

The Effects of Lies on Economic Decision Making. An Eye-Tracking Study

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Abstract In the economic domain often people have to make decisions by taking into account the perceived intentions of the partners. The aim of this study was to test how the perception that the responder is lying affects proposers' offers in the Ultimatum Game. Twenty undergraduates took part to the experiment by playing the role of proposers. They were matched with responders who could be sincere or lying. Participants' eye movements while watching the partners presenting themselves were recorded and their decision style (intuitive vs. deliberative) was assessed through the PID scale. It emerged that proposers offered less money to partners who were perceived as deceiving. Visual strategies during the inspection of the partner varied according to his/her perceived truthfulness. Decision style modulated both money offers and eye-movement patterns. The study supports the notion that lie detection is crucial in economic decisions involving the interaction with other people and that visual behaviors, as well as stylistic differences, play a mediating role.

Keywords: decision making, ultimatum game, lie, mindreading, eye movements, decision style

1. Introduction

According to the theory of rational choice, people should have coherent and self-interested preferences based on the assessment of the consequences of each possible choice of action. Yet, numerous studies have confirmed that individuals do not always act according to these assumptions and choices often are neither coherent nor self-interested. Some studies, for example, have shown that the choice is influenced by the representation of the advantage rather than the advantage itself [1]. In addition, Kahneman and Tversky [2] showed how important is, for determining the choice, the mere linguistic presentation of the positive or negative consequences of the different options. A decision anomaly, therefore, could be explained by the fact that people have different representations of the same dilemma of choice.

Anomalies of such a kind occur in economic games as the Ultimatum Game task [3]. In this classical economic game, participant A (proposer) has a certain amount of money to share with participant B (responder). B can either accept A's proposal for splitting the money between them or refuse it. If B accepts, the division becomes effective, otherwise both participants do not get anything. According to the theory of rational choice, B should accept any proposal by A, following the assumption that any sum of money is better than nothing. However, often participants' choices are influenced by the perception of unevenness, which is despised. Hence B usually turns down any offer that is less than half of the initial amount.

Within this framework, Kenning e Plassmann [4] described human behavior according to two systems: intuition and reasoning. These two systems operate together, balancing their contribution according to different tasks or settings. In a similar perspective, Sanfey and colleagues [5] distinguished between automatic and controlled processes. The first ones can not be consciously controlled by individuals and depend more on emotions and subjective variables such as motivation, attitudes, personality traits and thinking biases. Even though the two systems operate in every person, some people tend to rely more on either the first or the second system. The concept of "style" has been proposed to conceptualize this kind of individual differences. Styles concern the preferred strategies, which are relatively stable over time and across situations, of cognitive organization and functioning, as these emerge in perceiving, memorizing, learning, judging and solving problems [6]. The existence of stylistic differences has been proved in the specific field of decision making, where the dichotomy between intuitive-automatic and rational-controlled styles has been repeatedly proposed [7]. People characterized by the first style prefer to make decisions through a slow process, which implies a systematic, elaborated and logical evaluation of alternatives. People characterized by the second style, on the contrary, tend to decide through a fast, effortless and automatic process, which is usually based on hunches and feelings.

By referring to the Ultimatum Game, it is likely that players' choices are driven mainly by the first system, since the second one, relying on rational-utilitarian criteria, would lead proposers to split money selfishly and responders to accept any offer. If proposers behave fairly,

they are influenced by an intuitive sense of justice and modulate their offers according to the impressions provided by the partners; responders, on the other hand, reject unfair offers because of their immediate emotional reactions to the violation of such a moral sense. In order to explain decision anomalies in the Ultimatum Game, some authors referred to the theory of reciprocity [8]. According to the theory, people reward kind and punish unkind actions. Kindness regards both the intention and the consequences of an action. The same consequences of an action are perceived and reciprocated in a different way depending on the intention that guides the action. Thus, the way the players perceive the partners - an aspect of mindreading - is critical in determining their decisions in the Ultimatum Game [9].

