centred thoughts, but over time, there is a transition towards considering others and assuming social responsibilities [56]. Between the ages of 12 and 16, the non-linear changes in cortical grey matter influence multiple brain areas related to decision-making. Therefore, it is crucial to examine adolescent behaviour from a cognitive perspective [57]. Individuals acquire cognitive abilities that assist them in comprehending and managing life situations during adolescence. These abilities can either promote (participating in household tasks) or hinder (interpersonal conflicts) their development of prosocial behaviour [58].

During adolescence, there is a significant shift in social perspective-taking, and the decision-making heuristics and norms we carry into adulthood are largely formed during this period [59]. The transformation in perspective-taking also influences trust and reciprocity. Fett et al. (2014) observed that adolescents with higher perspective-taking abilities display higher levels of mutual trust and react more

negatively to unfair offers in the trust game [60]. With age, children become better at incorporating social context in decision-making. Guroglu (2014) found that older adolescents show varied prosocial behaviour depending on their relationship with peers, unlike younger participants [61].

Using the ultimatum and trust game, [62] observed that young adolescents make more self-centric and impulsive choices, which decrease with age as perspective-taking and impulse control abilities enhance. This is attributed to a shift in the relative contribution of brain regions involved in choice making, from the dorsomedial prefrontal cortex (focuses on self-referential processing) to the dorsolateral prefrontal cortex and temporal-parietal junction (responsible for selfish impulse control and perspective taking). Trusting tendencies of adolescents were observed to vary by age and gender, and the influence of brain regions related to decision-making also differed between genders [63]. During a trust game based choice-making task, the temporoparietal junction (TPJ) showed higher activation in males than females, whereas females demonstrated increased activation in the caudate region compared to males.

Van Den Bos et al. (2011) used magnetic resonance imaging to understand the transition of social perspective in three phases of adolescence [64]. The study used the trust game, with participants assigned the role of the receiver. Results show that social perspective-taking ability is enhanced with age. Sutter (2007) observed that in the Ultimatum game, adults focus more on the proposer's intention, thus turning down low offers [65]. In contrast, children and adolescents focus more on the outcome and tend to accept lower unfair offers. The understanding of fairness undergoes a major transformation during late childhood and early adolescence [66]. Preference for fairness increases with age, which can be partially attributed to the enhancement of perspective-taking abilities [67]. The developmental process during adolescence influences the decision-making process, mainly for social interactions, where strategic choices also depend on the choices of others.

2.4 Reciprocity and Dynamic Behaviour

Reciprocity is an important factor shaping interactions across individuals. The term implies rewarding kind actions (positive reciprocity) and punishing unkind ones (negative reciprocity), with the intentions behind the act being crucial in assessing kindness [68]. Reciprocity cannot be solely explained by selfish or outcome-driven preferences. Players exhibit negative reciprocity by turning down low offers in the Ultimatum game [69], although the payoff-maximisation strategy suggests otherwise. Berg et al. (1995) observed that participants positively reciprocated the offers by proposers in the Trust game [47]. Children were observed to respond positively to the cooperative actions of their peers ([70], [71]).

An individual's willingness to cooperate is influenced by whether their partner chooses to cooperate or not. In interactions between individuals, strategy choices are also influenced by their previous experiences with one another [72]. House et al. (2013) found that children exhibit contingent prosocial

behaviour (driven by a purpose and not truly altruistic), and older children follow their partner's actions more than younger children [5].

Reciprocity suggests that our decisions are not solely based on our own inherent behavioural traits; rather, the choices made by our partner or opponent significantly influence our responses. Thus, an individual who shares generously with one person may not exhibit the same level of generosity towards another, regardless of their inherent sharing tendency. Strategic decisions are also influenced by the situational context, implying that interactions between two individuals may not always be consistent. Because of the dynamic nature of prosocial behaviour influenced by various factors, comprehending the behavioural patterns for prosocial actions across individuals presents a challenge.

2.5 Role of Cultural background and Economic status

The ideologies of societal and cultural group kinship largely influence our behaviour. Various prior research studies have observed variations in trusting and sharing tendencies concerning an individual's social structure and economic status.

Buchan et al. (2002) analysed the mutual trust between strangers and neighbours across four countries (China, Japan, South Korea and the USA) using the Trust game [73]. The study was based on three variations of the Trust game setup – direct condition, group condition and stranger condition. Compared to the group condition, sharing drastically declined for the stranger condition. Participants from America and China were more trusting, and Chinese and Korean participants exhibited higher levels of reciprocity. Prior theories on the variation of trust across nations consider trust and reciprocity to vary in a similar manner, whereas results of the current study show that the relationship between trust and reciprocity is more complex.

European and Japanese participants were assessed using the Centipede game to analyse the cross-cultural differences between two communities with contrasting cultures [50]. A condition was added to the standard setup where the players could purchase commitment-enhancing tools to enhance social certainty. The bonus tool offers an incentive to the co-player should the purchasing player choose to deflect. With the purchase of the insurance tool, a certain cost will be deducted from the player's payoff at every turn, but the same cost will be reimbursed if the co-player deflects. Japanese participants exhibited a higher level of trust than European participants, with almost 30% of the Japanese participants reaching the natural end (maximum number of rounds possible). Additionally, Japanese participants exhibited higher cooperation than European participants after buying cooperation-enhancing tools.

Gachter et al. (2004) studied the variation in trusting attitudes as a function of socioeconomic status in the Russian rural and urban populations [74]. The researchers used the public goods game [75] in a

two-round setting, with one of the rounds containing playing the standard public goods game and another with participants having a chance to punish the rest of the group members for unfair sharing. The results show that voluntary contributions are not affected by socioeconomic status. However, socioeconomic status was found to impact trusting attitude, which in turn shaped the contributions in the public goods game. The data from the questionnaire suggests that older individuals tend to have higher levels of trust, and residents of larger cities tend to exhibit lower levels of trust compared to those in smaller cities.

Talking about the sharing tendency of individuals, the idea of fairness is associated with relative payoffs between oneself and others. Fairness is crucial for the establishment of cooperation in society. The concept of inequity aversion is inherent to the understanding of fairness. Blake et al. (2015) studied the development of fairness behaviour in children across seven societies (Canada, India, Mexico, Peru, Senegal, Uganda and USA) [2]. The study examines two types of inequality aversion (based on the nature of payoffs) and traces the age-wise development of this behaviour by observing children from 4 to 15 years of age. Disadvantageous inequality aversion (DI) occurs to avoid receiving less than the peer, and advantageous inequality aversion (AI) occurs to avoid receiving more. The results show that DI emerged during childhood in all seven societies. However, the rate of development is different across cultures. It was interesting to observe that AI emerged only in 3 of 7 societies.

House et al. (2013) analyse the development of prosocial behaviour with age in six diverse societies (United States, Fiji, Central African Republic, Namibia, Ecuador, and Australia) [5]. The study considers children from 3 to 14 years and adults as participants. The study is based on two tasks: the Costly Sharing Game (CSG), where players incur a cost to share rewards with peers, and the Prosocial Game (PG), where sharing benefits comes at no cost to the player. The results show that participants did not exhibit prosocial behaviour in CSG till middle childhood. The prosocial behaviour was seen to enhance with age for both CSG and PG. Interestingly, the enhancement patterns significantly differed across societies for CSG, whereas the developmental shifts in PG were similar across the six societies.

Looking at a more diverse set of populations, [3] examines the idea of fairness and the impact of social structure (in terms of collectivism and individualism) and cultural norms on the development of fairness with age. The focused countries were divided into collectivistic and individualistic groups using Hofsted's 100-point scale. The study is based on three versions of distributive justice games. Results show that generosity enhances with age across all societies, with older participants proposing higher equitable offers. However, the cultural background strongly impacted the age at which preference for equity emerged and the extent of generosity exhibited in each condition.

In a cross-national study using trust and dictator game, [76] considered participants from Mozambique (a low-income country), Brazil (a middle-income country) and Germany (a high-income country). The aim was to understand the behaviour of participants from middle-income countries based on whether

their opponents belong to wealthier, poorer, or similar economic backgrounds. For the trust game, Brazilians were found to share higher amounts with residents of Germany and Mozambique than Brazilians. Conducted with a different set of Brazilian participants, the offers for the dictator game were comparatively lower for Germans but remained the same for Mozambique citizens. The post-questionnaire data reveals that Brazilians trusted Germans to reciprocate in the trust game, and they shared even greater amounts with residents of Mozambique as they were motivated by outcome-based social preferences and did not expect a monetary return from them.

Pulickal and Chakravarty (2022) tested the Dictator game with the proposer and receiver belonging to different economic statuses (division done using an economic index constructed based on household ownership of assets), with adolescent participants from 11th and 12th grades [77]. The proposer was informed whether the receiver belongs to a rich, poor, or similar economic background or no information about the receiver's economic status was disclosed. Irrespective of the proposer's economic status, proposers were found to be more generous towards receivers from a comparatively lower economic status. However, the average proposed amount did not increase with the enhancement of economic status.

Schulreich et al. (2023) explored the neurocognitive mechanism connecting socioeconomic status and charitable giving [78]. The participants were asked to perform a charitable donation task, and their brain activity was monitored using functional magnetic resonance imaging (fMRI). Charitable giving was observed to be positively correlated with socioeconomic status. The mentalising ability mediated this positive correlation. The correlation is explained by mentalising-related neural value coding in the right temporoparietal junction.

The tendency to share is found to vary with the culture and economic status of the individual. A study across five nations [20], namely - the USA, Canada, China, Turkey, and South Africa, to understand the cultural impact on prosocial behaviour in the children population found a significant effect of cultural background on traits like empathy and generosity. The generosity factor was assessed using the Dictator game. Canada and the USA have the maximum number of ultra-generous participants, whereas Turkey and South Africa have the maximum number of hoarders. The data highlighted the complex role of an individual's socio-ecology, culture, and knowledge of the country's prosperity, which plays a significant role in the idea of a fair division of assets and altruistic behaviour. Interestingly, similarities were found between children from the USA, Canada (Individualistic culture), and China (Collectivist society) in comparison with China and Turkey (both having Collectivist societies).

Benenson et al. (2007) explored the level of generosity as a function of age and socioeconomic status (SES) using the Dictator game [18]. The participants were 4, 6 and 9-year-old primary school children from the UK. The children were asked to select ten stickers from a set of 30 attractive stickers and further decide how many they would like to share with all the children in the class. The number of participants

donating non-zero stickers and the average number of stickers donated were considered measures of altruism. It was found that children exhibited altruism by donating at least one sticker, even at the age of four. The sharing tendency was observed to be increasing with age. Higher SES participants exhibited a greater sharing tendency than the Lower SES group. The average donations were similar to those of adult participants in prior studies. This implies that conclusions regarding the inherently selfish nature of young children should be reanalysed.

A study [19] on understanding the altruistic behaviour of 4-year-old Chinese children from 8 counties in rural China looked at generosity as a function of family income and familiarity with opponents in the Dictator game using stickers. Interviewers asked the children in an isolated room how much they would like to share with a person who is either their best friend or a stranger. It was observed that children share more with friends than strangers. With respect to economic status, children from lower-income families shared more than children belonging to higher-income families. This contrasts with the British study's [18] findings that sharing increases with the enhancement of economic status.

2.6 The Social Structure of India

Collectivism and Individualism are considered 'deep structures' of cultural differences [79]. People in a collectivistic culture are interdependent, attribute importance to the group's collective goals, and strongly identify as part of the group [80]. They follow cultural norms and consider it very important to maintain relationships [81]. Contrary to this, citizens of an individualistic society are independent and focus on achieving personal goals more than in-group goals. Their behaviour is more guided by their attitudes than by in-group norms [80]. A society is considered collectivistic or individualistic depending on the predominant behavioural tendencies of its members.

India's social structure is a mixture of Collectivism and Individualism [82]. Studies on the rural-urban decision-making differences attributed to individualism-collectivism classification have shown that the Indian population scores tilt marginally towards collectivism ([83], [84]). Compared to Westerners, Indians strongly associate their identity with their ingroup and rely on cultural norms as behavioural guidelines [85]. A research study in North India found that Urban citizens are more competitive and strive for better options than Rural citizens [44]. Jha and Singh (2011) found that collectivism is reduced with increased urbanisation levels [86]. That is, the social structure shifts towards Individualism with economic development [87]. Srivastava et al. (2023) also show that while maximising was strong in the urban cohort, it was dependent on resource capabilities in the rural populations [44]. However, importantly, they found no significant difference in collectivistic values between the two populations. Shahrier et al. (2016) summarise that the urban populations show higher pro-self-competitive traits [88].

Indian society can be seen as a structured framework of diverse economic strata defined by income

and wealth. Below Poverty Line status represents individuals living below an income threshold level determined by the government. Low-income group families have modest incomes but still face financial restrictions. Families belonging to the Middle-Income group have moderate to sufficient monetary resources, which allow them sufficient access to basic amenities. Individuals who are a part of the Upper-Income group have relatively high levels of income and enjoy a luxurious and comfortable lifestyle. The highest level of economic strata consists of High Net Worth Individuals (HNIs) who have substantial wealth and monetary assets. Thus, Indian society provides us with a spectrum of socioeconomic levels with gradually varying levels of economic resources and collectivism-individualism.

Considering the emphasis on the achievement of in-group goals and interdependency in rural collectivistic society, we expect rural citizens to exhibit higher levels of prosocial behaviour than citizens of urban society (leaning towards individualism). However, urban individuals from higher SES backgrounds may exhibit higher trust and generosity due to greater resource availability [17]. Thus, for an Indian sub-continent population, observing the evolution of trust and generosity as a function of socio-ecology, economic and financial status, and cultural influence would be interesting. The observed patterns will help us understand the weights of factors like social structure (Collectivism and Individualism) and the individual SES in determining the levels of trust and generosity.

2.7 Our Contribution

Various studies have used economic games to study prosocial behaviour focusing on children and young adults ([18], [19], [20], [89], [90]). Specific to India, very few studies (ex., [77]) have looked at the behavioural traits of adolescents using socioeconomic status (SES) as a factor. The findings indicate that a child's cultural upbringing and SES subtly influence their trusting and sharing tendencies. Despite the complex socioeconomic structure globally, most reported studies have treated SES as binary segregation ([18], [19]). Analysing individuals across different SES levels can provide a spectrum. With reference to India, in addition to complex economic strata, the large population segment (8.35% or 117 million) in the 10-14 age group, and the coexistence of collectivism and individualism in society [82], understanding adolescents serve. We are focusing on early adolescents as major changes in social orientation are observed during this period [91].

Most of the behavioural studies using standard economic games make use of one or two economic games. Behaviour traits are classified by surveys (for example, risk-taking). The recorded choices in these studies can result from various factors, including the game mechanics or the distraction in a single-shot game. Consequently, confirming the association between the dependent variable of interest and behaviour becomes challenging. The current study does not categorise participants as individuals with specific behaviours. Rather, it aims to understand if certain behavioural patterns (as an interplay of inherent behavioural traits and reciprocity) are observed across sequential gameplays as a function of SES. The experimental design with games based on different game mechanics played sequentially helps

capture the possible dynamic nature of the behaviour of individuals as experienced in real-life interactions.

Our primary objective is to comprehensively examine the dynamics of trust and generosity in early adolescents influenced by family socioeconomic status (SES) extracted from the school fees of the child who has been admitted. The study focuses on rural and urban populations classified into economic levels. We categorise participants into five distinct groups, reflecting a gradual shift in SES levels in comparison to previous experiments where a binary classification is applied: High and low SES ([18], [19]).

Chapter 3

Standard Economic Games

Economic games can provide insights into real-world behaviour and are more efficient than observational and interview data [6]. These games have efficient and simple frameworks to study behavioural traits that are challenging to quantify. Each game is based on contextual decision-making, allowing us to isolate individual behavioural characteristics' impact on strategic choices. Additionally, experimenters can modify the game setup to include relevant features. Although some researchers criticise these setups as restrictive to lab settings and lacking generalisability, [92] demonstrates that lab experiment findings using economic games can be generalised to similar field contexts. Various prior studies based on games like prisoner's dilemma, public goods game and stag hunt are used to analyse the interaction between individuals.

The current study focuses on four games: Dictator, Ultimatum, Trust, and Centipede.

3.1 Dictator Game

The Dictator game is useful for understanding Altruistic behaviour ([93], [94], [95], [96], [97]). Dictator game involves players taking roles of proposer and receiver. Initially, the proposer is given a certain amount. As the name suggests, the proposer acts as a dictator, and he/she must decide how much to share with the receiver. In this case, the receiver must accept whatever amount the proposer offers. There is no condition on sharing (the proposer can even decide not to share any amount). Figure 3.1 summarises the flow of the Dictator game used in the current experiment. Researchers use the Dictator game to study unconditioned generosity, and the offer amounts by proposers convey the level of generosity [98]. The payoff maximisation strategy suggests that an individual should not share anything with the receiver as there is no condition on how much needs to be shared. However, experimental evidence indicates that people share varying amounts, with certain individuals sharing as much as 50% of the total endowment, with an average sharing of around 30% split.

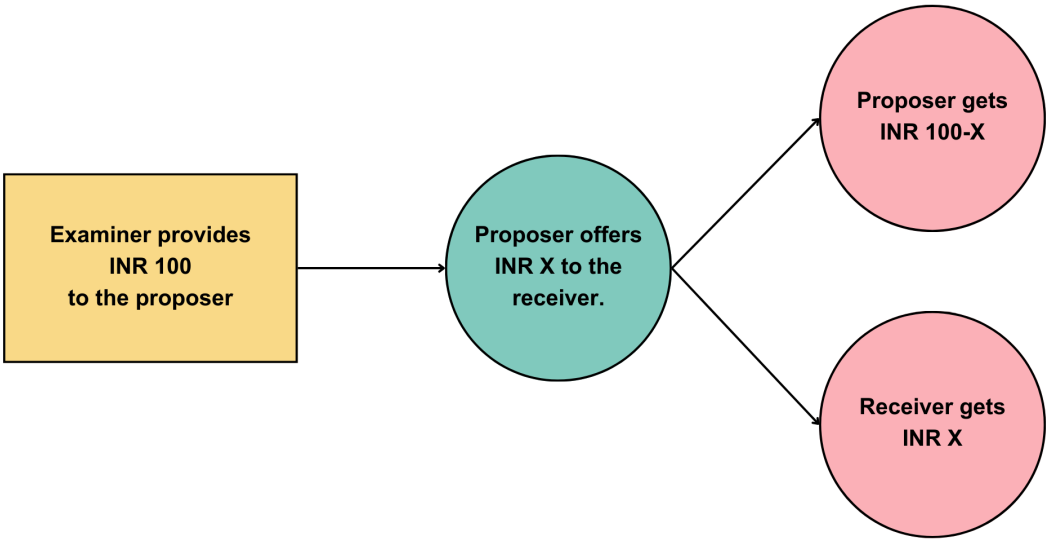


Figure 3.1: Flow of steps for Dictator game

The first dictator game experiment was performed by Kahneman, Knetsch and Thaler [99], where the participants were given $20 and asked if they would like to split it evenly ($10 - $10) or unevenly ($18 - $2) with another participant. Further, Participants were also given a choice: to share $6 with someone who previously shared unevenly ($18 - $2) and retain $6 for themselves or to share $5 with someone who previously shared equally and keep $5 for themselves. Interestingly, around 75% of the participants opted for an even split. Moreover, several participants opted to share with those who chose an equal split in the initial round, even if it meant incurring a $1 loss. Presently, the second part of the experiment is often omitted, and the dictator game is conducted purely as a free-sharing task.

Schulz et al. (2014) tried to understand if the decision for the extent of sharing is rooted in an emotionally driven affective process or a deliberate process that demands cognitive load [100]. Kahneman (2011) proposes a dual-process decision-making model, suggesting that our choices are influenced by two cognitive systems [23]. System 1 operates quickly, effortlessly, and automatically, leading to more impulsive decisions. In contrast, system 2 is slow, requires cognitive load and works in a deliberate manner. The study uses a variation of the dictator game where participants are asked to make allocation decisions under varying levels of cognitive load. The results show that participants with a higher cognitive load chose fair offers compared to those under a lower cognitive load.