An interesting and yet not investigated aspect of mindreading in the Ultimatum Game is the individuals' ability to detect lies in their partners. Lying is something constantly present in the course of life and it is easy to hypothesise that this may have an effect on everyday interactions. For instance, numerous studies showed that during conversation people make use of statements which are somehow misleading [10]. Although individuals tend to believe that other people are constantly telling the truth, every person intimately knows that this does not happen in all cases. Therefore, our decisions, which are based on information which we get from the surrounding context, is influenced not only by a general perception of others but also by our belief on what they are saying. For this reason exploring more deeply the link between decision making and lying (intended as an important interpersonal and emotive variable in everyday interaction) is relevant.

We lie for various reasons, from the most trivial to the most important ones [11]. Many theorists [12,13] argued that the reason for lying is somehow linked to survival of human species: actually, facing scarcity of resources, men have always lied to get what they needed. Like many other behaviours that were maintained over time for this reason, lying has now a different meaning. People do not lie only to gain resources needed for survival, but also, for example, to obtain desired but unnecessary goods, to look better, to deceive others, to protect those they care about and so on [14,15,16].

Lying is different from other similar concepts for three fundamental characteristics: the falsity of the content, which is communicated in a linguistic or extra-linguistic way; the knowledge of such falsity; the intent to deceive the recipient [17,18]. As far as the last characteristic is concerned, cognitive planning process is essential in lie. To better understand why people lie, it is important to distinguish between low-risk and high-risk lies, which represent, respectively, the two poles of a continuum. The first type can be defined as "a daily-life lie", which is said during the easy conversation and is not particularly relevant on the interpersonal level. It requires a limited cognitive effort in terms of planning and communication and it is characterized by a low concern about the possibility of being caught. A high-risk lie, on the other hand, involves serious consequences (in terms of costs, but also benefits) for both the liar and the partner. In this case, lying is a complex cognitive function, since it requires the activation of several different high functions, such as inhibitory control, working memory and advanced cognitive planning [19-25].

A model, particularly relevant to the present study, which integrates the requirements of these cognitive skills is the activation-decision-construct model (ADCM) developed by Walczyk and collaborators [21]. ADCM is a cognitive-based theory of deception that has three components. The first component is the activation of information, which requires working memory to manage the activated memories and knowledge of the truth. This is followed by the decision-making component, in which the choice to tell either the truth or a lie requires inhibition to suppress critical details related to the truth when a lie is said. Finally, the construction component, in which a plausible alternative to the truth is constructed, requires attention. However, when the speaker's intention is to respond honestly, only the activation component is required, suggesting an increased planning time requirement to tell a lie compared with the truth [21].

In general people, presumably because they are aware of how many resources are required to tell a lie, overestimate their ability to unmask those who lie [26]. However, many studies showed that humans are modest debunkers of the lies of others. Among the different human groups there are certain categories of people who have proven to be more adept at uncover lying clues, such as delinquents [27], spies and clinical psychologists [28]. The reason why human beings have, in general, limited powers to spot lies is related primarily to the lack of certain and universal clues to detect lies. The second reason for this difficulty is related to the extreme heterogeneity of registers and styles of communication used in lying. Thirdly, people develop stereotypical "theories" on clues that help to detect lies, which are not based on empirical evidence, and can easily lead to errors of judgment. Fourthly, it should be noted that the basic social conventions tend not to lead to suspicious attitude. Doubting everything and constantly accusing others of falsehoods prevents establishing any relationship of intimacy and trust [26]. Lying is thus an important interpersonal phenomenon that serves the purpose of regulating social life [29].

The present study was designed to investigate how lies affect decision-making processes in the economic domain. We used the Ultimatum Game task to test our main hypothesis that economic decisions are affected by the perception of lies. The effects of lying were investigated not only through direct behavioural and self-report measures, but also implicit indexes derived by the use of eye-tracking technologies. More in detail, the following hypotheses were formulated.

1. Because of the influence of mindreading process in the Ultimatum Game, when an individual believes that his/her partner is lying, this can rise negative attitudes towards him/her and affect how this individual will calibrate his/her choices, which will be aimed in some way at disadvantaging and hinder the insincere partner. Hence, we expected that in the Ultimatum Game detecting the lie leads the proposer to give a less fair offer to the responder.