3.2 Ultimatum Game

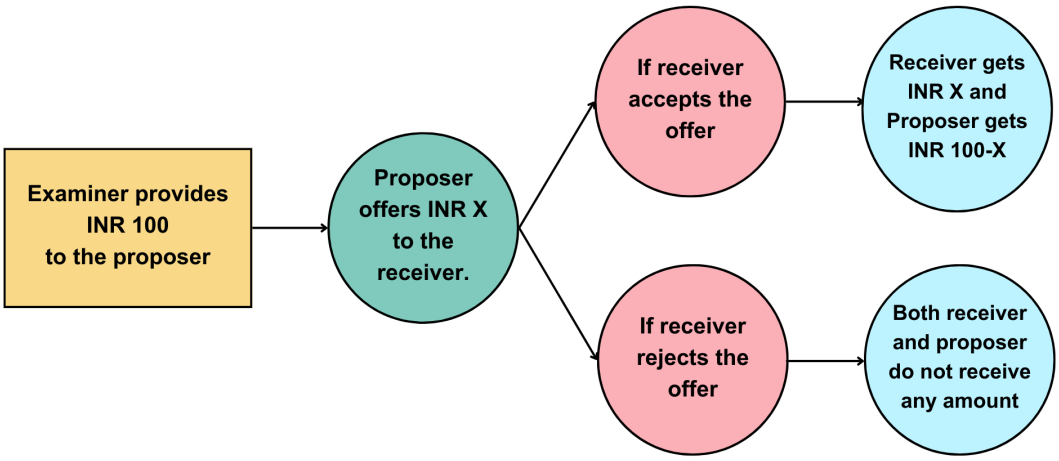


Figure 3.2: Flow of steps for Ultimatum game

Güth, Schmittberger, and Schwarze used the Ultimatum game for the first time to study bargaining strategies [69]. Several studies use the Ultimatum game to explore the idea of fairness ([52], [101], [102]). The ultimatum game is a two-player game with players taking on the roles of proposer and receiver. The proposer is given a certain amount from which he/she can share any amount with the receiver. The receiver has the authority to accept or reject the offer. If the receiver rejects the offer, neither player will receive any amount. Both the proposer and receiver are informed about the receiver's authority of rejection before the game starts. The stepwise flow of the Ultimatum game is represented in Figure 3.2. The authority of rejection acts like a condition that needs to be considered by the proposer while making an offer. The receiver's authority of rejection influences offers made in the Ultimatum game [98]. Theoretical speculations (based on utility maximisation) suggest that the least possible offers should be made, and receivers should accept any non-zero offer. Although individuals are observed to make an average offer of around 40% of the total allocation. Additionally, many recipients are seen rejecting non-zero offers [103].

The ultimatum game is also used to understand the Entitlement effect in resource division [104], where the role of the proposer is allotted based on performance in a chosen task. The individual's self-regarding behaviour depends on the entitlement assigning method. The distribution followed the Lockean theory of earned dessert, which states that an individual deserves an entitlement to resources based on their efforts. The proposer treats their entitlement as a right to unequal distribution and feels they deserve the extra

share. Other variations of the ultimatum game include – using non-monetary endowments and providing partial information where the receiver does not know how much the proposer has initially received.

Murnighan & Saxon (1998) looked at a diverse age group, from kindergartners (5 to 6-year-olds) to third-year college students (20 to 22-year-olds), to understand the age-wise development of bargaining behaviour [105]. Experimenters interacted one-on-one with younger children who were asked to share M&M chocolates and money as a part of the Ultimatum game task, whereas older participants completed a questionnaire centred on scenarios from the Ultimatum game. It was observed that younger children make larger offers and accept smaller offers compared to older children or adults. Female participants showed more generous behaviour in the partial information scenario. Children were more strategic in monetary sharing than in sharing M&Ms. Younger participants accepted one M&M but refused to accept one penny. This variation in behaviour could be further examined to see if easily available and desirable items like chocolates are perceived as preferable to receiving nothing at all.

3.3 Trust Game

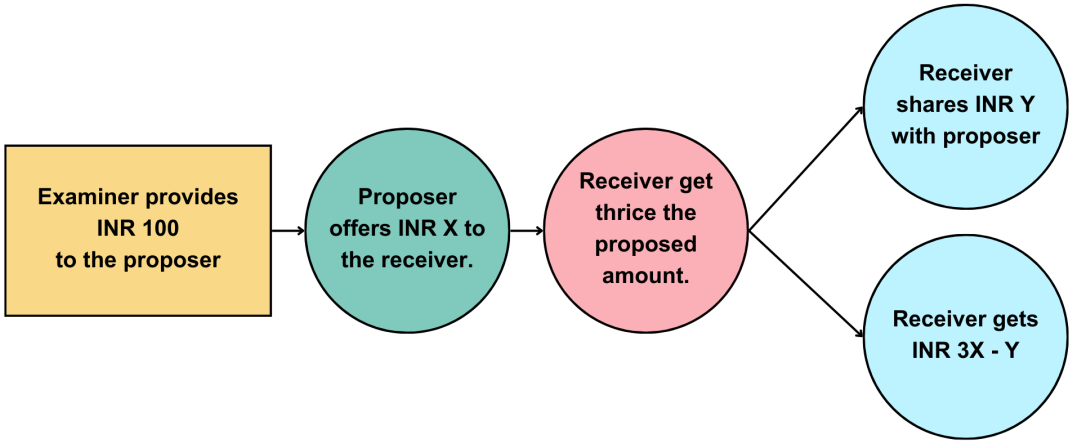


Figure 3.3: Flow of steps for Trust game

To examine Trust, many previous studies have used the Trust game (also referred to as the Investment game) ([47], [45], [106], [107], [108]). It helps us understand the establishment of trust in the context of a monetary transaction. In a standard form of Trust game, the proposer is given a certain amount from which he/she can offer any amount to the receiver, who receives thrice (or a certain multiple) of that amount.

The receiver can share any desired amount with the proposer and keep the rest for themselves. Figure 3.3 represents the stepwise flow of the Trust game used in the current study. The proposer is likely to offer a larger amount to the receiver if there is trust, anticipating that the receiver will reciprocate with a similar or equivalent return. Economic theories suggest that the proposer might withhold sharing, anticipating that the receiver may not share anything in return. Trust game, being a one-shot setting, helps us understand the level of mutual trust between the two players conveyed by the amount offered by the proposer.

Yashodha (2019) applied the trust game to analyse trust towards kin and non-kin in rural India [109]. The study focused on the farmers from the state of Karnataka. The findings indicate that individuals trust kin more than non-kin, and the level of trust was higher in individuals who were very closely associated with the kinship network. Importantly, trust towards kin members was found to be because of higher levels of other-regarding behavioural characteristics like fairness and altruism and not because trust is driven by reciprocity. Cesarini et al. (2008) studied the difference between cooperative behaviour resulting from genetic and environmental behaviour [108]. The study focused on monozygotic and dizygotic twins from Sweden and the United States to understand the heritability of trust and trustworthiness. It was observed that while genetic variations impact strategic decisions in trust games, environmental factors have a more significant influence than genetic differences.

The Trust game is also helpful in understanding reciprocity along with trust, as the amount given back by the receiver reflects the degree of reciprocity. van de Groep et al. (2020) explore the development of trust and reciprocity in adolescents as a function of gender, age, risk, difference in empathy and antisocial tendencies [110]. It was observed that the average level of trust does not vary with age, and younger participants exhibit higher levels of reciprocity than older participants. The age-wise variation was the same across both genders. Additionally, males trusted more often than females. However, the decision to trust was not driven by a desire for fairness but rather by maximising gains, which is seen as trust within the current framework. Variations in empathy contributed to a decrease in reciprocity as individuals grew older.

3.4 Centipede Game

The Centipede game studies trust in a multiple-trial setting to understand trust's evolution ([48], [50], [111], [112]). The game starts with players getting amounts in a 3:1 or 4:1 ratio, with the player starting the game assigned a higher amount. There are two possible actions – 'Push' and 'Take'. Push implies switching and doubling the amounts. Take implies the end of the game. Participants take turns choosing between these choices, with a growing reward and a risk of losing a chance of achieving a higher reward with each choice. Centipede game varies based on the nature of the number of rounds - the game played for a fixed number of rounds (the game automatically terminates after N rounds, where N is known to both players), an unlimited number of rounds (the game continues till one of the players decides to end

the game) and a random number of rounds (the game can abruptly end on its own at any given moment of time). Figure 3.4 represents the progression of payoffs at each round for a 7-round centipede game, starting with INR 30 for player 1 and INR 10 for player 2.

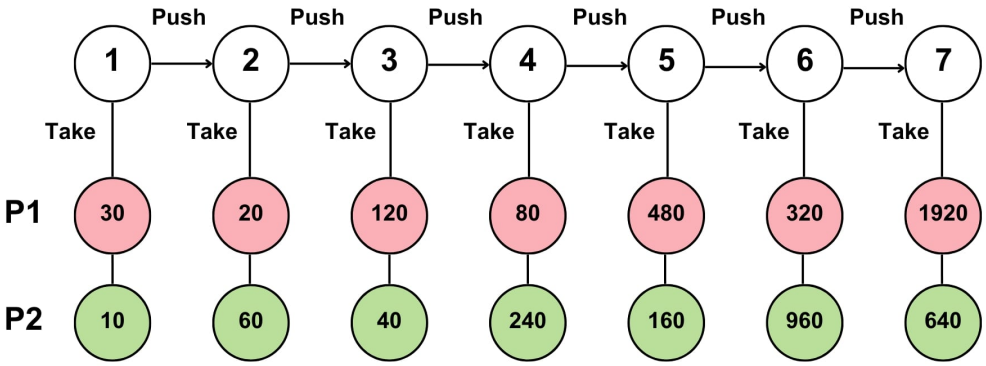


Figure 3.4: Flow of steps for Centipede game

To understand the theoretically rational strategy for the centipede game, the backwards induction technique begins by examining the last stage of the game, which is the end of the game. From this endpoint, one works backwards, step by step, towards the initial stage of the game. The expected value of stopping or continuing the game is computed at each step. This process yields deflection at the initial step as the optimal strategy, although this strategy is not always applied by participants. Brocas and Carrillo (2022) studied the development of backward induction in children and adolescents to understand the influence of backwards induction on this strategic choice [113]. The results show that backward induction ability is enhanced with age. Interestingly, this deflection in the first round (in line with backward induction) is observed in younger participants. For middle-school children, the Theory of Mind abilities also influence the decision. These abilities help them consider the other player's perspective, preventing immediate deflection, much like what is seen in adults.

Because of the interdependency, the Centipede game makes the players dependent on each other's choices and vulnerable to probable losses. This interdependency makes the setups suitable to be used for analysing trusting behaviour. The players cooperate with each other to maximise the overall payoff.

Centipede game provides a setup to study the transition of trust influenced by the rising level of stakes involved. It yields the breaking point of mutual trust as a function of the monetary stakes involved.

Chapter 4

Experimental Methodology

Our research study aims to analyse the variation in prosocial behaviour in young Indian adolescents, specifically focusing on trust and generosity as a function of socioeconomic status. We use four standard economic games played in a sequential manner. The strategies used in these games are then interpreted to understand the level of trust, generosity, fairness and reciprocity across individuals of five socioeconomic groups. This framework assists in analysing how socioeconomic factors influence behavioural patterns in social interactions.

This chapter discusses the experimental methodology employed for the research study, along with a detailed description of the procedure and demographic details of the participants. Before the main data collection phase, a pilot data collection phase was conducted to see if any improvements were required in the experimental design. We collected data for 22 pairs (44 participants). Initially, we had considered the students from grades 5th to 10th as participant cohorts. However, during pilot data collection, we observed that younger children were finding it difficult to understand the instructions of the gameplay. Thus, for the final data collection phase, we only considered students from classes 8th to 10th.

Additionally, the initial design contained 5 standard economic games – Ultimatum, Dictator, Centipede, Trust and Stag Hunt, where Stag Hunt was used to understand the variation in mutual cooperation. The conventional stag hunt [114] setup (Two players decide whether to hunt together for a deer or separately for a rabbit. The game emphasises maximising payoffs through collaboration while trusting the other player to share equally) was slightly modified to be more relatable for participants and used in the current study. The description used for the Stag Hunt was:

Let us work on the farm! If both of you decide to rent a tractor for the farm together, you have to spend Rs. 1000 each, and the work will be done in 2 days. If you decide to work with a plough, you have to spend Rs. 200 each, and you will require ten days. What will you do? Tractor OR Plough?

The description is structured to make participants balance the time needed and the financial cost while also deciding whether to cooperate or not. The interaction with students revealed that they focus more on the money to be spent and the time required to complete the work than whether they are willing to collaborate based on their interactions in prior gameplays. As we could not capture the aspect of mutual cooperation, we decided to drop the Stag Hunt game and consider the four games in the main phase.

The study focuses on young Indian adolescents and analyses the variation in trust and generosity as a function of their cultural and economic background. Due to certain restrictions, we were unable to ask individual participants about their economic background (questions like parents' income, monetary value of assets, etc.). That is why we decided to use the participant's yearly school fees as a proxy for their socioeconomic status. India's intricate education system, marked by stratification, provides the contextual backdrop for our investigation. The identified groups are as follows:

1. State government schools: Primarily employing regional languages as the medium of instruction, these schools operate without charging fees. Additionally, they offer mid-day meals and breakfast in some states of the country.
2. Central/federal government-managed schools: These English medium institutions feature a low fee structure. They predominantly cater to the children of central government employees.
3. State government-aided private schools: Charging a nominal fee for English medium education, these schools fall within the affordability range of the lower-middle socioeconomic range.
4. Private unaided schools: Ranging from low to medium budgets and operated by societies, these schools constitute children mostly from middle-class SES.
5. Highly expensive corporate-run schools: Representing the upper echelons of SES, these institutions are commercial by design with very high fees.

The nuances and challenges associated with each category of the school system have been extensively documented in prior research, notably by [115] and [116]. The income-level categorisation linked to each school level, as [115] outlined, serves as our study's foundational framework.

Subsequent sections provide detailed information about the experimental methodology of the research study.

4.1 Participants

Children from grades 8th to 10th (age: 13 – 16 years; Males: 138; Females: 172) participated in the experiment. The data collection was done in person at the schools. We consider five school categories based on the yearly fee range (details in Table 4.1). The school's fee structure is a proxy for the economic status of the families of the children. The experiment involved playing a two-player board game, and

participants belonging to the same gender were paired together. The game and the study were cleared by the Institute Ethics Committee. As per the school's request, no monetary (direct payment of real-currency) incentives as wins were included. The non-incentivized choice of design has not affected the gameplay or the interest in participation. However, we are cognizant of the factors cited as limitations in non-incentivized economic behaviour experiments. Figure 4.1 represents the schools visited for data collection along with further details mentioned in Table 4.2.

Group	Abbreviations used	Yearly Fees (INR)	No. of Pairs	No. of schools visited
Rural Government welfare (Zilla Parishad) schools	R ZP	Negligible	33 (8M, 25F)	2
Urban Government welfare (Zilla Parishad) schools	U ZP	Negligible	31 (15M, 16F)	2
Urban Government-aided private schools	U GovAided	5000 - 10000	29 (14M, 15F)	2
Urban Private schools (Medium Fee range)	U Pvt Med	60000 - 70000	31 (16M, 15F)	1
Urban Private schools (High Fee range)	U Pvt High	150000 - 200000	31 (16M, 15F)	1

Table 4.1: Groupwise Details of Participants

Figure 4.1: Shools visited. The images are named as per serial numbers in Table 4.2

Sr No.	Group	Place	Latitude	Longitude
1	Rural Government welfare (Zilla Parishad) schools	New Highschool and Higher Secondary School Dhondalgaon, Maharashtra	19°58'58"N	74°56'18"E
2	Rural Government welfare (Zilla Parishad) schools	Zilla Parishad High School Chilkur, Telangana	17°21'37"N	78°17'55"E
3	Urban Government welfare (Zilla Parishad) schools	Zilla Parishad High School Gowlidoddy, Hyderabad, Telangana	17°25'17"N	78°19'28"E
4	Urban Government welfare (Zilla Parishad) schools	Mahatma Phule High School Aurangabad, Maharashtra	19°51'51"N	75°19'0"E
5	Urban Government-aided private schools	Shri Sharda Mandir Highschool Aurangabad, Maharashtra	19°52'59"N	75°19'41"E
6	Urban Government-aided private schools	Saraswati Bhuvan Highschool Aurangabad, Maharashtra	19°58'58"N	74°56'18"E
7	Urban Private schools (Medium Fee range)	DAV Public School Safilguda, Hyderabad, Telangana	17°27'51"N	78°32'39"E
8	Urban Private schools (High Fee range)	Stepping Stones Highschool Aurangabad, Maharashtra	19°58'37"N	75°22'37"E

Table 4.2: Details of Schools visited

4.2 Experimental Setup

Four Standard economic games are used, each focusing on a specific behavioural trait of interest
1. Ultimatum game (UG) - fairness measured by the division of available assets.
2. Dictator game (DG) - altruism measured by the amount shared.
3. Centipede game (CG) - mutual trust measured by the number of rounds.
4. Investment/Trust game (TG) - reciprocity and mutual trust level measured by the amount invested.

The instructions used for each game are given below.

Figure 4.2: Board game and the game descriptions used

4.3 Procedure

We designed a two-player board game of standard economic games as subtasks for data collection. The board game includes four economic games (listed in section 4.2), each played twice, with players switching roles across trials. We used fake money notes for all the transactions. The participants could transact in multiple of 10 (0, 10, 20, 30, . . . , 100). To randomise the order of the subgames, we used cards containing the description of each economic game in English.

Initially, INR 3000 was provided to both the players. Each player was assigned four cards (corresponding to the four economic games) and a player token (usually used in board games). Players took turns to draw cards from their card deck, and at each turn, they played the game described on the card. After choosing a card, the experimenter explained the description to the players in English, Hindi, Telugu, or Marathi, depending on their native language. The instructions were repeated to ensure the players understood the rules of the games.

Figure 4.2 represents the board game and game descriptions used. The player tokens are initially placed in the circular box on the left bottom. Starting from this position, players take turns drawing cards at alternate positions (Positions marked with flag). After playing the game described on the card, the player tokens are moved to the next position on the board, after which both players roll dice, the

numbers appearing on the dice are noted down, and both tokens move one step forward. This procedure is repeated eight times (4 games, each played twice). After completing the eight subtasks, the numbers appearing on the dice were summed up, and the players were given chocolates (as a reward) based on the final sum. The player with the higher sum was given three chocolates, and the other player was given two chocolates. Each game took around 15 to 20 minutes and did not have a time limit for making a decision. Figure 4.3 contains few snapshots of examiner interacting with participants.

Figure 4.3: Data collection at schools. The data was collected in person, and the examiner explained all the instructions to the participants and manually noted the data.

Chapter 5

Analysis and Results

Based on the existing literature, the social structure of the society in which an individual is raised and their economic status play significant roles in determining their prosocial behaviour. The results indicate positive and negative relationships between trust, generosity, and socioeconomic status (SES). Individuals from collectivistic societies tend to have a higher tendency to trust and share with their peers. The chosen participant cohort contains five groups progressing from lower to higher economic status and from a collectivist to an individualist orientation. We aim to explore the impact of an interplay of SES and social structure on sharing and trusting tendencies. Considering the study by [20], which looked at the impact of economic status and social structure of a country on sharing tendency, we expect the trusting and sharing tendency to enhance as we move from lowest to highest socioeconomic status and exhibit a uniform trend with gradual shifts in level of behavioural traits.

For analysis purposes, we assigned scales as labels for players' decisions (Table 5.1). This method helped establish a connection between the numerical representation of decisions made and the extent of behavioural traits of interest. We looked at changes in the offer characteristics by comparing these labels across trials and pairwise variation in offer amounts. The comparison across groups, we hypothesised, could reveal the effect of socioeconomic status on behavioural traits.

We performed the analysis at two levels -

1. Pair-wise analysis (section 5.1)
   Within group pairwise analysis was performed to understand the level of reciprocity within pairs. We plotted graphs for the data from each trial as a linear trend, applied k-means clustering, and identified predominant trends.

2. Group-wise analysis (section 5.2)
   We compared the level of behavioural traits across the five socioeconomic groups. The following statistical tests were used -

(a) Chi-square test

This test is used to analyse whether a statistically significant association exists between categorical variables. The chi-square test can be applied as we are trying to understand if there is a significant association between the behavioural labels for each game and the distribution of these labels for the five socioeconomic groups.

(b) One-way ANOVA (Analysis of Variance)

The statistical test is used to determine if there are any statistically significant differences between means of three or more independent groups. The one-way ANOVA was applied to observe if there was a statistically significant difference between the average sharing amount or number of rounds played across the five socioeconomic groups. Before applying ANOVA, the data was tested for parametric characteristics. If it was found to be non-parametric, it was transformed into a normal distribution before performing the test.

Ultimatum Game	Dictator Game
Offer above INR 50 - Generous Split	Offer above INR 50 - Altruistic sharing
Offer of INR 50 - Fair Split	Offer of INR 50 - Fair sharing
Offer of INR 30 or Rs. 40 - Near fair Split	Offer of INR 30 or Rs. 40 - Near Fair sharing
Offer below INR 30 - Unfair Split	Offer of INR 20 or Rs. 10 - Slight sharing
	Offer of INR 0 - No sharing
Trust Game	Centipede Game
Offer above INR 50 - Very Trusting	1 to 2 Rounds – Non trusting
Offer of INR 30/INR 40/INR 50 - Trusting	3 to 4 Rounds – Trusting
Offer below INR 30 - Not trusting	5 to 7 Rounds – Very Trusting

Table 5.1: Assignment of Behavioural Labels

5.1 Pair-wise Analysis

The two-trial setting is used to understand the level of reciprocity between the paired participants. There is a considerable variation in offers across the two trials for all four games. The tables (5.2 and 5.3) below contain the percentage of pairs and the comparison between offers in the second and first trials. In other words, the tables represent the percentage of offers that exhibited an increase, a decrease or remained the

same in terms of the amount shared (for Ultimatum, Dictator and Trust games) or the number of rounds played (for Centipede game) across the two trials.

Group	Ultimatum			Dictator		
	No change	**Increase**	**Decrease**	**No change**	**Increase**	**Decrease**
Rural ZP	54.5	18.2	27.3	60.6	12.1	27.3
Urban ZP	51.6	19.4	29	54.8	16.1	29
Urban GovAided	55.2	27.6	17.2	44.8	27.6	27.6
Urban Pvt Med	48.4	22.6	29	48.4	6.5	45.2
Urban Pvt High	48.4	29	22.6	31.3	25	43.8

Table 5.2: Percentage of pairs showing variation in gameplay across trials for Ultimatum and Dictator games

Group	Trust			Centipede		
	No change	**Increase**	**Decrease**	**No change**	**Increase**	**Decrease**
Rural ZP	63.64	15.15	21.21	45.45	21.21	33.33
Urban ZP	54.84	16.13	29.03	45.16	25.81	29.03
Urban GovAided	68.97	24.14	6.9	51.72	17.24	31.03
Urban Pvt Med	54.84	19.35	25.81	54.84	9.68	35.48
Urban Pvt High	50	18.75	31.25	40.625	28.125	31.25

Table 5.3: Percentage of pairs showing variation in gameplay across trials for Trust and Centipede games

Except for the three highlighted cases in table 5.2 and one highlighted case in table 5.3, there is a greater decrease in the percentage of shared amount or number of rounds compared to the percentage increase in these metrics. Interestingly, apart from Urban Private High Dictator trials, most pairs across all groups show no change between the two trials, suggesting that individuals tend to mimic their partner's behaviour in the first trial.

To analyse the dynamics of reciprocity across all the games, we scaled up the output values (score) for each game to 100 and plotted the scores for eight trials for 155 pairs. An example graph is provided below (Figure 5.1).

A K-means clustering algorithm was applied to capture significant linear trends. The linear trends

were divided into 10 clusters (trials with different numbers of clusters were conducted, and it was found that 10 clusters provided the best grouping with minimum outliers per cluster). Further, we plotted the average linear trends for each cluster as follows (the top-left graph denotes the average trend for cluster 1, and the bottom-right graph denotes the average trend for cluster 10).

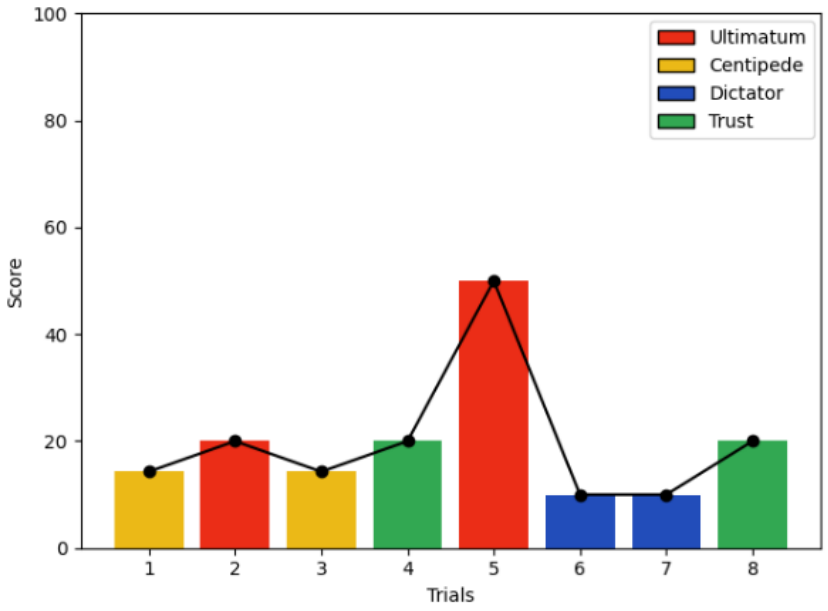


Figure 5.1: Variation of scores across eight trials for a pair of participants. The bar's colour represents the economic game played, and the linear graph connects the corresponding scores.

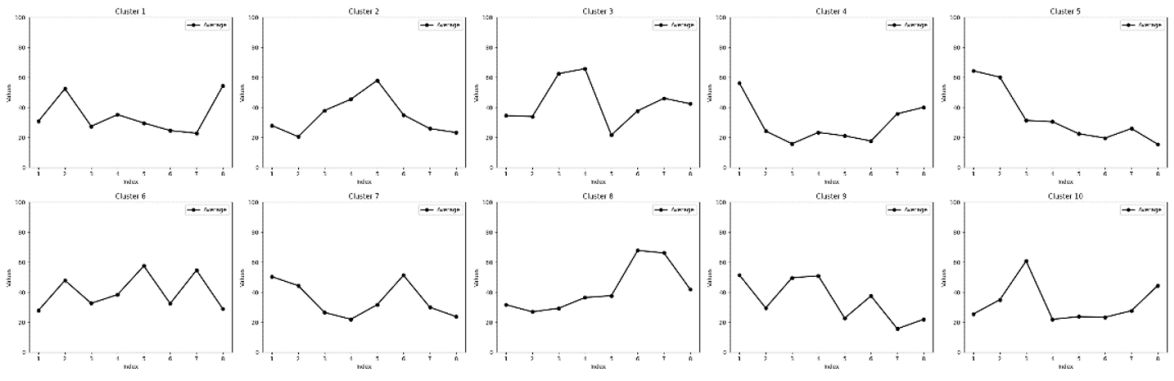
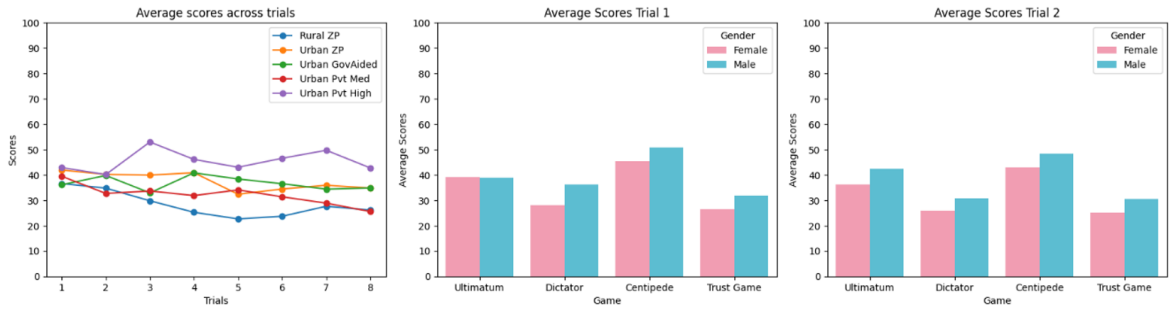


Figure 5.2: Average linear trend of scores across eight trials. The x-axis denotes the trials numbered from 1 to 8. The y-axis represents the average scores for the respective trials

The resulting patterns (figure 5.2) were complex and did not exhibit a clear monotonic trend. Except for two of the ten clusters (cluster 6 and cluster 9), the rest do not exhibit significant fluctuations, indicating that players follow their opponent's strategy in the previous trial with minor changes.

In the comparison of the pairwise average scores for each trial across the five groups, the linear trend shifts upwards towards the higher SES group (Figure 5.3 (a)). A higher score indicates a higher level of generosity or trust. There is a clear difference and a trend between the lowest (Rural ZP) and highest (Urban Pvt High) SES groups. Interestingly, the urban effect is observed in the mid-lower SES groups independent of the fee structure. The upward shift conveys that prosocial behaviour improves with the enhancement of socioeconomic status.

The comparison of average scores for female and male pairs across all groups (Figure 5.3 (b) and 5.3 (c)) yields no significant difference in score values in the between-genders analysis. However, the female cohort consistently has lower scores than the male group across all games. Performing the Mann-Whitney U test (p-value < 0.05), we found a statistically significant difference between amounts shared by male and female participants only for Dictator game trial 1 (p-value = 0.011).



(a) (b) (c)

Figure 5.3: (a) Denotes Variation of Groupwise Average scores across eight trials. Gender-wise distribution of scores for trial one and trial two is represented by (b) and (c), respectively.

5.2 Group-wise Analysis

We performed a Chi-square test (p-value$<$0.05) to check the difference as per the behavioural labels (Table 5.1) across the five groups. A One-way ANOVA test (p-value$<$0.05) was performed to look for differences in average sharing amounts across the five groups. The statistical tests were performed using Python script. In each case, the independent variable remains socioeconomic status. The table 5.4 lists the dependent variables and the respective tests conducted, along with the p-values computed for each case (a p-value below 0.05 implies statistical significance). The effect size is mentioned in the bracket

next to the p-value for each significant result. The effect size for the Chi-square test is Crammer's V, corresponding to each p-value, whereas for one-way ANOVA, we have represented the corresponding η^2 value.

Game	Dependent Variable	Statistical Test	Trial 1	Trial 2
Ultimatum Game	Behavioural Labels	Chi square	p<0.001 (0.321)	p<0.001 (0.529)
	Amount Shared	One-way ANOVA	p<0.001 (0.084)	p<0.001 (0.101)
Dictator Game	Behavioural Labels	Chi square	p<0.001 (0.212)	p<0.001 (165)
	Amount Shared	One-way ANOVA	0.197	0.0062 (0.057)
Trust Game	Behavioural Labels	Chi square	p<0.001 (0.215)	p<0.001 (0.274)
	Amount Shared	One-way ANOVA	0.0095 (0.018)	0.0092 (0.020)
Centipede Game	Behavioural Labels	Chi square	p<0.001 (0.190)	p<0.001 (0.211)
	Number of Rounds	One-way ANOVA	0.1225	0.0644

Table 5.4: The table describes the dependent variables, the statistical tests applied and p-values computed for each game. The highlighted values denote statistically significant results (p<0.05).

The results observed for each game are as follows.

5.2.1 Ultimatum Game

A statistically significant difference exists between the offer categories (Figure 5.4(a) and 5.4(b)) for both trials. Comparing the distribution of behavioural labels (based on Table 5.1) across groups, generous behaviour is negligible in both trials. We identify an increasing trend for fair behaviour, almost similar percentages for near-fair behaviour, and a decreasing trend for unfair behaviour as we move towards

higher economic status.

There is a significant difference between the offer amount averages across groups (Figure 5.4(c)) for both trials. The lowest average sharing amount is INR 25.75 (Rural ZP group trial 2), and the highest is INR 51.25 (Urban Pvt High group trial 2). The average sharing amount for both trials increases as we move towards higher economic status. The percentage of rejected offers was very low for generous and fair offers. The rejection rate for offers below INR 50 is considerably higher for Urban Pvt Med and Urban Pvt High-SES groups (Figure 5.4(d)).

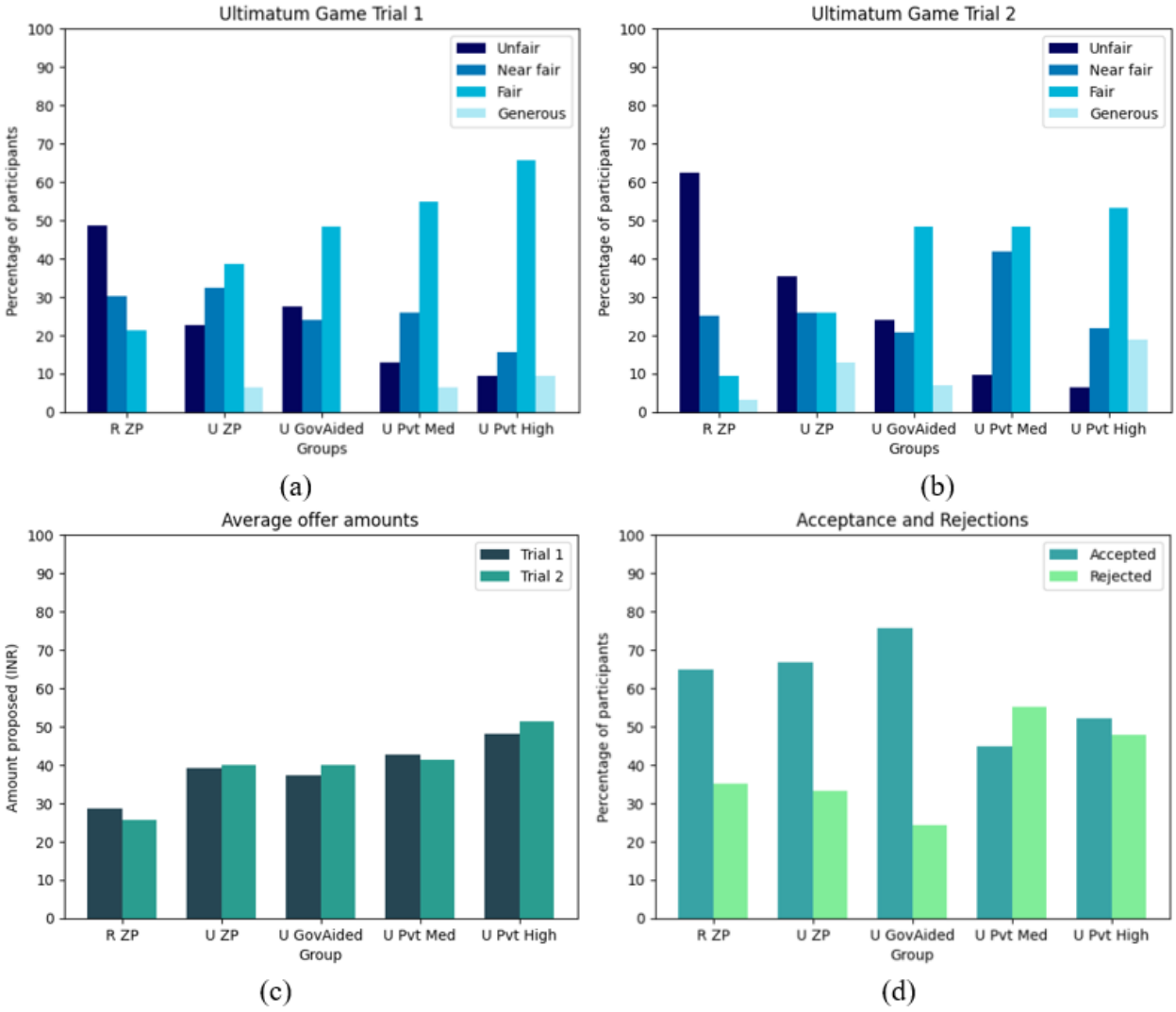


Figure 5.4: (a) and (b) represent the nature of offers in UG trial 1 and trial 2. (c) Average offer amounts in UG (in INR) (d) Acceptance and rejection of offers below INR 50 in UG

Performing Multivariate ANOVA by combining the data for gameplays across both trials and considering socioeconomic groups and trials as dependent variables, we observed a statistically significant difference with (Wilk's Lambda: $p < 0.001$).

5.2.2 Dictator Game

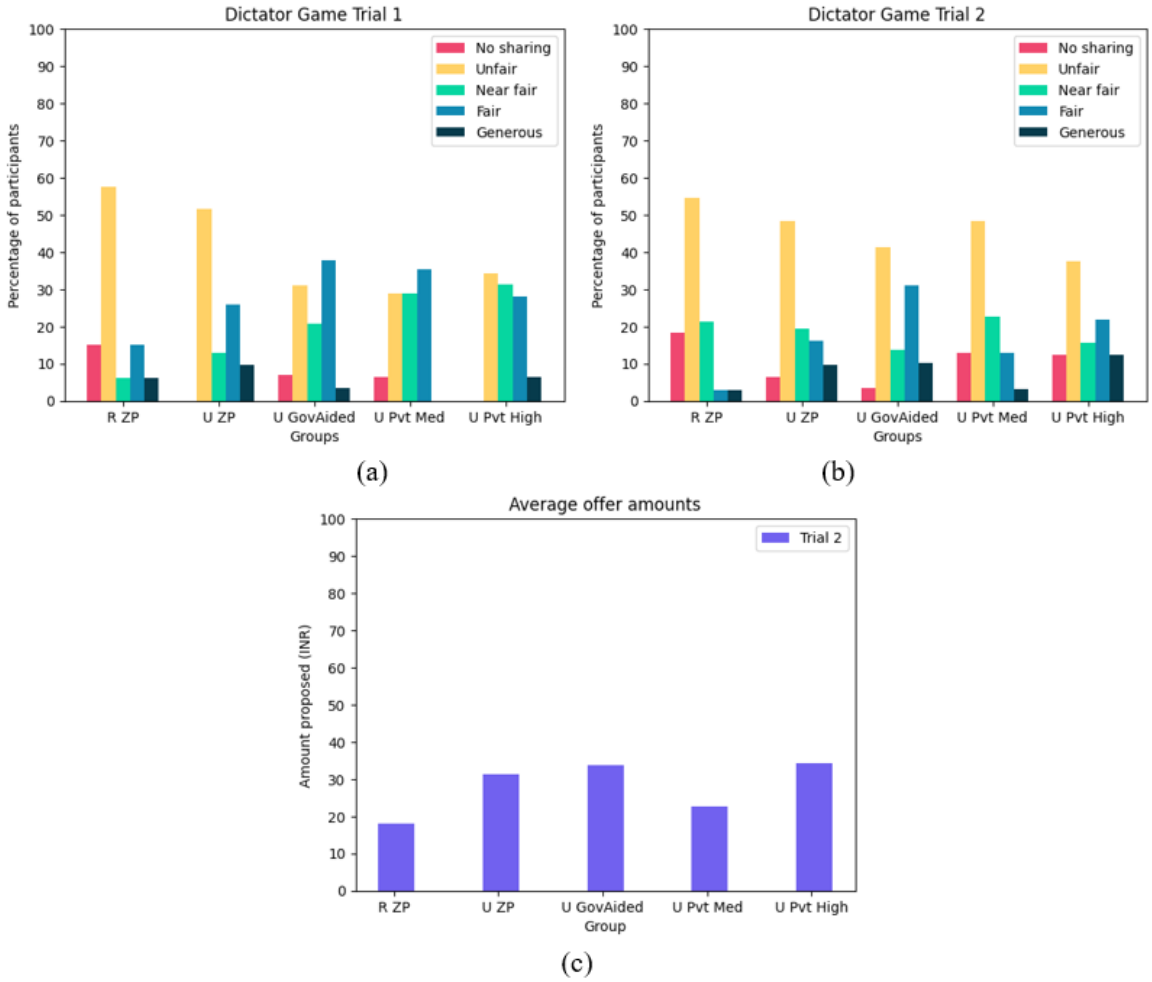


Figure 5.5: (a) and (b) represent the percentage of participants and the nature of offers proposed in the Dictator game for the first and second trials. (c) Average offer amounts in DG trial 2 (in INR).

Comparing the distribution of behavioural labels (Table 5.1) across five groups (Figure 5.5(a) and 5.5(b)), we found a statistically significant difference for both trials. The one-way ANOVA shows a significant difference between sharing amount averages (Figure 5.5(c)) for trial two only. Unlike UG, DG does not exhibit any specific trend for the average sharing amount. For trial 2, the majority of the participants

propose unfair offers for all SES. The average sharing amount is similar for the Urban ZP, Urban GovAided and Urban Pvt High groups.