2. Knowing that the partner may lie should lead individuals to use different visual strategies to process the non-verbal communication of the other player. It was expected that, while looking videos showing a lying partner, players focus more on hands (as reliable indicators of the tension produced by the intention to

deceive), but while watching true presentations attention would be directed mainly to the face.

3. We also hypothesized that individual decision-making style affects:

3a. Players' visual behaviors: it was expected that intuitive people are mostly attracted by the face and rational people by the hands in their visual exploration of the partner. The former ones should try to make the most of the our main non-verbal mean of communication (the face) because it can provide an overall impression of the partner's intentions; the latter ones should try to build their judgment on the part of the body (the hands) which conveys a set of cues about the tension-relaxation state of the partner from which it can figured out if he/she is lying.

3b. The decision-making strategies used during the Ultimatum Game Task: intuitive decision-makers, because of their higher skill in detecting lies (see 3c), should be more affected by mindreading, and hence offer less money to lying responders.

3c. Their ability in detecting lies: intuitive individuals should base their representations on the non-verbal hunches provided by the interlocutor, without analysing thoroughly the truthfulness of the message received (an operation which is not possible with time constraints as those imposed in our experiment).

2. Materials and Methods

2.1. Instruments

2.1.1. Decision-Making Task

The Ultimatum Game task was employed. Participants played the role of proposer in 4 consecutive runs. In each run they were matched to a different, unknown responder, who was presented to them through a video. Responders were 4 people who volunteered to present themselves and having their presentations recorded. We chose 2 men and 2 women. Within each couple of responders, one person was close to the participants' age, whereas the other one was older. The responders presented themselves following the same schema in providing information (see Table 1 for details). Information to be provided in the presentation was derived from personal knowledge that proved to be influential in the Ultimatum Game to modulate players' behaviour according to their perception of the partner's intentions [30]. We asked each responder to provide two versions of his/her presentation, focusing on the same topics, but once they had to say the truth, the other one they had to lie. Topics (see Table 1) have been defined by the researchers. The truth version corresponded to responder's real life, the false one was a plausible one. Each false version was proposed by responders and then discussed with researchers in order to guarantee homogeneity within the different presentations. None of the responders were professional actors, in order to have more spontaneous behaviours. We asked responders to wear simple clothes with neutral colours. Each video featured the responder's steady close-up. All the videos had approximately the same length.

Table 1. Summary of Information about the Responder Provided to Participants in the Video Presentations

Responder: ALEX (age 21)		
	TRUE	FALSE
Occupation	Student and waiter	Drop out from school, he helps his father in his hardware store
Interest	Writing	Politics and reality shows
Personal value	Flexibility and independence	He believes in institutions
Family	He teaches rugby to children. He is very attached to his family. His dream is to write a book. He believes that fantasy can help to live a better life.	His mother is a doctor. He has a younger brother who gets the most attention. He relieves his trust in government that, according to him, reflects the interests of most families.
Responder: ELIJAH (age 46)		
	TRUE	FALSE
Occupation	Probation officer	Chef
Interest	Sports	He likes travelling
Personal value	Determination	Ambition and hard work
Family	He is the eldest son. Married for 15 years. Introverted and stubborn. He is not interested in politics and do not believes in institutions.	It owns a restaurant on Lake Garda; he had to make many sacrifices, but he loves his job because it is creative. He lives with his girlfriend and they have a 7-year-old daughter.
Responder: ESTHER (age 25)		
	TRUE	FALSE
Occupation	Student	Clerk and bartender
Interest	Chess	Having fun and meeting people
Personal value	She believes in family	She never compromises
Family	She has a 6-month-old daughter with a former teacher with whom she lives. She is not wealthy but she is happy because she has everything she needs.	She is dating a new guy. She likes moving and she hopes to move to Rome in the coming future. She is determined and stubborn.
Responder: ARMANDA (age 54)		
	TRUE	FALSE
Occupation	Employee	Florist
Interest	Politics ad traveling	Photography
Personal value	Fairness, equality and justice	She believes that children of different nationality should have separate school courses
Family	She has two grown sons. She was the first mayor woman of her town.	Her husband is laid off. She has no children but she always took care of her niece. She would like to make a trip to the US.

After shooting the videos, each of them was examined by three psychologists (not aware of the research aims and not informed about which videos were true or false), who were asked to observe them looking for signals of

deceptions. Judges were provided with an observation form where some indexes were listed. The indexes, derived from the literature [26,31,32], were: smiles, head movements, eye movements, pauses, voice pitch, eyelids

beats. Judges were asked to rate each index as revealing either a sincere or lying responder's attitude. Significant differences in ratings between true and false presentations emerged in all judges' reports, thus supporting the notion that videos included cues from which the participants could infer the partner's intention (that is, telling the truth or lying).

In each run the participant had to decide how to split 100 euros with the responder. Responders' feedbacks were revealed at the end of the 4 runs. It was set that the responders accepted fair (50:50) and rejected unfair offers (participants were unaware of this criterion). One out of the 4 responders was randomly selected at the end of the game and the 10% of the pay-off of the corresponding run was given to the participant (thus, a participant gained 5 euros if he/she split money fairly with the extracted responder, nothing if he/she split money unfairly).

2.1.2. Eye-Movement Recording

While playing the Ultimatum Game, participants' eye movements were recorded using an eye-tracking (ET) system. This tool, using infrared technology, allows investigators to record eye movements made by a participant in front of a monitor that shows a video or an image. We used a Tobii x-120 eye-tracker and analysed data by means of the Tobii Studio software. This system allows a rapid and automatic calibration procedure for each participant. Tolerance of large head movements allows participants to move freely and naturally in front of the stimulus. If the subject moves out of range, the ET system resumes almost instantly when he/she comes back into range. The unobtrusive technology creates a distraction-free test environment, ensuring the natural behaviour of subjects and valid research data. Advanced drift compensation maintains high accuracy and precision under varying light conditions. Robust ET capability ensures very low data losses, regardless of the participant's ethnic background, age, use of glasses, contact lenses or mascara.

The qualitative output provided by ET is represented by clustered images related to the most intensely fixated areas of the stimuli. Quantitative data return specific measures linked to number and lengths of fixations and observations. These indexes were considered with reference to two specific parts of the stimuli (called "areas of interest": AOI): the face and the hands of the responder. The indexes considered in our study were: time passing before the first fixation (TBFF: the time in seconds from when the stimulus was shown until the start of the first fixation within an AOI), first fixation duration (FFD), fixation length (FL: the length of the fixations in seconds within an AOI), fixations count (FC: the number of fixations within an AOI), observation length (OL: the total time in seconds for every time a person has looked within an AOI, starting with a fixation within the AOI and ending with a fixation outside the AOI) and observations count (OC: The number of visits and re-visits to an AOI). These data are useful to see if people use different visual strategies when trying to detect lies, focusing more on those non-verbal indexes that are associated with lies.

2.1.3. Assessment of the Decision-Making Style

The Preference for Intuition-Deliberation scale (PID) [33,34] was administered to identify the preferred decision

style. PID includes two subscales of 9 items each: one measures the tendency for intuition (PID-I) and the other one for the deliberation (PID-D). Examples of items on the two subscales are:

- "Before making decisions I first think them through" (PID- D).

- "I listen carefully to my deepest feelings" (PID-I).

Participants express their degree of agreement with each statement on a scale with five possible responses, with 1 corresponding to complete disagreement and 5 corresponding to complete agreement.

Factorial analysis confirmed the two-subscale structure and their time stability ($r = .59$ for PID-D and $r = .76$ for PID-I after two weeks; $r = .74$ for PID-D and $r = .76$ for PID-I after 6 months). The psychometric properties of PID were confirmed for the Italian version of the instrument [35]. The PID appears to be a reliable instrument to assess stylistic differences in decision making [36].

Since the decision-making style has not to be intended as dichotomy, we computed the scores for the two subscales and then assigned participants to three groups: intuitive (participants falling in the two highest quartiles in the distribution of scores in the PID-I subscale), deliberative (two highest quartiles in the PID-D subscale) and balanced (two lowest quartiles in the PID-I and PID-D subscales).