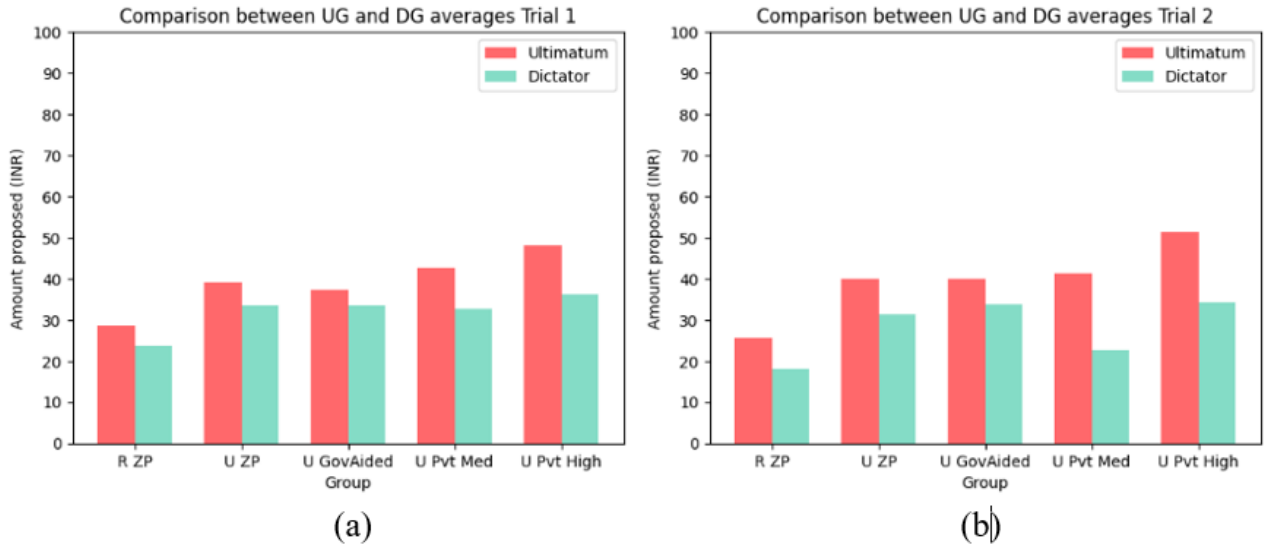


Figure 5.6: (a) and (b) represent the comparison between average sharing amounts for UG and DG in trial 1 and trial 2, respectively.

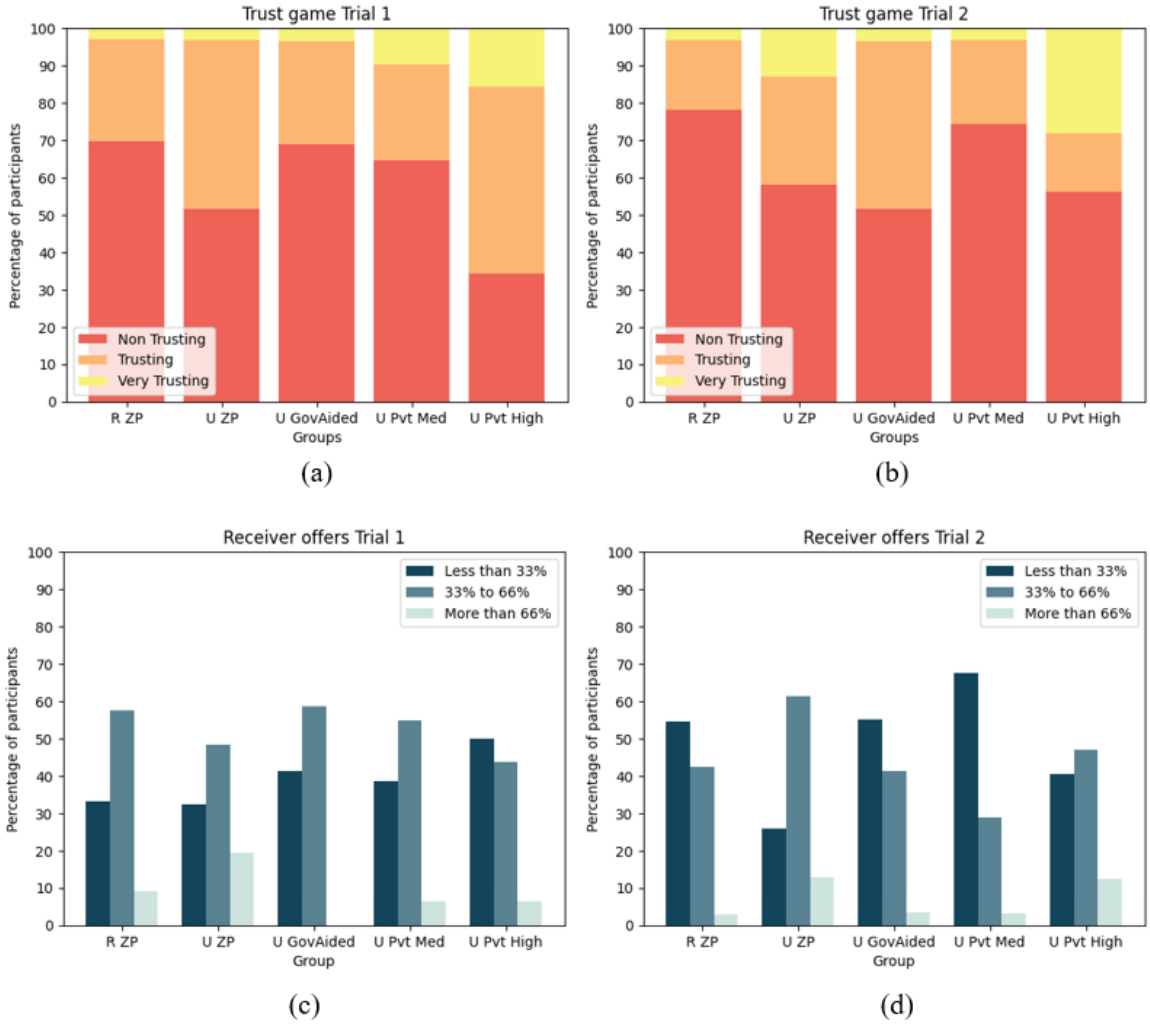
Comparing the average sharing amounts for UG and DG (Figure 5.6 (a) and (b)), we observe that the sharing amount for UG is higher than DG for all the groups across both trials. The no-sharing tendency is rarely followed, with the highest being 18.2% of participants offering zero amount for Rural ZP group trial 2. The maximum amount offered was INR 100 for the lower two (Rural ZP and Urban ZP) and highest (Urban Pvt High) SES groups and INR 60 for the other two groups. Performing Multivariate ANOVA by combining the data for gameplays across both trials and considering socioeconomic groups and trials as dependent variables, we observed a statistically significant difference with (Wilk's Lambda: p-value = 0.042).

5.2.3 Trust Game

The distribution of behavioural labels (Figure 5.7(a) and 5.7(b)), as mentioned in Table 5.1, differed for both trials. For trial 2, the non-trusting nature decreases across groups as we move towards higher economic status, except for the Urban Pvt Med group. Despite the incrementing trusting behaviour, the percentage of non-trusting choices is more than 50% for all the cases except one (Urban Pvt High trial 1).

The level of reciprocity is inferred by the amount returned by the receiver to the proposer. As re-

ceivers get thrice of the proposer's offer, we classify receiver's offers as less than 33% (less than the amount offered by the proposer), 33% to 66% (greater than or equal to the amount offered by the proposer but less than twice of proposer's offer) and greater than 66% (more than twice of the received amount). Very few participants shared more than twice the amount received. Except for the second trial for the Urban Pvt Med group, more than 40% of participants returned greater than or equal to the received amount (Figure 5.7(c) and 5.7(d)). Applying ANOVA, we found a significant difference between the averages of the five groups in both trials for proposers and trial 2 for receivers (p-value = 0.0014). The average amount shared by the proposer increases as we move towards the higher SES group, with the exception of the Urban Pvt Med group. In terms of reciprocity, the percentage of the received amount shared back by the receiver increments as a function of SES, with a slight drop in Urban GovAided and Urban Pvt Med groups.



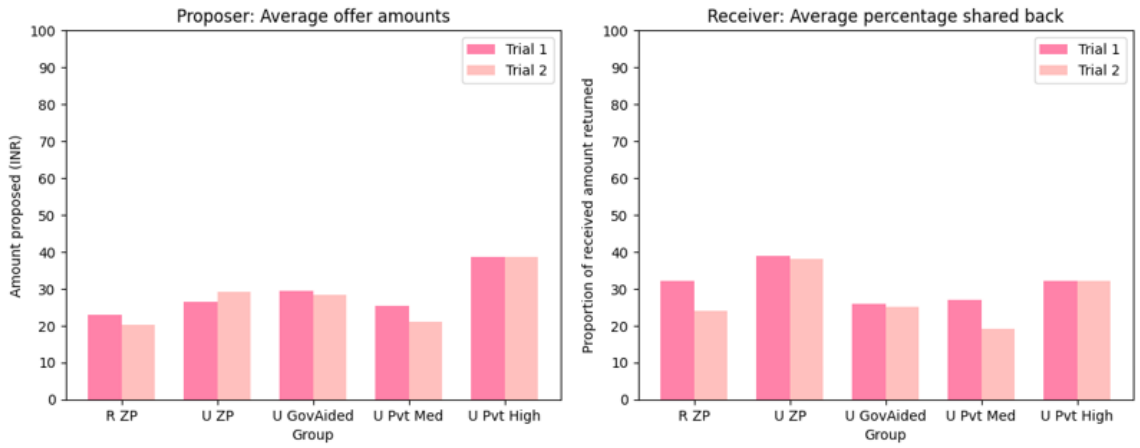


Figure 5.7: Percentage of Participants and the nature of offers proposed in the Trust game for (a) Trial 1 and (b) Trial 2. (c) and (d) represent the percentage of received amount shared back by the receiver. (e) shows the average offer amounts by the proposer, and (f) shows the average percentage of the received amount shared back by the receiver.

Performing Multivariate ANOVA by combining the data for gameplays across both trials and considering socioeconomic groups and trials as dependent variables, we observed a statistically significant difference with (Wilk's Lambda: p-value = 0.0024).

5.2.4 Centipede Game

We found a statistically significant difference for both trials by comparing the distribution (Figure 5.8(a) and 5.8(b)) of three behavioural labels (Table 5.1) across five groups. Overall, trust gradually increases from the Rural ZP to the Urban Pvt High group, with anomalies observed for Urban GovAided and Urban Pvt Med groups. Applying ANOVA, we found no significant difference between the average number of rounds across five groups (Figure 5.8 (d)) for both trials. The percentage of participants opting for Nash equilibrium (deflecting in the first round) is significantly high for all groups (Figure 5.8 (c)), even for the highest SES group; around 20% of participants exhibited Nash equilibrium in both trials. Performing Multivariate ANOVA by combining the data for gameplays across both trials and considering socioeconomic groups and trials as dependent variables, we did not observe a statistically significant difference with (Wilk's Lambda: p-value = 0.06).

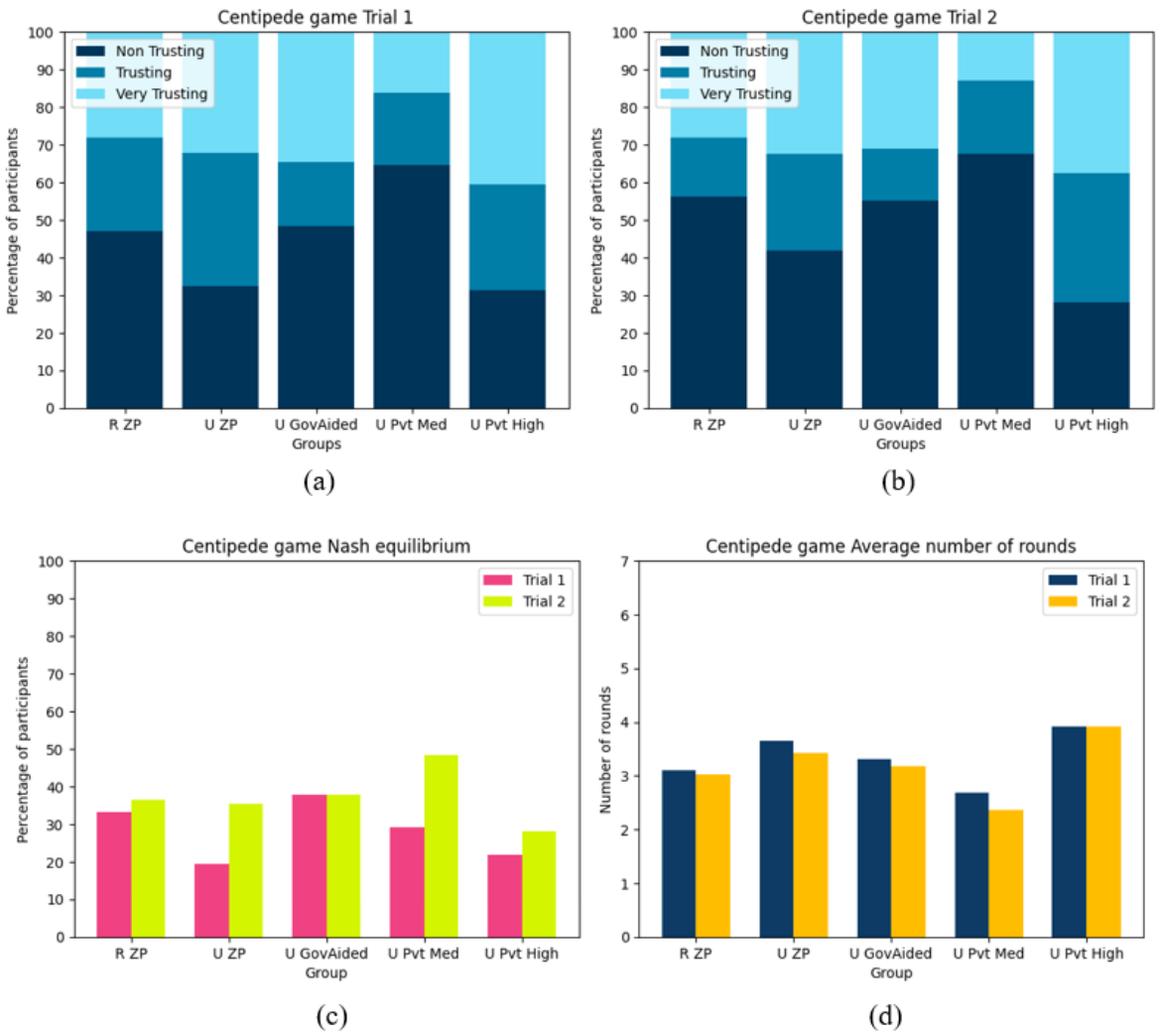


Figure 5.8: Percentage of Participants and number of rounds played in Centipede game for (a) Trial 1 and (b) Trial 2. (c) represents the percentage of participants following the Nash equilibrium, and (d) shows the average number of rounds played across the five groups.

5.3 Main Findings

Summarising the findings and observations of the research study -

1. The Chi-square test (p-value < 0.05) showed a significant difference in the distribution of behavioural labels across the five groups for all 4 games.

2. In the Ultimatum game, the number of fair offers increases as the SES increases.

3. In the Dictator game, no clear trend for generosity was observed.

4. Sharing tendency is higher for the Ultimatum game compared to the Dictator game.

5. For the Trust game, more than 50% of the participants exhibited non-trusting behaviour except in the first trial for the Urban Private High group.

6. For the Centipede game, trust shows an increasing trend with a significant drop for the Urban GovAided and Pvt Med schools.

7. The average scores shift upwards as we move towards higher economic status.

5.4 Discussion

The empirical analysis conducted using four economic games by inferring the family SES, derived from the school fee, confirms previous reports to a certain extent ([77], [20], [117], [15], [118]) while presenting intriguing deviations. In UG, with receivers having the authority of rejection, we observed a positive correlation between fair offerings and SES, which contrasts with [11]. A possible explanation could be the urban-rural income gap [119], which leads to resource scarcity and, hence, lower levels of generosity in the Rural ZP group.

We found a higher rejection percentage for higher SES participants (Urban Pvt Med and Urban Pvt High groups) compared to lower SES groups, which supports the findings from [120]. No overall specific trend was observed for unconditioned generosity in DG compared to UG. This finding is also in contrast to ([18], [19]), conducted on British and Chinese participants, respectively and comparing two SES groups. If we apply the same comparison (extremely low SES to extremely high SES) to our dataset, we find a higher sharing and trusting tendency for the higher SES group. It is to be noted that the age groups and the methodology were different in our study compared to the ([18], [19]), which can probably explain the lower generosity in the lower SES school children as one's subjective perception of social and economic status is heightened by adolescence.

For TG, we observed a prevalent non-trusting behaviour across all SES groups, with more than 50% of participants adopting a non-trusting strategy. The average number of rounds played (which indicates the level of trust) did not vary much across the five groups. Interestingly, trusting behaviour in both CG and TG exhibited an overall increasing trend with SES with certain anomalies. This observation implies that higher SES is associated with increased levels of trust, highlighting a potential reciprocal relationship between economic status and trust as pro-social behaviours, which supports the findings from ([14], [15], [16]). The exception is the significant drop observed in the Urban Pvt Med group. An explanation from our limited understanding solely from personal experiences is that the children in these schools come from financially middle-class households who aspire to provide quality education to their wards. In a

family with two school-going children, there is a resource scarcity that impacts the children – that is, they are cognizant of the shoestring budget the household runs on. Second, competition is very high in this social status range, as educational opportunities are few but critical for upward mobility. Third, there is pressure from society and family to succeed. The unique dynamics within this group can also be attributed to a sense of insecurity stemming from attempts to assimilate into a higher-income middle-class environment, potentially influencing lower levels of sharing and trusting tendencies. However, any strong inference requires detailed and focused studies from social sciences and economic behaviour.

Considering the theoretically expected payoff maximisation behaviour in these games, trusting and sharing choices are not in line with the Nash equilibrium strategies. A trusting strategy expects you to rely on someone else's actions, which can reduce payoff, while generosity decreases your own gain and increases others'. In the current study, a small percentage of participants was observed to follow Nash equilibrium in Dictator and Ultimatum games, indicating a preference for sharing over personal gains and demonstrating fairness and generosity. Interestingly, a significant percentage of participants employed the Nash equilibrium strategy in the Centipede game. In the trust game, although participants did not strictly adhere to the exact Nash equilibrium (zero sharing by the proposer), they still shared minimal amounts and exhibited non-trusting behaviour. In trust-based situations, Nash equilibrium is notably exhibited, whereas in scenarios centred on sharing, a significant portion of participants opt to distribute resources fairly with their partner.

The analysis of reciprocity, through the examination of time series data, that is, combining the choices across all four games, indicating a dyadic relation over the games and between the pair of players, revealed that participants generally adhered to their opponent's strategy from previous trials with minor deviations. This suggests a degree of consistency in decision-making patterns over time, reinforcing the stability of reciprocity as a social behaviour within the economic game paradigms ([121], [68]). Across trials of a particular game, reciprocity was observed for most of the participants in all four games across the five groups. Analysing the percentage of offers with differences between the first and second trials, most cases showed a substantially higher percentage of decrease in offers (either amount or number of rounds). Hence, while many participants demonstrated reciprocity and mirrored their peers' behaviour from the previous trial, a significant portion exhibited a negative deviation compared to trial one. The significant non-reciprocal behaviour of our participant group can be attributed to a few showing self-centric behaviour, as recorded in young adolescents [56].

Interestingly, the female gender consistently shows lower sharing in all four games compared to the male population. However, the same gender was paired, with statistical significance in the dictator game (Figure 5.3(b) and 5.3(c)). Studies contrary to our results, like [122], showed women often prefer fairness and equity more than men, and this is attributed to the propensity for fairness influenced by socialisation processes and societal expectations that encourage women to adopt cooperative and nurturing roles.

Buchan et al. (2008) and Gneezy et al. (2003) also suggest that women tend to trust each other and reciprocate trust more than men do ([123], [124]). However, it is essential to understand that gender dynamics in fairness, trust, and reciprocity are rooted in cultural norms and contextual factors. The distribution of resources is inequitable, with females having less access to opportunities and resources than males ([125], [126]). Roux et al. (2015) observed that individuals commonly exhibit selfish behaviour in scenarios with resource scarcity [127]. Based on these studies, we attribute the lower sharing in the female gender to self-centred behaviour and competition within gender, as resources are even more scarce for this population of the country compared to the male gender. Having said this, further analysis of the opportunities, equality, and equity in the socio-cultural environment of an individual's upbringing is required. Second, the data across all SES was grouped as the number in each was not sufficient for gender-based analysis. We believe that a gender study between SES will isolate the effects of financial and family support on the female child.

Chapter 6

Conclusion

Our research study analyses the interaction between an individual's behavioural traits and their demographic features of interest. Specifically, we focus on two chosen features: economic status, which reflects resource availability, and social and cultural background. Notably, these features have been observed to exert contrasting effects on prosocial behaviour. We aimed to understand whether affluent participants living in urban areas exhibit higher levels of sharing and trust (due to their access to sufficient or surplus resources) or if rural participants from relatively low-income households exhibit greater tendencies to share and trust (owing to their collectivistic cultural background), regardless of their limited resource availability. The observed behavioural patterns across the five socioeconomic groups show complexity rather than a straightforward linear trend arising from the interplay of an individual's social and economic backgrounds.

The experimental design based on multiple standard economic games with diverse game mechanics helps us study the behaviour of individuals in sequential settings across various contexts. The pairwise analysis shows that most of the participant pairs exhibit reciprocity with minor deviations from their partner's gameplay in the previous trial. This implies that a non-generous (generous) or non-trusting (trusting) offer in trial 'n' will be followed by a similar offer in trial 'n+1'. The findings from our present study illustrate the dynamic nature of the behaviour, offering more widely applicable results. This is achieved by acknowledging the varying contexts in which individuals make decisions and considering the influence of their past experiences on their choices.