2.2. Sample and Procedure

Twenty university students (15 girls and 5 boys, aged between 22 and 25 years) took part to the study. They attended different faculties. They had never played the Ultimatum Game before and they did not attend courses concerning both decision making nor economic psychology and behavioural economics. They received no course credit nor were paid for participation, except the 5-euro gain which they possibly obtained according to how they split money with the extracted responder.

The experiment took place in a quiet laboratory room. Participants were tested individually in a session of about 30 min. The first part of the session was carried out in front of a computer screen. Firstly the equipment to record eye movements was installed and calibrated. The rules of the Ultimatum Game were explained. In each run of the game the participant firstly watched the video where the responder presented him/herself. Participants knew that their partners in the game might be lying when presenting themselves. Afterwards the participant decided how the sum of 100 euros had to be split between him/herself and the partner. Participants gave their responses aloud and the experimenter recorded them. Finally the participant was asked to rate responder's truthfulness on a dichotomy scale ("he/she is lying" - "he/she was telling the truth").

Each participant was exposed to two true and to two false videos. The combinations of responders (Alex, Elijah, Esther, Armanda) and conditions (true, false) was designed so that each responder was presented in the true and false conditions the same number of times. The order of presentation of the responders and of the conditions was counterbalanced in the whole sample so to control possible order and sequence effects.

Before leaving the room, participants were asked to fill in the PID questionnaire in a paper-and-pencil format.

3. Results

3.1. Lie Detection

As far as the participants' responses concerning the truthfulness of the presentations, it was found that proposers tended to regard their partners in the Ultimatum Game as sincere. This was true of Alex, Elijah and Esther. The opposite was true of Armanda (Table 2). In any case,

Table 2. Percentages of Participant's Responses Concerning the Truthfulness of the Partners

	Alex		Elijah		Esther		Armanda	
	"Is lying"	"Is telling the truth"	"Is lying"	"Is telling the truth"	"Is lying"	"Is telling the truth"	"Is lying"	"Is telling the truth"
True Video	20	80	30	70	10	90	70	30
False video	40	60	40	60	30	70	80	20

3.2. Effects of Lying on Decision Making

The means of the sums of money offered to each responder by the participants under the sincere and lying conditions were computed. The mean amount of money given to the responders was not different by comparing actually true and false presentations. However, by considering the true/false distinction as based on the participants' perceptions (namely, by computing the mean offers given to the responders when they were perceived, respectively, as being sincere or lying) differences emerged. Participants offered less to every responder when they believed that the partner was lying and this was especially true when they were faced to female responders (Table 3).

Taking into account the decision-making style, a link was found between this individual difference and the offer

when the responder presented him/herself in a false way, the percentage of the response "Is telling the truth" decreased. Such a trend emerged with all responders.

Analysing the accuracy of lie detection according to the decision style, it was found that intuitive participants provided a higher percentage of correct answers (58.33%) as compared to the deliberative ones (41.67%), but this difference was not statistically significant ($p > .05$).

to Armanda when she was perceived as lying ($F_{(2,9)} = 7.92, p < .05$): deliberative decision-makers offered much more ($M = 61.67$ euros, $SD = 10.4$) than intuitive ($M = 31.00$ euros, $SD = 13.4$) and balanced ($M = 20.00$ euros, $SD = 14.0$) decision-makers. In all other cases (for each responder and condition) balanced participants tended to offer more than the other subsamples.

Table 3. Amount of Money (in Euros) Proposed to the Responders Depending on Truth Judgments

Character	Judgment	M (SD)	t_{19}
Armanda	"Is telling the truth"	48.00 (17.89)	2.19 $p < .05$
	"Is lying"	26.00 (14.42)	
Esther	"Is telling the truth"	46.25 (21.87)	2.38 $p < .05$
	"Is lying"	31.25 (6.29)	
Elijah	"Is telling the truth"	47.33 (19.17)	0.35 $p > .05$
	"Is lying"	47.00 (16.43)	
Alex	"Is telling the truth"	35.00 (15.06)	0.30 $p > .05$
	"Is lying"	32.50 (20.92)	

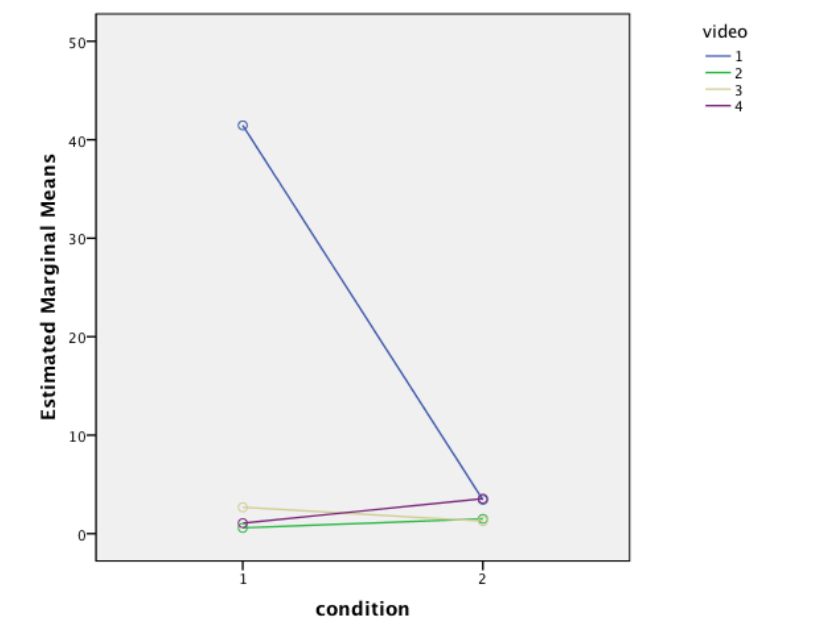


Figure 1. Mean Values of the TBFF Index (AOI = Face) for Each Responder under the True vs. False Conditions

3.3. Visual Behaviour

We tried to highlight possible effects depending on the responders, the condition (true vs. false video) and their interaction on the participants' visual behaviour while watching the partners' presentations. Running a repeated-measured ANOVA, the significant main effect of

responder emerged ($F_{1.04, 18.67} = 4.53, p < .05, \eta^2 = .32$) on the TBFF index related to the AOI of face. As it clearly detectable from Figure 1, the effect concerns mainly Video 1 (Alex) in Condition 1 (False) where the highest value ($M = 41.46, SD = 60.89$), compared to the other responders, was recorded. This effect can be due to the very first information given by Alex in the false condition

(being a school drop-out working with his father): it is possible that participants focused first on the general environment to search for evidence of this statement, which could be confirmed by a more scruffy environment.

Considering the FL index concerning the AOI of face, a significant main effect of the responder emerged ($F_{3, 54} = 29.45, p < .001, \eta^2 = .67$). Comparing the simple effects of the different responders, we found significant differences between Armanda's presentations compared to all other ones (vs. Alex: $p < .001$; vs. Elijah: $p < .001$; vs. Esther: $p < .001$), but also between Alex and Esther ($p < .001$) and between Elijah and Esther ($p < .001$). As can be seen in

Figure 2, Video 1 (Alex) and 3 (Elijah) obtained low scores, whereas Armanda (Video 2) had the highest.

Analysing the index FL related to AOI of hands, we observed a different trend, with a significant interaction effect of responder and condition ($F_{3, 54} = 3.06, p < .05, \eta^2 = .28$). Considering the simple effects, particularly relevant is the video of Esther, for which there was a significant difference if compared to Elijah ($p < .05$) and a significant change from a condition to the other one: while looking at false presentations, participants tended to focus more on the hands than on the face (Figure 3).