For our study, the group under consideration consists of adolescents aged between 13 and 16 years. During adolescence, social cognition develops, and individuals can take into consideration the situational context more efficiently. For instance, participants often make self-centric decisions regardless of their socioeconomic status, as observed in the Centipede game, suggesting limited influence from SES. Moreover, behaviour may vary based on socioeconomic status, as evidenced by the evolution of fairness in the Ultimatum game. This implies that young adolescents have an understanding of their socioeconomic standing in society, and the individual's trust and generosity are also deeply influenced by

their perspective-taking abilities and the context involved.

In conclusion, while fairness and trust tend to increase with higher SES, generosity in the DG does not follow a linear trend, which could be due to the non-bargain option in this game. The unique behaviour observed in the Urban Pvt Med group underscores the importance of considering specific contextual factors in the interpretation of economic decision-making. Our findings contribute to the broader discourse on the intricate relationship between socioeconomic status and social behaviours, emphasising the need for a multi-dimensional categorisation of SES in similar research studies. Importantly, understanding the interplay between SES, trust, fairness, and altruism in adolescents has implications for interventions aimed at promoting positive social development.

6.1 Limitations of our study

The research study is limited to interactions of participants from the same socioeconomic group and same gender. The participants are categorised into socioeconomic groups based on their yearly school fees, which is an indirect measure of the family's financial condition. Using school fees as a criterion for grouping might lead to inappropriate assignments for some participants due to factors such as a preference for schools nearby or a selection of schools with higher fees in anticipation of better education. Participants paired together were friends or acquaintances; hence, a participant's strategy choice also considers prior experience and the nature of the relationship with their partner.

Chapter 7

Visual Gaze Analysis of Stock market Strategies

We are required to make choices in various kinds of situations in day-to-day life. The choices are based on factors like prior knowledge, personal preferences and how choices are presented. These factors are responsible for the differences observed in choices made by different people in the same situation. The decision-making process involves evaluating the available information and comparing the components to make a specific choice. Due to either limited or excessive information, it can be challenging to process the data effectively and make informed decisions. Individuals rely on heuristics to reach a conclusive decision and display behavioural biases while making choices. The stock market presents a dynamic environment where investors often exhibit a range of behavioural biases.

Investments in stock markets require individuals to make decisions under risk and uncertainty. The advent of the internet and the web has allowed for access to huge volumes of data, thus helping investors who base their choices on different types of available information [128]. These information pieces act as anchors [129] for future price prediction. Considering that all human judgments are comparative in nature ([130], [131], the presented information components are assigned different weights in determining the choice. Exploring the influence of various anchors can provide deeper insights into investors' decision-making process. Eye-tracking acts as an efficient tool to understand the weightage assigned to information components through the analysis of visual attention data [132]. This study seeks nuanced insights into the impact of graphical and numerical formats of stock price information that influence investment decisions.

7.1 Behavioural Biases Exhibited by Investors

Standard financial theories consider the market and investors efficient and systematic. The Efficient Market Hypothesis (EMH) considers that investors process all the available information for price estimation [133]. Expected Utility Theory (EUT) proposes that we make rational choices by thoroughly analysing all the available choices and the associated utility and risk [134]. The stock market is an uncertain and dynamic environment. Investor decisions are not always rational and exhibit various biases ([135], [136],

[137]). Through empirical studies, [138] observed investor behaviour inconsistent with EMH and EUT. Individuals apply heuristics and exhibit behavioural biases while making decisions under uncertainty [129].

Through empirical studies, [139] showed that individuals have varying risk attitudes based on the estimated probability of an event and whether they are incurring a loss or a profit. Individuals exhibit loss aversion [140] and disposition effect by selling profitable assets and retaining loss-making ones during financial decision-making [141]. Loss aversion is the tendency for individuals to be more impacted by potential losses than by equivalent gains, causing them to focus on avoiding losses. Because of Loss aversion, individuals tend to hold on to losing assets. The disposition effect refers to investors' tendency to sell winning assets and hold on to losing assets, whereas rational strategy suggests otherwise. This phenomenon can be explained by the fourfold pattern of risk-taking [23], which states that individuals are risk-averse in the domain of gain and risk-seeking in the domain of losses.

Another frequently observed bias is herd behaviour, where individuals tend to follow the actions of the majority, often leading to momentum trading and the formation of stock market bubbles [142]. Overconfidence bias is when individuals overestimate their prediction accuracy and knowledge, leading to excessive trading. Availability bias occurs when investors are heavily influenced by current and easily available information while making investment decisions. This can cause investors to overreact to an event or news, disproportionately affecting stock prices. Anchoring is another bias where people anchor their predictions on the information in hand. The current study analyses the anchoring bias and the role of information components as anchors and compares the weightage attributed to various anchors.

7.1.1 Anchoring Bias in the Stock Market

Anchoring bias occurs when an investor's decision-making for future predictions is influenced by initially exposed information ([143], [144]). Stock price graphs are a rich information source and an effective visual tool for comparisons ([145], [146]). Behavioural biases significantly influence investment decisions when only textual and tabulated information is provided, whereas the bias is reduced after incorporating graphical information [147]. Graphical information is given more weightage when presented simultaneously with textual information [148]. Further, [149] found that extreme points in historical price trends play an important role in investment decisions. That is, 52-week highs are considered significant reference points ([150], [151], [130].

Other factors include circumstantial information, the processing of which depends on the investor's experience and investment horizon [152]. Investment strategies and the nature of risk-taking change with age and experience [153]. Miazee et al. (2014) observed that financial literacy assists preliminary decision-making in order to avoid major losses [154].

7.2 Techniques to Measure Information Processing

Eye movements of participants provide rich information about the attentional process employed during decision-making and help to understand the underlying cognitive process of decision-making [155]. Results of prior studies have shown that eye-tracking can be used as a reliable tool to understand the underlying aspects of information processing and decision-making ([155], [156]). The mere exposure effect states that looking at a stimulus increases its preference in making a choice ([157], [158], [159], [160]). It is also observed that the component given greater visual attention significantly influences the decision made [161]. The visual gaze data indicated that participants base their decisions on the past performance of mutual funds and exhibit the hot hand fallacy, with disclaimers showing no discernible effect [162]. Toma et al. (2023) used eye tracking to understand investor behaviour in boom-bust scenarios [163].

An alternate metric is the response time to complete a task, though not considered a replacement for the richer eye-tracking data [164]. A study by [132] to examine the overweighing of specific components from the presented portfolio analysed the time spent looking at information components, and it was found that specific components are allotted more attention than others, the focus can be explained by behavioural biases.

Our research study considers visual gaze and attention allotted to graphical and numerical data associated with stocks to understand the decision-making process. The twofold objective of the current study is to identify the information component considered most influential in investment decisions (specifically comparing graphical and numerical data) and to analyse the impact of complex patterns in graphical data on estimating price trends. Though the choices can give an idea about the cumulative impact of the presented information (buying action implies a positive impact, and selling action implies a negative impact), we cannot determine which components are given more attention and are most influential in decision-making. To the best of our knowledge, no prior study has looked at the influence of complex graphical patterns using visual gaze analysis.

7.3 Methodology

We conducted an eye-tracking experiment with participants performing a decision-making task on stock investment.

7.3.1 Participants

Seventy-six participants (54 males, 22 females) in the age group 17 to 57 years (Mean = 21.06, Std dev = 6.56) participated in the experiment. The population mainly contained undergraduate and graduate students, with few investment professionals. All the participants had normal or corrected to normal

vision. 39 participants reported having a basic understanding, 14 reported good knowledge, whereas 23 participants reported no knowledge of the stock market. 54 participants have never traded, 6 have traded in the past, and 16 are currently trading in the stock market.

7.3.2 Apparatus

A Tobii X-30 eye-tracker (capturing gaze data at a rate of 30 Hz) was used to track the eye movements of the participants while they were performing the task. On a laptop LCD screen, graphical and numerical data for nine different stocks were presented through an in-house developed web application (Link). Participants used a mouse to mark the choice in the decision-making task.

7.3.3 Stimuli

Figure 7.1 shows the interface display. The following information is presented (currency in INR) -

1. Graphical Component

    (a) Depicts stock price trends for a 1-year period.

    (b) Contains the Buying and Current price of the stock.

    (c) The two prices indicate the beginning and ending points of the investment period, aiding investors in understanding the price fluctuations between them.

2. Numerical Components

    (a) Buying price of the stock.

    (b) Portfolio section

        i. Number of shares: Current shares in the portfolio.

        ii. Money to invest: Available funds to invest

Figure 7.1: Interface for company A. In the graph, BP denotes the buying price, and CP denotes the current price.

The numerical information remains consistent for nine stock entries (Figure 7.2) labelled with hypothetical company names (A to I). The plot pattern and occurrence of loss or profit vary across the stocks. The buying price is INR 100, and the current price is INR 110 in case of profit and INR 90 in case of loss. The number of shares currently owned is 100 units, and the amount of money the participant has in hand to invest further is INR 50,000. The amount of loss or profit is INR 1000 for all nine stocks.

Graphical patterns for the tasks were chosen to reflect an unequal number of highs and lows. The highs (H) and lows (L) are permuted to obtain four patterns - HHL, HLH, LLH and LHL. These patterns are considered to examine the difference between the role of visual representation of highs and lows in conveying or predicting the stock price trend. The stock price graphs were randomly generated but controlled to show a price fluctuation between INR 50 and INR 120 over the period of one year.

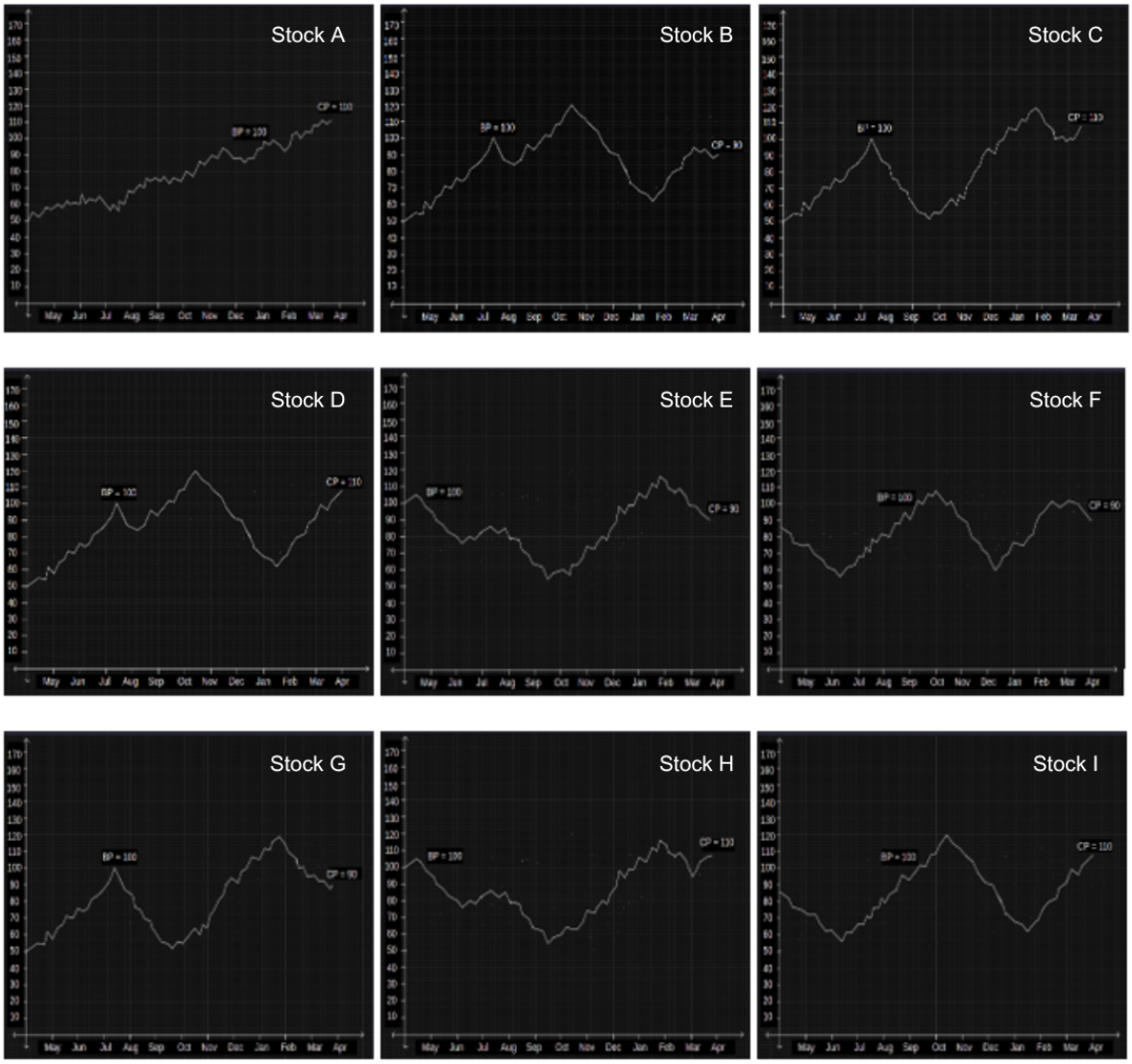


Figure 7.2: Graphical patterns used in the experiment

The eye-tracking data were analysed by focusing on four areas of interest (AOIs) - graph, buying price, number of shares and money to invest. Within the graph, the extreme points were considered distinct AOIs. Figure 7.3 contains all the areas of interest highlighted on the interface. The Total Fixation Duration (TFD) is compared across AOIs. TFD measures visual attention allotted to the component, which can efficiently explain the role of components in an investment decision (Shavit et al., 2010).

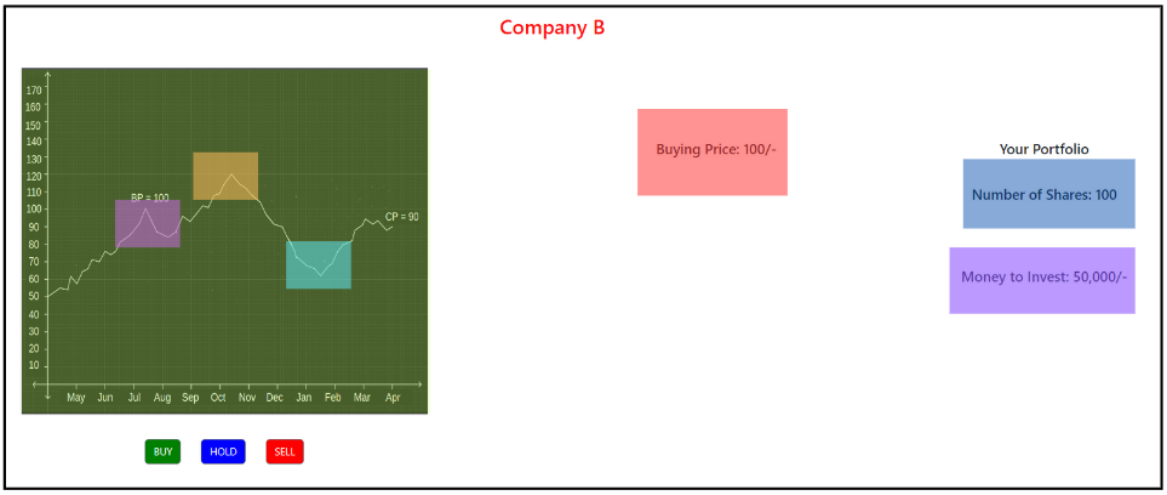


Figure 7.3: AoIs marked for visual gaze analysis

7.3.4 Procedure

Before starting the experiment, each participant performed the 9-point eye-tracker calibration procedure for the eye tracker. A set of instructions on the flow of the experiment were provided. There was no time restriction, and the participant could take the desired time to decide on each stock. A participant required around 8 to 10 minutes to finish the experiment. Based on the information presented, the participant was instructed to choose from buy, sell, and hold.

The user interface had three distinct press buttons for each decision. A blank white screen with a plus sign (fixation target) at the centre was displayed for 6 seconds between two consecutive graph patterns. The nine stocks were shown in succession, with an additional sample stock at the beginning to familiarise the participant with the display. The data for the sample stock was not included in the analysis.

After completing the task, the participant was asked to complete a questionnaire containing questions from the Domain Specific Risk-Taking (DOSPERT) survey from the social risk and financial risk-related sections [165]. These questions require the participant to rate how likely he or she will perform the activity mentioned in the question on a Likert scale of 1 to 5, where 5 is most likely and 1 is not at all likely. The responses to the questionnaire helped us understand the nature of the participants' risk-taking.

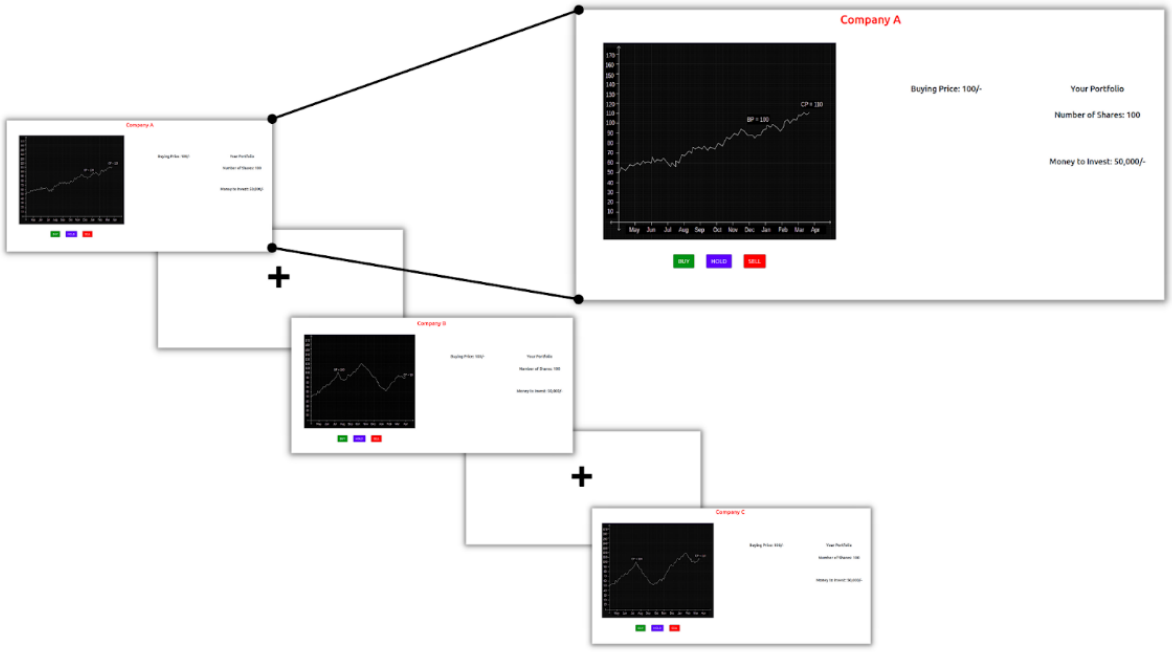


Figure 7.4: Flow of decision-making task

7.3.5 Hypothesis

We propose hypotheses based on established psychological theories and prior eye movement analysis. We anticipate visual attention patterns influenced by confirmation bias [23] as components supporting decisions are assigned greater importance.

1. Comparing graphical and numerical data, we anticipate investors will allot greater visual attention to the graph as the price trend offers anchoring points that serve as the basis for estimations.

2. In the case of loss - The investors will hold the stock due to loss aversion and the disposition effect [23]. Because of confirmation bias [23], the stock price graph's peaks will be more focused.

3. In the case of Profit – The investors tend to be risk-averse, exhibiting the disposition effect [23], leading to a greater inclination to sell stocks. We anticipate the recency effect [23] to influence decision-making, with investors holding the stock after a recent peak and selling after a recent valley in the graph, with the most recent extreme point receiving greater visual attention.

Stock	Graph, State	Hypothesis
A	Steady increase, Profit	H1 a: Buy H1 b: Peak
B	HHL, Loss	H2 a: Hold H2 b: Peaks
C	HLH, Profit	H3 a: Hold H3 b: Peaks
D	HHL, Profit	H4 a: Sell H4 b: Valley
E	LLH, Loss	H5 a: Hold H5 b: Peak
F	LHL, Loss	H6 a: Hold H6 b: Peak
G	HLH, Loss	H7 a: Hold H7 b: Peaks
H	LLH, profit	H8 a: Hold H8 b: Peak
I	LHL, Profit	H9 a: Sell H9 b: Valleys

Table 7.1: Graph states and corresponding hypothesis. Hypothesis 'a' states the expected choice, and hypothesis 'b' is the anticipated graphical region with the highest TFD.

Based on these considerations, Table 7.1 contains details for anticipated behaviour for each stock. The second column denotes the graphical pattern and state associated with each of the nine stocks. H represents a high (peak), and L represents a low (valley) in the graph. The current state denotes whether the investor would have profit or loss if all the stocks were sold at the current price. The third column contains the expected behaviour in each of the cases. Hypothesis 'a' proposes the expected investment behaviour. The Expected visual attention is stated in subpart 'b' of the hypothesis.

7.4 Analysis and Results

The proportion of TFD allotted was considered a measure of visual attention allocated for an AOI. Since there can be variation in the time taken to make a decision, the proportion of TFD instead of the absolute

values will be an efficient indicator of visual attention [21]. For each stock, entries with TFD values of zero for all AOIs were excluded from the participant data. We applied the Wilcoxon Signed Rank test to compute if there is a statistically significant difference (p-value < 0.05) between visual attention allotted to graphical and numerical components. Friedmans test was performed to find if there was a statistically significant difference ($p < 0.05$) between the percentage distribution of TFD for the three extreme points in the graph.

Figure 7.6 depicts the choice-wise distribution of participants. In loss scenarios, most investors chose to hold stocks for company B. Company G saw a preference for buying, while companies E and F had investors divided between holding and selling. In profitable situations, the predicted behaviour was observed in companies D and I. Company C witnessed most investors selling, while for Company H, there was a tie between holding and selling decisions.

Comparing the TFD distribution for three extreme points in the graph (Figure 7.7) for loss, a statistically significant difference in administering the Kruskal Wallis test was found for three of four stocks (B, F and G). For these three stocks, the attention on the peaks was greater than the graph's dips, validating the hypothesis. A statistically significant difference was found for two of the four stocks (C and I) in the profit condition. The rest showed a difference between only one pair of extreme points. between 1st High and the Low for HHL (p-value = 0.036) and 2nd Low and the High for LLH (p-value = 0.039). No recency effect was observed, and peaks were allotted greater visual attention for all four profit conditions.

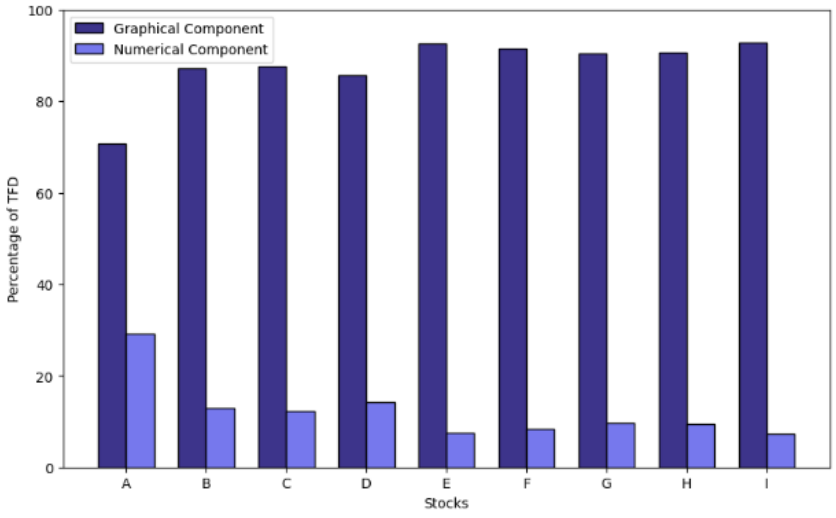


Figure 7.5: TFD comparison for graphical and numerical components

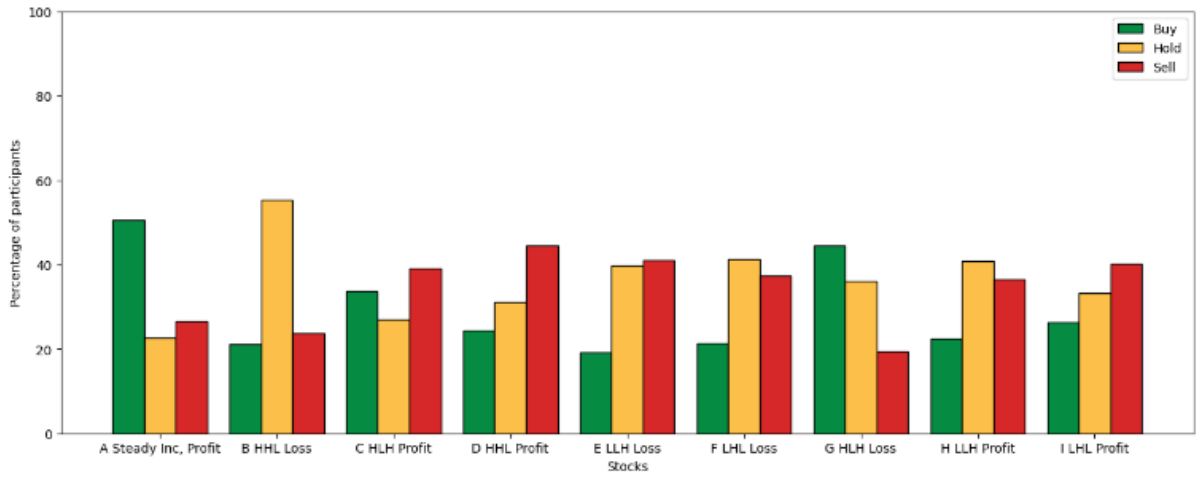


Figure 7.6: Choice preferences among participants

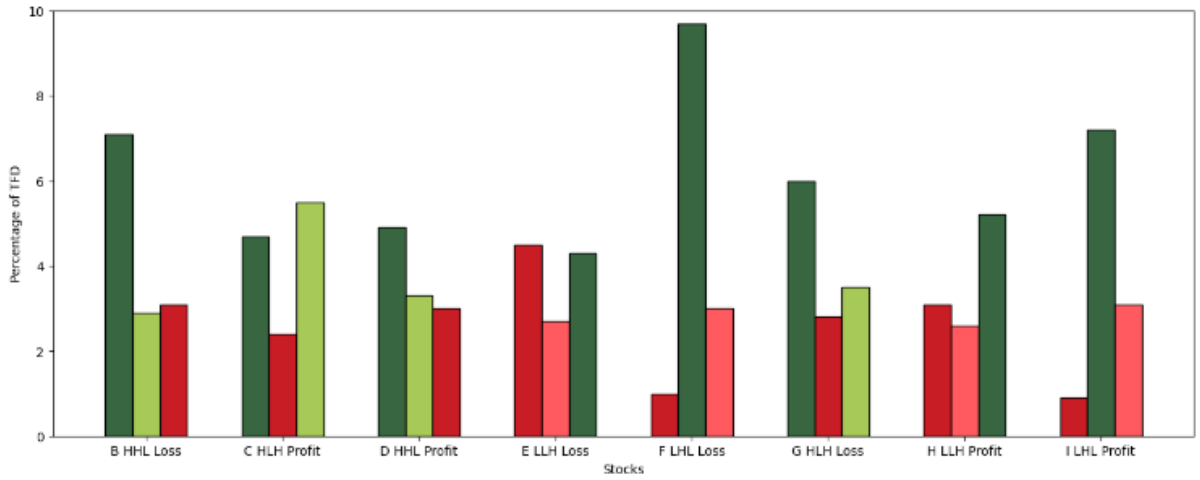


Figure 7.7: Average distribution of TFD for the three extreme points. Shades of green represent TFD for peaks, and shades of red represent TFD for valleys.

7.4.1 Role of Prior Knowledge of Stock Market

We divided the dataset into three parts based on an individual's knowledge of the stock market (none, basic and good). Participants with basic knowledge displayed higher holding behaviour in loss scenarios for stocks B, E and F (Figure 7.9) and slightly higher selling behaviour in profit scenarios (Figure 7.10). Good-knowledge participants exhibit a strong buying tendency in 3 of 4 profitable stocks (stocks A, H and I) as represented by Figure 7.8. Interestingly, the choices made by the no-knowledge and good-knowledge

groups exhibit a striking similarity in distribution for the majority of the cases.

The participants' choices indicate that those with basic knowledge demonstrate higher loss aversion and a disposition effect compared to both the no-knowledge and good-knowledge groups. Participants with good knowledge exhibit higher risk-seeking behaviour even in the domain of gains. The graphical data is given greater visual attention for all nine stocks in all three groups. Comparing the TFD distribution for the three extreme points in the graph, statistically significant results were obtained for stocks F (p-value = 0.013) and I (p-value = 0.006) for the no knowledge group, stocks B (p-value = 0.005), F (p-value $<$ 0.05), and I (p-value $<$ 0.05) for the basic knowledge group and stock F (p-value = 0.007) for the good knowledge group.

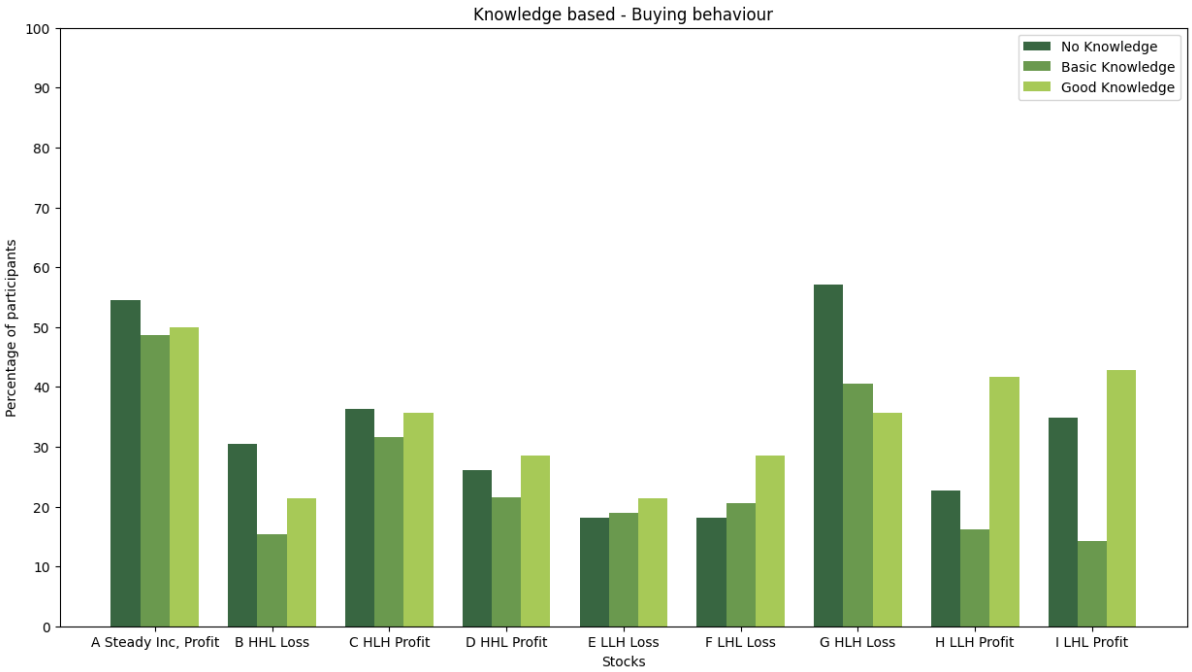


Figure 7.8: Buying behaviour of participants (Grouped based on Knowledge)

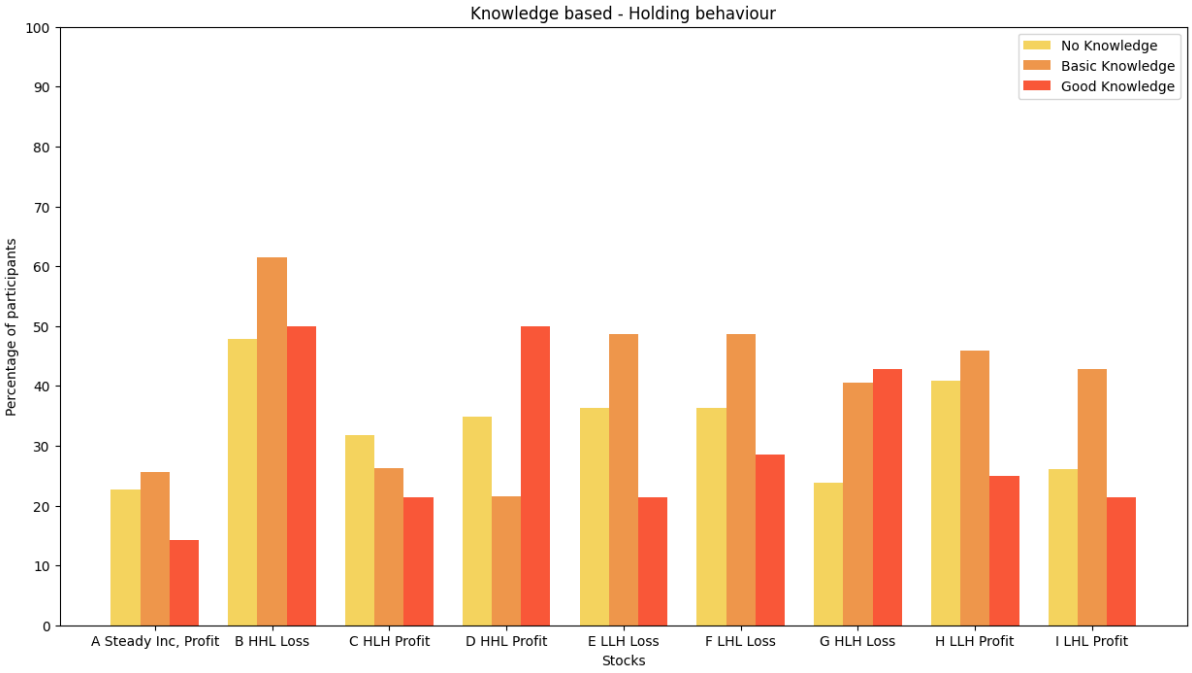


Figure 7.9: Holding behaviour of participants (Grouped based on Knowledge)

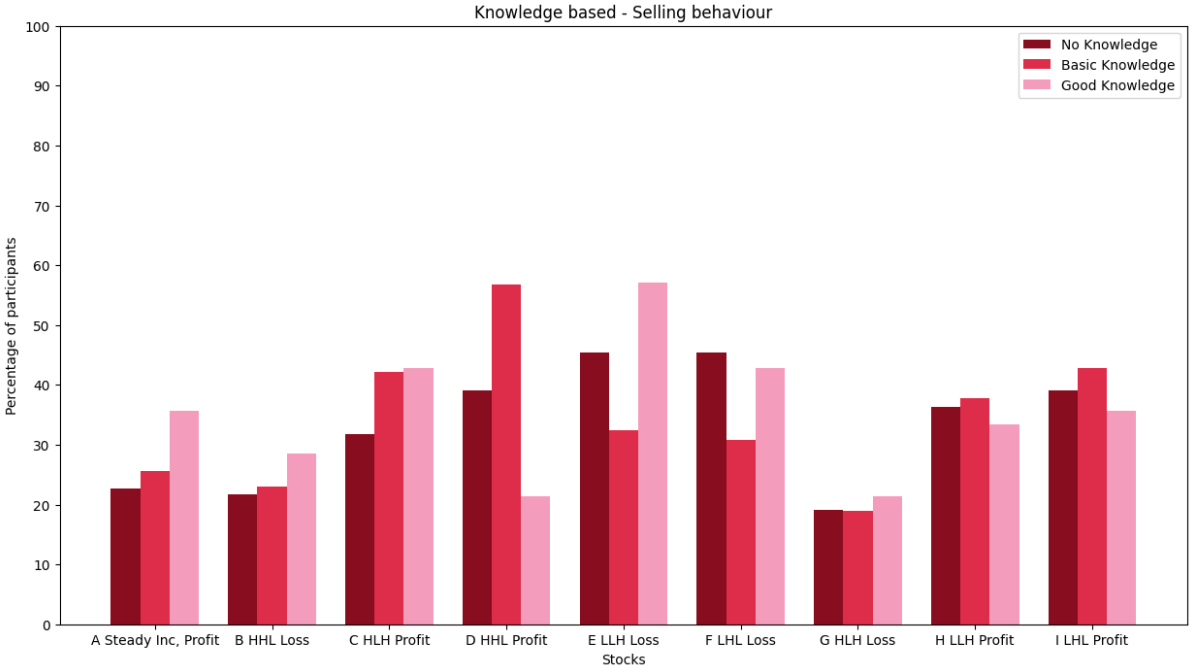


Figure 7.10: Selling behaviour of participants (Grouped based on Knowledge)

7.4.2 Role of Experience in Stock Market Trading

Segmenting the dataset based on trading experience revealed that both experienced (having traded in the past or currently trading) and amateur participants focus more on graphical information than numerical information. Both groups' buying behaviour is similar for most of the stocks (Figure 7.11). The holding behaviour for loss is significantly higher for amateur participants in 3 of 4 stocks with loss (Figure 7.12). A greater proportion of amateur investors often sell stocks at a loss, while experienced investors sell underperforming assets more than novice participants (Figure 7.13).

Comparing the choice distribution between the two groups, amateur participants displayed higher loss aversion and a slightly greater disposition effect than their experienced counterparts. A statistically significant difference between TFD for the three extreme points was observed only for stock B (p-value = 0.013), F (p-value < 0.05), and I (p-value < 0.05) for the amateur group, while statistically significant differences were observed for stock C (p-value = 0.015), F (p-value < 0.05), and G (p-value = 0.044) in the experienced group.

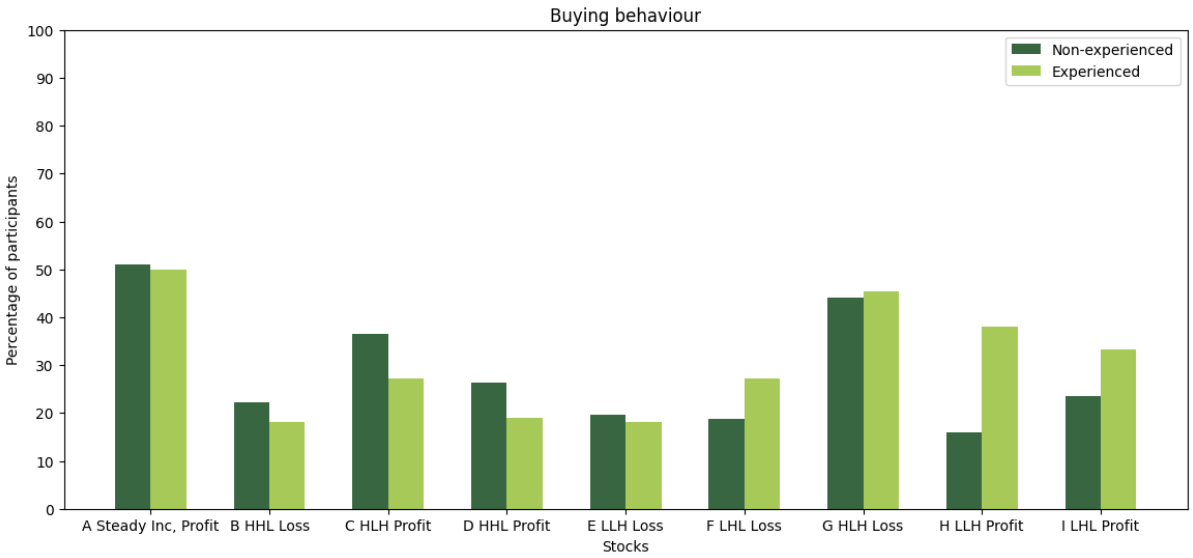


Figure 7.11: Buying behaviour of participants (Grouped based on Experience)

Figure 7.12: Holding behaviour of participants (Grouped based on Experience)

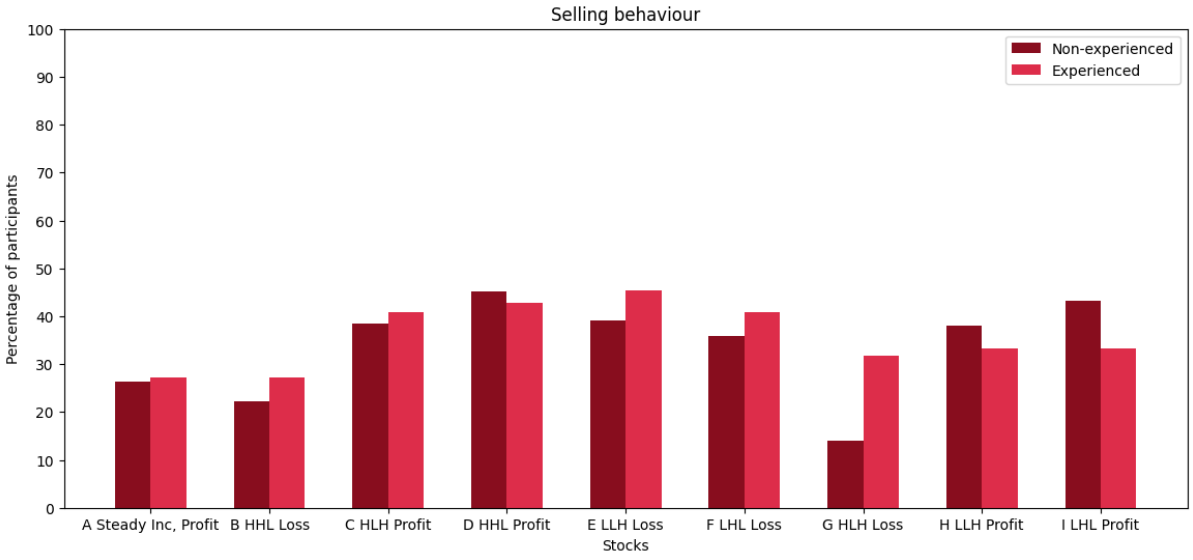


Figure 7.13: Selling behaviour of participants (Grouped based on Experience)

Applying the multinomial logistic regression, we did not find a correlation between the risk scores for the DOSPERT survey and the investment decisions.