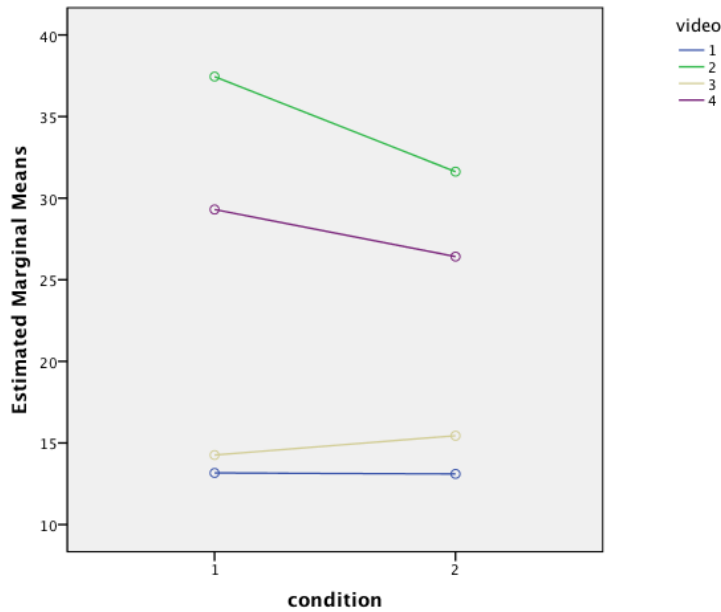


Figure 2. Mean Values of the FL Index (AOI = Face) for Each Responder under the True vs. False Conditions

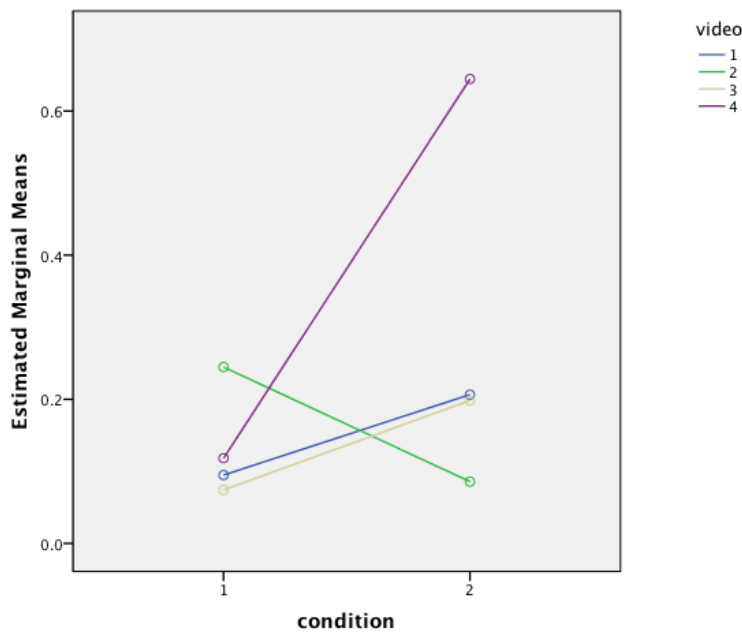


Figure 3. Mean Values of the FL Index (AOI = Hands) for Each Responder under the True versus False Conditions

Taking into account the FFD index related to the AOI of face, the main significant effect of the responder ($F_{3, 54}$

$= 3.10, p < .05, \eta^2 = .29$) and the significant interaction of video and condition ($F_{3, 54} = 2.89, p < .05, \eta^2 = .27$)

emerged. Considering the simple effects, the two more interesting presentations were those of Alex and Armanda. Alex's one turned out to be extremely different almost from all the other presentations (vs. Armanda: $p < .05$; vs. Elijah: $p = .07$; vs. Esther: $p < .05$), showing that participants, while looking at this presentations, focussed less, when starting their visual exploration, on his face, compared to what they tended to do while looking at other presentations (Figure 4). Yet, this data could be explained also by a greater richness of contextual elements in this

specific presentation. The video of Armanda is also particularly interesting as it showed the largest gap between the first and the second condition. In the truthful presentation, in fact, there was a greater duration of the first fixation of her face. Adding to this data those derived from the FL indexes related to AOI of hands, we can derive a clear trend: in the truthful presentation people tended to focus more on the face, whereas they directed their attention on hands while looking at the false one.