7.5 Discussion

We could spot specific behavioural patterns from the investor strategies used in the investment tasks. Irrespective of the level of prior knowledge and experience, graphical data was given more weightage in decision-making as the past price trend provides an anchor for estimating the future price [145]. The declining visual attention to numerical components (Figure 7.5) shows a learning effect.

Prior studies have observed that investors provide greater significance to the 52-week highs and 52-week lows ([166], [167], [151], [168], [149]). In our experiment, the peaks (precisely the peak corresponding to the 52-week high) were allotted more visual attention for seven of nine stocks. Extensive buying for stock G (HLH Loss) could be attributed to two peaks in the graph acting as a strong indicator of a positive price trend and the 52-week high being used as a strong reference point [168], data also supported by the eye-tracking gaze analysis. The selling behaviour for E (LLH Loss) and C (HLH Profit) could be due to stock downgrading as the price is approaching a 52-week high [169].

Contrary to our hypothesis, participants do not consistently exhibit loss aversion, whereas, in the case of profit, the disposition effect was prominently observed. The participants who had reported having a basic knowledge of the stock market exhibited the highest levels of loss aversion and disposition effect compared to the other two groups (no knowledge and good knowledge). Contrary to ([170], [171]), we did not observe a specific correlation between prior knowledge and behavioural biases in investment decisions. Comparing the visual attention allotted to the extreme points, the three groups slightly varied. The statistically significant difference observed for the LHL pattern across all three groups highlights the significance associated with a 52-week high peak [168]. Based on the TFD distribution for extreme points, it can be inferred that participants in the good-knowledge group do not assign particular significance to a specific extreme point in terms of visual attention (except for stock F), thereby treating them equally in investment decisions.

In terms of stock trading experience, our findings revealed that experienced participants showed lower levels of loss aversion and a slightly reduced disposition effect compared to novice participants. However, it should be noted that experience alone does not eliminate behavioural biases [172]. The visual focus on extreme points displays minor differences between the two experience groups, while stock F stands out as a common factor, where the 52-week high has the highest TFD value, indicating its perceived significance [168].

Psychological research indicates that individual preferences influence information processing ([173], [174]). Investors tend to interpret information in line with their directional preferences [175]. When examining the distribution of choices for identical graphical patterns in instances of loss and profit, we observe notable distinctions across all four patterns. Although the TFD distribution shows that peaks are allotted higher visual attention, decisions are also influenced by the current state of the stock. This

suggests that the perception of the same information varies depending on whether an immediate or recent loss or profit is associated with the investment.

7.6 Conclusion

The eye-tracking technique provided an efficient way to analyse decision-making and information-processing mechanisms in a stock market scenario. Analysing visual gaze patterns reveals the presence of behavioural biases such as confirmation bias and the recency effect in investment decisions, which are challenging to capture solely through an analysis of investment choices. Investors' visual gaze patterns combined with their investment choices efficiently explain the role of various information components in stock market decisions.

Most of the participants in the study do not have stock trading experience. The dataset can be further expanded by including participants with different levels of trading experience while also examining long-term and short-term traders as distinct groups. We could integrate more stock-related data, including news related to the company, sector-specific performance and historical data for stock market performance.

In summary, we identified diverse decision-making patterns correlated with stock price trends spanning a year. Visual gaze patterns offer deeper insights into decision-making. They expand our comprehension regarding which information components receive greater attention, indicating their heightened significance in investment decisions.

7.7 Contributions

In both of our conducted studies, we aim to dig deeper into understanding the underlying driving factors of our decision-making processes, whether in situations involving individual choices such as stock market investments or in contexts involving social interactions and interdependence among multiple individuals, such as participating in standard economic games. The use of eye-tracking to analyse the influence of multiple peaks and valleys in stock price graphs represents an innovative methodological approach. We employed four standard economic games sequentially across five socioeconomic groups, thereby making a significant contribution to the existing literature, which typically focuses on one or two economic games and binary categorisation of socioeconomic status. The studies focus on Indian stock market traders and young Indian adolescents, cohorts that have received relatively less attention in previous studies. Our research work contributes to the domain of behavioural economics by exploring two different contexts based on monetary decision-making.

7.8 Reviews from Cognitive Science Society Conference 2024

The research presented in this chapter was submitted as a paper titled "Visual Voyage of Stock Market Strategies" to the Cognitive Science Society (CSS) Conference in 2024. We got a full paper acceptance for the same. Following are the reviews shared by the meta-reviewer -

The reviews of this paper are quite consistent. The reviewers appear to all see the experiment as well conducted, and the methodology of using eye-tracking to indicate what information is being used as interesting. However, they seem to see the paper as having a limited theoretical impact. I found myself largely in agreement with these assessments though perhaps a little more positive regarding the impact of the paper because I gave more weight to the innovative use of eye-tracking tracking data.

The results found are generally consistent with the theory used to justify the predictions so the paper does not break new ground. However, it is an effective demonstration of the utility of incorporating eye-tracking data into studies of stock market decisions and, as such, would be a good first study in a line of research on such decisions. The expertise effects would appear worth following up and the results for loss aversion are potentially interesting. Although there is evidence of loss aversion in stock market decisions, the bias is small and clearly, traders often go against it. Perhaps the techniques the authors used here could help to tease apart what is really going on regarding loss aversion in the stock market.

The Submission's Originality and Significance

This is not the first time eye-tracking data has been used to identify what information a participant is using in decision-making, but it is rare in this domain. So, I saw the greatest significance of the paper as being the demonstration that such data can be useful for investigating the process of decision-making. As such, it may encourage more use of eye-tracking in decision-making research, especially now that eye-tracking is much easier to implement.

Technical Soundness

The study is well conducted, and the analysis appears sound.

Theoretical Merit

The theory background of the paper is solid, but it does not break new ground. Perhaps the most interesting result theoretically is how sometimes the people with high knowledge and no knowledge were more similar than those with some knowledge. However, the knowledge level was mainly based on self-reports, and the distribution of stock-trading knowledge in a university sample may be low. It would

be interesting to run this study with participants who can be objectively identified as experts.

Breadth of Interest for the Broad Cognitive Science Audience

There is a reasonable-sized audience for decision-making work at the confidence, and I think anyone in that area would find this paper interesting.

Clarity of Writing

Generally, the writing is clear, but I agree with the comments that the graphs are hard to read. Just because there is the potential to zoom in on PDF documents online is not a reason to make the printed graphs unreadable.

Related Publications

- Tanvi Narsapur, Kavita Vemuri. ”Decoding the Highs and Lows - Eye-tracking Analysis of Graphical Interpretations in the Stock Market” was selected as an extended abstract at the Behavioural Science in Management (BSIM) conference 2023, IIM Ahmedabad.
- Tanvi Narsapur, Kavita Vemuri. ”Deciphering Trust and Generosity - Unravelling Behaviour Beyond Socioeconomic Boundaries” abstract selected at Judgement and Decision Making (JDM) conference 2023, IIT Kanpur.
- Tanvi Narsapur, Kavita Vemuri. ”Visual Voyage of Stock Market Strategies - Eye-tracking Insights into Investor Choices” full paper selected at Cognitive Science Society (CSS) conference 2024.

Bibliography

[1] Nancy Eisenberg and Paul Henry Mussen. *The roots of prosocial behavior in children*. Cambridge University Press, 1989.

[2] Peter R Blake, Katherine McAuliffe, John Corbit, Tara C Callaghan, O Barry, A Bowie, Lauren Kleutsch, KL Kramer, E Ross, H Vongsachang, et al. The ontogeny of fairness in seven societies. *Nature*, 528(7581):258–261, 2015.

[3] Elizabeth Huppert, Jason M Cowell, Yawei Cheng, Carlos Contreras-Ibáñez, Natalia Gomez-Sicard, Maria Luz Gonzalez-Gadea, David Huepe, Agustin Ibanez, Kang Lee, Randa Mahasneh, et al. The development of children's preferences for equality and equity across 13 individualistic and collectivist cultures. *Developmental science*, 22(2):e12729, 2019.

[4] Robert V Levine, Ara Norenzayan, and Karen Philbrick. Cross-cultural differences in helping strangers. *Journal of cross-cultural psychology*, 32(5):543–560, 2001.

[5] Bailey R House, Joan B Silk, Joseph Henrich, H Clark Barrett, Brooke A Scelza, Adam H Boyette, Barry S Hewlett, Richard McElreath, and Stephen Laurence. Ontogeny of prosocial behavior across diverse societies. *Proceedings of the National Academy of Sciences*, 110(36):14586–14591, 2013.

[6] Anne C Pisor, Matthew M Gervais, Benjamin G Purzycki, and Cody T Ross. Preferences and constraints: the value of economic games for studying human behaviour. *Royal Society open science*, 7(6):192090, 2020.

[7] Urie Bronfenbrenner. *The ecology of human development: Experiments by nature and design*. Harvard university press, 1979.

[8] Urie Bronfenbrenner. Recent advances in research on the ecology of human development. *Development as action in context: Problem behavior and normal youth development*, pages 287–309, 1986.

[9] Shigehiro Oishi and Jesse Graham. Social ecology: Lost and found in psychological science. *Perspectives on Psychological Science*, 5(4):356–377, 2010.

[10] Liz Sutton. 'they'd only call you a scally if you are poor': the impact of socio-economic status on children's identities. *Children's Geographies*, 7(3):277–290, 2009.

[11] Paul K Piff, Michael W Kraus, Stéphane Côté, Bonnie Hayden Cheng, and Dacher Keltner. Having less, giving more: the influence of social class on prosocial behavior. *Journal of personality and social psychology*, 99(5):771, 2010.

[12] Ana Guinote, Ioanna Cotzia, Sanpreet Sandhu, and Pramila Siwa. Social status modulates prosocial behavior and egalitarianism in preschool children and adults. *Proceedings of the National Academy of Sciences*, 112(3):731–736, 2015.

[13] Ingvild Almås, Alexander W Cappelen, Erik Ø Sørensen, and Bertil Tungodden. Global evidence on the selfish rich inequality hypothesis. *Proceedings of the National Academy of Sciences*, 119(3):e2109690119, 2022.

[14] Anjana Balakrishnan, Paolo A Palma, Joshua Patenaude, and Lorne Campbell. A 4-study replication of the moderating effects of greed on socioeconomic status and unethical behaviour. *Scientific data*, 4(1):1–7, 2017.

[15] Angelos Stamos, Efthymios Altsitsiadis, and Siegfried Dewitte. Investigating the effect of childhood socioeconomic background on interpersonal trust: Lower childhood socioeconomic status predicts lower levels of trust. *Personality and Individual Differences*, 145:19–25, 2019.

[16] Fabian Kosse, Thomas Deckers, Pia Pinger, Hannah Schildberg-Hörisch, and Armin Falk. The formation of prosociality: causal evidence on the role of social environment. *Journal of Political Economy*, 128(2):434–467, 2020.

[17] Marijn A Keijzer and Rense Corten. Socioeconomic status, reputation, and interpersonal trust in peer-to-peer markets: Evidence from an online experiment. *Rationality and Society*, 35(1):34–60, 2023.

[18] Joyce F. Benenson, Joanna Pascoe, and Nicola Radmore. Children's altruistic behavior in the dictator game. *Evolution and Human Behavior*, 28(3):168–175, 2007.

[19] Yongxiang Chen, Liqi Zhu, and Zhe Chen. Family income affects children's altruistic behavior in the dictator game. *PloS one*, 8(11):e80419, 2013.

[20] Jason M Cowell, Kang Lee, Susan Malcolm-Smith, Bilge Selcuk, Xinyue Zhou, and Jean Decety. The development of generosity and moral cognition across five cultures. *Developmental science*, 20(4):e12403, 2017.

[21] Haruto Takagishi, Shinya Kameshima, Joanna Schug, Michiko Koizumi, and Toshio Yamagishi. Theory of mind enhances preference for fairness. *Journal of experimental child psychology*, 105(1-2):130–137, 2010.

[22] Ken J Rotenberg, Serena Petrocchi, Flavia Lecciso, and Antonella Marchetti. The relation between children's trust beliefs and theory of mind abilities. *Infant and Child Development*, 24(2):206–214, 2015.

[23] Daniel Kahneman. *Thinking, fast and slow*. macmillan, 2011.

[24] Werner De Bondt, Rosa M Mayoral, and Eleuterio Vallelado. Behavioral decision-making in finance: An overview and assessment of selected research. *Spanish Journal of Finance and Accounting/Revista Española de Financiación y Contabilidad*, 42(157):99–118, 2013.

[25] David Premack and Guy Woodruff. Does the chimpanzee have a theory of mind? *Behavioral and brain sciences*, 1(4):515–526, 1978.

[26] Denise M Rousseau, Sim B Sitkin, Ronald S Burt, and Colin Camerer. Not so different after all: A cross-discipline view of trust. *Academy of management review*, 23(3):393–404, 1998.

[27] Jack Barbalet. A characterization of trust, and its consequences. *Theory and society*, 38:367–382, 2009.

[28] Diego Gambetta et al. Can we trust trust. *Trust: Making and breaking cooperative relations*, 13(2000):213–237, 2000.

[29] Mari Sako. *Price, quality and trust: Inter-firm relations in Britain and Japan*. Number 18. Cambridge University Press, 1992.

[30] Roy J Lewicki, Barbara B Bunker, et al. Developing and maintaining trust in work relationships. *Trust in organizations: Frontiers of theory and research*, 114(139):30, 1996.

[31] Graham Dietz. Going back to the source: Why do people trust each other? *Journal of Trust Research*, 1(2):215–222, 2011.

[32] Chris Snijders and Gideon Keren. Do you trust? whom do you trust? when do you trust? In *Advances in group processes*, pages 129–160. Emerald Group Publishing Limited, 2001.

[33] Robert A Hinde and Jo Groebel. *Cooperation and prosocial behaviour*. Cambridge University Press, 1991.

[34] Jessica L Collett and Christopher A Morrissey. The social psychology of generosity: The state of current interdisciplinary research. *Report for the John Templeton Foundation Generosity Planning Project*, 15:2008–2009, 2007.

[35] Alexander L Davis, Nadja Jehli, John H Miller, and Roberto A Weber. Generosity across contexts. 2015.

[36] Felix Warneken and Michael Tomasello. Helping and cooperation at 14 months of age. *Infancy*, 11(3):271–294, 2007.

[37] Ernst Fehr and Urs Fischbacher. The nature of human altruism. *Nature*, 425(6960):785–791, 2003.

[38] Michaela Gummerum, Yaniv Hanoch, and Monika Keller. When child development meets economic game theory: An interdisciplinary approach to investigating social development. *Human development*, 51(4):235–261, 2008.

[39] Erik Homburger Erikson. Childhood and society, new york (ww norton) 1950. 1950.

[40] Jo Cutler, Jonas P Nitschke, Claus Lamm, and Patricia L Lockwood. Older adults across the globe exhibit increased prosocial behavior but also greater in-group preferences. *Nature Aging*, 1(10):880–888, 2021.

[41] Fabrice Clément, Melissa Koenig, and Paul Harris. The ontogenesis of trust. *Mind & Language*, 19(4):360–379, 2004.

[42] William T Harbaugh, Kate Krause, and Steven J Liday. Bargaining by children. *University of Oregon Economics Working Paper*, (2002-4), 2003.

[43] Martina Wittig, Keith Jensen, and Michael Tomasello. Five-year-olds understand fair as equal in a mini-ultimatum game. *Journal of experimental child psychology*, 116(2):324–337, 2013.

[44] Ajita Srivastava, Ulrich Kühnen, Dora Simunovic, and Klaus Boehnke. "more" or "enough"? rural-urban differences in maximizing: The case of india. *Current Research in Ecological and Social Psychology*, 5:100140, 2023.

[45] Stephen V Burks, Jeffrey P Carpenter, and Eric Verhoogen. Playing both roles in the trust game. *Journal of Economic Behavior & Organization*, 51(2):195–216, 2003.

[46] Robert J Aumann. Backward induction and common knowledge of rationality. *Games and economic Behavior*, 8(1):6–19, 1995.

[47] Joyce Berg, John Dickhaut, and Kevin McCabe. Trust, reciprocity, and social history. *Games and economic behavior*, 10(1):122–142, 1995.

[48] Richard D McKelvey and Thomas R Palfrey. An experimental study of the centipede game. *Econometrica: Journal of the Econometric Society*, pages 803–836, 1992.

[49] Eva M Krockow, Andrew M Colman, and Briony D Pulford. Cooperation in repeated interactions: A systematic review of centipede game experiments, 1992–2016. *European Review of Social Psychology*, 27(1):231–282, 2016.

[50] Eva M Krockow, Masanori Takezawa, Briony D Pulford, Andrew M Colman, Samuel Smithers, Toshimasa Kita, and Yo Nakawake. Commitment-enhancing tools in centipede games: Evidencing european–japanese differences in trust and cooperation. *Judgment and Decision Making*, 13(1):61–72, 2018.

[51] Ingolf Stahl. Bargaining theory (stockholm school of economics). *Stockholm, Sweden*, 1972.

[52] Richard H Thaler. Anomalies: The ultimatum game. *Journal of economic perspectives*, 2(4):195–206, 1988.

[53] Todd L Cherry, Peter Frykblom, and Jason F Shogren. Hardnose the dictator. *American economic review*, 92(4):1218–1221, 2002.

[54] Susan M Sawyer, Peter S Azzopardi, Dakshitha Wickremarathne, and George C Patton. The age of adolescence. *The lancet child & adolescent health*, 2(3):223–228, 2018.

[55] Eveline A Crone and Ronald E Dahl. Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature reviews neuroscience*, 13(9):636–650, 2012.

[56] Nancy Eisenberg, Gustavo Carlo, Bridget Murphy, et al. Prosocial development in late adolescence: a longitudinal study. In *Cognitive and Moral Development, Academic Achievement in Adolescence*, pages 75–93. Routledge, 2016.

[57] Laurence Steinberg and Elizabeth Cauffman. Maturity of judgment in adolescence: Psychosocial factors in adolescent decision making. *Law and human behavior*, 20(3):249–272, 1996.

[58] Aerika S Brittian and Marisha L Humphries. Prosocial behavior during adolescence. *International encyclopedia of the social & behavioral sciences*, 19:221–227, 2015.

[59] EvElInE A CRonE, Geert-Jan Will, Sandy Overgaauw, and B Güroğlu. Social decision-making in childhood and adolescence. *Reward and punishment in social dilemmas*, pages 161–181, 2014.

[60] Anne-Kathrin J Fett, Sukhi S Shergill, Paula M Gromann, Iroise Dumontheil, Sarah-Jayne Blakemore, Farah Yakub, and Lydia Krabbendam. Trust and social reciprocity in adolescence–a matter of perspective-taking. *Journal of adolescence*, 37(2):175–184, 2014.

[61] Berna Güroğlu, Wouter van den Bos, and Eveline A Crone. Sharing and giving across adolescence: An experimental study examining the development of prosocial behavior. *Frontiers in Psychology*, 5:76915, 2014.

[62] Eveline A Crone. Considerations of fairness in the adolescent brain. *Child Development Perspectives*, 7(2):97–103, 2013.

[63] Imke LJ Lemmers-Jansen, Anne-Kathrin J Fett, Sukhi S Shergill, Marlieke TR Van Kesteren, and Lydia Krabbendam. Girls-boys: An investigation of gender differences in the behavioral and neural mechanisms of trust and reciprocity in adolescence. *Frontiers in Human Neuroscience*, 13:257, 2019.

[64] Wouter Van Den Bos, Eric Van Dijk, Michiel Westenberg, Serge ARB Rombouts, and Eveline A Crone. Changing brains, changing perspectives: the neurocognitive development of reciprocity. *Psychological science*, 22(1):60–70, 2011.

[65] Matthias Sutter. Outcomes versus intentions: On the nature of fair behavior and its development with age. *Journal of Economic Psychology*, 28(1):69–78, 2007.

[66] Berna Güroğlu, Wouter van den Bos, and Eveline A Crone. Fairness considerations: increasing understanding of intentionality during adolescence. *Journal of experimental child psychology*, 104(4):398–409, 2009.

[67] Ilaria Castelli, Davide Massaro, Alan G Sanfey, and Antonella Marchetti. Fairness and intentionality in children's decision-making. *International Review of Economics*, 57:269–288, 2010.

[68] Armin Falk and Urs Fischbacher. A theory of reciprocity. *Games and economic behavior*, 54(2):293–315, 2006.

[69] Werner Güth, Rolf Schmittberger, and Bernd Schwarze. An experimental analysis of ultimatum bargaining. *Journal of economic behavior & organization*, 3(4):367–388, 1982.

[70] Ervin Staub and Linda Sherk. Need for approval, children's sharing behavior, and reciprocity in sharing. *Child Development*, pages 243–252, 1970.

[71] Mary J Levitt, Ruth A Weber, M Cherie Clark, and Patricia McDonnell. Reciprocity of exchange in toddler sharing behavior. *Developmental psychology*, 21(1):122, 1985.

[72] Michael Gurven. The evolution of contingent cooperation. *Current Anthropology*, 47(1):185–192, 2006.

[73] Nancy R Buchan, Rachel TA Croson, and Robyn M Dawes. Swift neighbors and persistent strangers: A cross-cultural investigation of trust and reciprocity in social exchange. *American journal of sociology*, 108(1):168–206, 2002.

[74] Simon Gächter, Benedikt Herrmann, and Christian Thöni. Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. *Journal of Economic Behavior & Organization*, 55(4):505–531, 2004.

[75] C Bram Cadsby and Elizabeth Maynes. Gender and free riding in a threshold public goods game: Experimental evidence. *Journal of economic behavior & organization*, 34(4):603–620, 1998.

[76] Angela Cristiane Santos Póvoa, Wesley Pech, and Edinéia Woiciekovski. Trust and social preferences: A cross-cultural experiment. *Journal of Behavioral and Experimental Economics*, 86:101526, 2020.

[77] Anuvinda Pulickal and Sujoy Chakravarty. The effect of own and recipient economic status on the dictator game giving of adolescents: Experimental evidence from india. *Available at SSRN 4184279*, 2022.

[78] Stefan Schulreich, Anita Tusche, Philipp Kanske, and Lars Schwabe. Higher subjective socioeconomic status is linked to increased charitable giving and mentalizing-related neural value coding. *NeuroImage*, 279:120315, 2023.

[79] Patricia M Greenfield. Three approaches to the psychology of culture: Where do they come from? where can they go? *Asian journal of social psychology*, 3(3):223–240, 2000.

[80] Harry C Triandis. Individualism-collectivism and personality. *Journal of personality*, 69(6):907–924, 2001.

[81] Ken-Ichi Ohbuchi, Osamu Fukushima, and James T Tedeschi. Cultural values in conflict management: Goal orientation, goal attainment, and tactical decision. *Journal of cross-cultural psychology*, 30(1):51–71, 1999.

[82] Jai BP Sinha, TN Sinha, Jyoti Verma, and RBN Sinha. Collectivism coexisting with individualism: An indian scenario. *Asian journal of social psychology*, 4(2):133–145, 2001.

[83] Geert Hofstede. *Culture's consequences: International differences in work-related values*, volume 5. sage, 1984.

[84] Henri C Santos, Michael EW Varnum, and Igor Grossmann. Global increases in individualism. *Psychological science*, 28(9):1228–1239, 2017.

[85] JBP Sinha. The salient indian values and their socio-ecological roots. *Indian Journal of Social Sciences*, 3(4):478–488, 1990.

[86] Shalini Duggal Jha and Kamlesh Singh. An analysis of individualism-collectivism across northern india. *Journal of the Indian Academy of Applied Psychology*, 37(1):149–156, 2011.

[87] Rajen K Gupta and Abinash Panda. Individualised familial self: The evolving self of qualified technocrats in india. *Psychology and Developing Societies*, 15(1):1–29, 2003.

[88] Shibly Shahrier, Koji Kotani, and Makoto Kakinaka. Social value orientation and capitalism in societies. *PLoS One*, 11(10):e0165067, 2016.

[89] Simon Czermak, Francesco Feri, Daniela Glätzle-Rützler, and Matthias Sutter. How strategic are children and adolescents? experimental evidence from normal-form games. *Journal of Economic Behavior & Organization*, 128:265–285, 2016.

[90] Antonella Marchetti, Francesca Baglio, Ilaria Castelli, Ludovica Griffanti, Raffaello Nemni, Federica Rossetto, Annalisa Valle, Michela Zanette, and Davide Massaro. Social decision making in adolescents and young adults: evidence from the ultimatum game and cognitive biases. *Psychological reports*, 122(1):135–154, 2019.

[91] Eric E Nelson, Ellen Leibenluft, Erin B McClure, and Daniel S Pine. The social re-orientation of adolescence: a neuroscience perspective on the process and its relation to psychopathology. *Psychological medicine*, 35(2):163–174, 2005.

[92] Colin F Camerer. *Behavioral game theory: Experiments in strategic interaction*. Princeton university press, 2011.

[93] Francesco Guala and Luigi Mittone. Paradigmatic experiments: the dictator game. *The Journal of Socio-Economics*, 39(5):578–584, 2010.

[94] Christoph Engel. Dictator games: A meta study. *Experimental economics*, 14:583–610, 2011.

[95] John A List. On the interpretation of giving in dictator games. *Journal of Political economy*, 115(3):482–493, 2007.

[96] Anja Achtziger, Carlos Alós-Ferrer, and Alexander K Wagner. Money, depletion, and prosociality in the dictator game. *Journal of Neuroscience, Psychology, and Economics*, 8(1):1, 2015.

[97] Benjamin E Hilbig, Isabel Thielmann, Johanna Hepp, Sina A Klein, and Ingo Zettler. From personality to altruistic behavior (and back): Evidence from a double-blind dictator game. *Journal of Research in Personality*, 55:46–50, 2015.

[98] Katharina Allgaier, Karolina A Ścigała, Ulrich Trautwein, Benjamin E Hilbig, and Ingo Zettler. Honesty-humility and dictator and ultimatum game-giving in children. *Journal of Research in Personality*, 85:103907, 2020.

[99] Daniel Kahneman, Jack L Knetsch, Richard Thaler, et al. Fairness as a constraint on profit seeking: Entitlements in the market. *American economic review*, 76(4):728–741, 1986.

[100] Jonathan F Schulz, Urs Fischbacher, Christian Thöni, and Verena Utikal. Affect and fairness: Dictator games under cognitive load. *Journal of Economic Psychology*, 41:77–87, 2014.

[101] Martin A Nowak, Karen M Page, and Karl Sigmund. Fairness versus reason in the ultimatum game. *Science*, 289(5485):1773–1775, 2000.

[102] David G Rand, Corina E Tarnita, Hisashi Ohtsuki, and Martin A Nowak. Evolution of fairness in the one-shot anonymous ultimatum game. *Proceedings of the National Academy of Sciences*, 110(7):2581–2586, 2013.

[103] Alvin E Roth, Vesna Prasnikar, Masahiro Okuno-Fujiwara, and Shmuel Zamir. Bargaining and market behavior in jerusalem, ljubljana, pittsburgh, and tokyo: An experimental study. *The American economic review*, pages 1068–1095, 1991.

[104] Elizabeth Hoffman and Matthew L Spitzer. Entitlements, rights, and fairness: An experimental examination of subjects' concepts of distributive justice. *The Journal of Legal Studies*, 14(2):259–297, 1985.

[105] J Keith Murnighan and Michael Scott Saxon. Ultimatum bargaining by children and adults. *Journal of Economic Psychology*, 19(4):415–445, 1998.

[106] Noel D Johnson and Alexandra A Mislin. Trust games: A meta-analysis. *Journal of economic psychology*, 32(5):865–889, 2011.

[107] Nava Ashraf, Iris Bohnet, and Nikita Piankov. Decomposing trust and trustworthiness. *Experimental economics*, 9:193–208, 2006.

[108] David Cesarini, Christopher T Dawes, James H Fowler, Magnus Johannesson, Paul Lichtenstein, and Björn Wallace. Heritability of cooperative behavior in the trust game. *Proceedings of the National Academy of sciences*, 105(10):3721–3726, 2008.

[109] Yashodha. Trust and kinship: experimental evidence from rural india. *Journal of the Economic Science Association*, 5(2):223–237, 2019.

[110] Suzanne van de Groep, Rosa Meuwese, Kiki Zanolie, Berna Güroğlu, and Eveline A Crone. Developmental changes and individual differences in trust and reciprocity in adolescence. *Journal of Research on Adolescence*, 30:192–208, 2020.

[111] Bernardo García-Pola, Nagore Iriberri, and Jaromír Kovářík. Non-equilibrium play in centipede games. *Games and Economic Behavior*, 120:391–433, 2020.

[112] Segismundo S Izquierdo, Luis Rodrigo Izquierdo Millán, et al. " test two, choose the better" leads to high cooperation in the centipede game. *Journal of Dynamics and Games*, 9(4):461–498, 2022.

[113] Isabelle Brocas and Juan D Carrillo. The development of randomization and deceptive behavior in mixed strategy games. *Quantitative Economics*, 13(2):825–862, 2022.

[114] Brian Skyrms. The stag hunt. In *Proceedings and Addresses of the American Philosophical Association*, volume 75, pages 31–41. JSTOR, 2001.

[115] Geetha B Nambissan. Private schools for the poor: Business as usual? *Economic and Political Weekly*, pages 51–58, 2012.

[116] Geetha B Nambissan and Stephen J Ball. Advocacy networks, choice and private schooling of the poor in india. In *Education and Social Justice in the Era of Globalisation*, pages 161–186. Routledge India, 2020.

[117] Kerstin Pahl and Niobe Way. Longitudinal trajectories of ethnic identity among urban black and latino adolescents. *Child development*, 77(5):1403–1415, 2006.

[118] Carolina Dahlhaus and Thomas Schlösser. The interplay of social status and trust: A critical review of concepts, operationalizations, and findings. *Review of General Psychology*, 25(2):203–220, 2021.

[119] Rajesh Shukla. The official poor in india summed up. *Indian Journal of Human Development*, 4(2):301–328, 2010.

[120] Youngju Kim, Jaewuk Jung, and Jinkyung Na. Socioeconomic status differences in psychological responses to unfair treatments: Behavioral evidence of a vicious cycle. *Plos one*, 17(6):e0268286, 2022.

[121] Martin Dufwenberg and Georg Kirchsteiger. A theory of sequential reciprocity. *Games and economic behavior*, 47(2):268–298, 2004.

[122] Rachel Croson and Uri Gneezy. Gender differences in preferences. *Journal of Economic literature*, 47(2):448–474, 2009.

[123] Nancy R Buchan, Rachel TA Croson, and Sara Solnick. Trust and gender: An examination of behavior and beliefs in the investment game. *Journal of Economic Behavior & Organization*, 68(3-4):466–476, 2008.

[124] Uri Gneezy, Muriel Niederle, and Aldo Rustichini. Performance in competitive environments: Gender differences. *The quarterly journal of economics*, 118(3):1049–1074, 2003.

[125] Sunita Kishor and Kamla Gupta. *Gender equality and women's empowerment in India*. International Institute for Population Sciences, 2009.

[126] Uma S Kambhampati and Raji Rajan. The 'nowhere'children: Patriarchy and the role of girls in india's rural economy. *The Journal of Development Studies*, 44(9):1309–1341, 2008.

[127] Caroline Roux, Kelly Goldsmith, and Andrea Bonezzi. On the psychology of scarcity: When reminders of resource scarcity promote selfish (and generous) behavior. *Journal of consumer research*, 42(4):615–631, 2015.

[128] Taqadus Bashir, A Javed, Arslan A Butt, N Azam, A Tanveer, and I Ansar. An assessment study on the factors influencing the individual investor decision making behavior. *IOSR Journal of Business and Management*, 9(5):37–44, 2013.

[129] Amos Tversky and Daniel Kahneman. Judgment under uncertainty: Heuristics and biases: Biases in judgments reveal some heuristics of thinking under uncertainty. *science*, 185(4157):1124–1131, 1974.

[130] Thomas Mussweiler. Comparison processes in social judgment: mechanisms and consequences. *Psychological review*, 110(3):472, 2003.

[131] Daniel Kahneman and Dale T Miller. Norm theory: Comparing reality to its alternatives. *Psychological review*, 93(2):136, 1986.

[132] Tal Shavit, Cinzia Giorgetta, Yaniv Shani, and Fabio Ferlazzo. Using an eye tracker to examine behavioral biases in investment tasks: An experimental study. *Journal of Behavioral Finance*, 11(4):185–194, 2010.

[133] Eugene F Fama. Efficient capital markets. *Journal of finance*, 25(2):383–417, 1970.

[134] Paul JH Schoemaker. The expected utility model: Its variants, purposes, evidence and limitations. *Journal of economic literature*, pages 529–563, 1982.

[135] Lingesiya Kengatharan and Navaneethakrishnan Kengatharan. The influence of behavioral factors in making investment decisions and performance: Study on investors of colombo stock exchange, sri lanka. *Asian Journal of Finance & Accounting*, 6(1):1, 2014.

[136] Satish Kumar and Nisha Goyal. Behavioural biases in investment decision making–a systematic literature review. *Qualitative Research in financial markets*, 7(1):88–108, 2015.

[137] Geetika Madaan and Sanjeet Singh. An analysis of behavioral biases in investment decision-making. *International Journal of Financial Research*, 10(4):55–67, 2019.

[138] Daniel Kahneman and Amos Tversky. Prospect theory: An analysis of decision under risk. In *Handbook of the fundamentals of financial decision making: Part I*, pages 99–127. World Scientific, 2013.

[139] Amos Tversky and Daniel Kahneman. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, 5:297–323, 1992.

[140] Daniel Kahneman, Jack L Knetsch, and Richard H Thaler. The endowment effect, loss aversion, and status quo bias. 1991.

[141] Terrance Odean. Are investors reluctant to realize their losses? *The Journal of finance*, 53(5):1775–1798, 1998.

[142] Adik Duwi Rahayu, Aditya Putra, Chiata Oktaverina, and Regina Aulia Ningtyas. Herding behavior in the stock market: A literature review. *International Journal of Social Sciences Review*, 1(2):08–25, 2021.

[143] Muhammad Ishfaq and Noshaba Anjum. Effect of anchoring bias on risky investment decision. evidence from pakistan equity market. *International Journal of Engineering and Management Research (IJEMR)*, 5(4):32–38, 2015.

[144] Robin Robin and Vanne Angelina. Analysis of the impact of anchoring, herding bias, overconfidence and ethical consideration towards investment decision. *JIMFE (Jurnal Ilmiah Manajemen Fakultas Ekonomi)*, 6(2):253–264, 2020.

[145] Thomas Mussweiler and Karl Schneller. " what goes up must come down"-how charts influence decisions to buy and sell stocks. *The Journal of behavioral finance*, 4(3):121–130, 2003.

[146] Ricardo Lopes Cardoso, Rodrigo Oliveira Leite, and André Carlos Busanelli de Aquino. A graph is worth a thousand words: How overconfidence and graphical disclosure of numerical information influence financial analysts accuracy on decision making. *PloS one*, 11(8):e0160443, 2016.

[147] Peter de Goeij, Timo Hogendoorn, and Geert Van Campenhout. Pictures are worth a thousand words: graphical information and investment decision making. *Mimeo*, 2014.

[148] Nicholas H Lurie and Charlotte H Mason. Visual representation: Implications for decision making. *Journal of marketing*, 71(1):160–177, 2007.

[149] Steven Huddart, Mark Lang, and Michelle H Yetman. Volume and price patterns around a stock's 52-week highs and lows: Theory and evidence. *Management Science*, 55(1):16–31, 2009.

[150] Peter Clarkson, Alexander Nekrasov, Andreas Simon, and Irene Tutticci. Target price forecasts: The roles of the 52-week high price and recent investor sentiment. *Journal of Business Finance & Accounting*, 47(9-10):1365–1399, 2020.

[151] Joshua Della Vedova, Andrew Grant, and P Joakim Westerholm. Investor behavior at the 52-week high. *Journal of Financial and Quantitative Analysis*, 58(7):2852–2889, 2023.

[152] Claus Holm and Pall Rikhardsson. Experienced and novice investors: does environmental information influence investment allocation decisions? *European Accounting Review*, 17(3):537–557, 2008.

[153] Samreen Lodhi. Factors influencing individual investor behaviour: An empirical study of city karachi. *Journal of Business and Management*, 16(2):68–76, 2014.

[154] Md Hossen Miazee, ANM Shareef, and Md Nazmul Hasan. Fundamentals knowledge of investor and its influence on investment in capital market-a study from dhaka stock exchange. *Research Journal of Finance and Accounting*, 5(24):7–19, 2014.

[155] Cengiz Acartürk and Christopher Habel. Eye tracking in multimodal comprehension of graphs. In *Proceedings of the workshop on technology-enhanced diagrams research*, volume 887, pages 11–25, 2012.

[156] Joseph Tao-yi Wang, Michael Spezio, and Colin F Camerer. Pinocchio's pupil: using eyetracking and pupil dilation to understand truth telling and deception in sender-receiver games. *American economic review*, 100(3):984–1007, 2010.

[157] Robert B Zajonc. Attitudinal effects of mere exposure. *Journal of personality and social psychology*, 9(2p2):1, 1968.

[158] William Raft Kunst-Wilson and Robert B Zajonc. Affective discrimination of stimuli that cannot be recognized. *Science*, 207(4430):557–558, 1980.

[159] Richard L Moreland and Robert B Zajonc. Is stimulus recognition a necessary condition for the occurrence of exposure effects? *Journal of Personality and Social Psychology*, 35(4):191, 1977.

[160] Richard L Moreland and Robert B Zajonc. Exposure effects in person perception: Familiarity, similarity, and attraction. *Journal of Experimental Social Psychology*, 18(5):395–415, 1982.

[161] Jacob L Orquin and Simone Mueller Loose. Attention and choice: A review on eye movements in decision making. *Acta psychologica*, 144(1):190–206, 2013.

[162] Andreas Hüsser and Werner Wirth. Do investors show an attentional bias toward past performance? an eye-tracking experiment on visual attention to mutual fund disclosures in simplified fund prospectuses. *Journal of Financial Services Marketing*, 19:169–185, 2014.

[163] Filip-Mihai Toma, Cosmin-Octavian Cepoi, Matei Nicolae Kubinschi, and Makoto Miyakoshi. Gazing through the bubble: an experimental investigation into financial risk-taking using eye-tracking. *Financial Innovation*, 9(1):28, 2023.

[164] Glenn W Harrison and J Todd Swarthout. Eye-tracking and economic theories of choice under risk. *Journal of the Economic Science Association*, 5:26–37, 2019.

[165] Ann-Renée Blais and Elke U Weber. A domain-specific risk-taking (dospert) scale for adult populations. *Judgment and Decision making*, 1(1):33–47, 2006.

[166] Weicong Guo. How the 52-week high and low affect investors behavior. *Review of Integrative Business and Economics Research*, 10:1–18, 2021.

[167] Hans-Peter Burghof and Felix Prothmann. The 52-week high strategy and information uncertainty. *Financial Markets and Portfolio Management*, 25:345–378, 2011.

[168] Thomas J George and Chuan-Yang Hwang. The 52-week high and momentum investing. *The Journal of Finance*, 59(5):2145–2176, 2004.

[169] Fengfei Li, Chen Lin, and Tse-Chun Lin. Salient anchor and analyst recommendation downgrade. *Journal of Corporate Finance*, 69:102033, 2021.

[170] G Suresh. Impact of financial literacy and behavioural biases on investment decision-making. *FIIB Business Review*, 13(1):72–86, 2024.

[171] H Kent Baker, Satish Kumar, Nisha Goyal, and Vidhu Gaur. How financial literacy and demographic variables relate to behavioral biases. *Managerial Finance*, 45(1):124–146, 2019.

[172] Lei Feng and Mark S Seasholes. Do investor sophistication and trading experience eliminate behavioral biases in financial markets? *Review of finance*, 9(3):305–351, 2005.

[173] Peter H Ditto and David F Lopez. Motivated skepticism: Use of differential decision criteria for preferred and nonpreferred conclusions. *Journal of personality and social psychology*, 63(4):568, 1992.

[174] Peter H Ditto, James A Scepansky, Geoffrey D Munro, Anne Marie Apanovitch, and Lisa K Lockhart. Motivated sensitivity to preference-inconsistent information. *Journal of personality and social psychology*, 75(1):53, 1998.

[175] Jeffrey Hales. Directional preferences, information processing, and investors' forecasts of earnings. *Journal of Accounting Research*, 45(3):607–628, 2007.