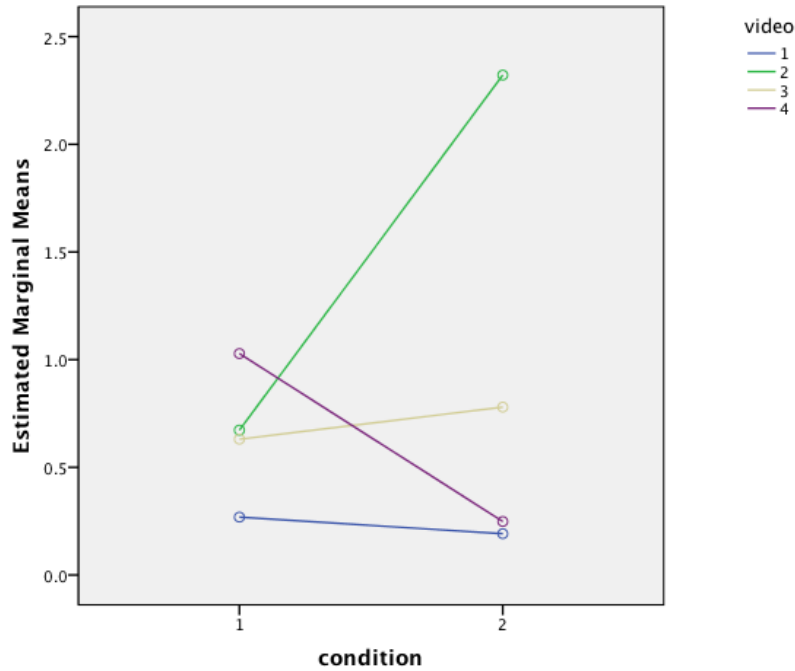


Figure 4. Mean Values of the FFD Index (AOI = Face) for Each Responder under the True vs. False Conditions

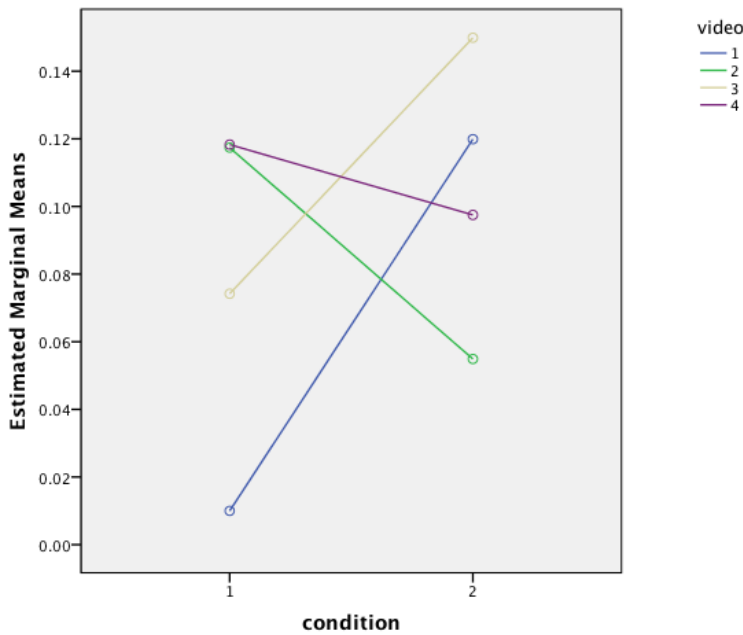


Figure 5. Mean Values of the FFD Index (AOI = Hands) for Each Responder under the True vs. False Conditions

Although no significant data emerged regarding the FFD index on the AOI of hands, it is worthwhile to note a general trend in visual behaviour regarding this index. It is possible to notice that Alex’s and Elijah’s videos on the one side and Esther’s and Armanda’s videos on the other one varied in the same direction: for the first two responders the higher value of this index occurred in the second condition than the first one; for the latter responders, on the other hand, the higher value occurred in the first condition (Figure 5).

Some interesting results were found in relation to the decision-making style. Deliberative decision-makers explored the face later (TBFF: M = 18.13, SD = 27.73), whereas the balanced ones took less time to focus their attention onto the face (TBFF: M = 10.97, SD = 22.00), but only with male responders. When faced to the women’s presentations, instead, intuitive and balanced participants were much slower (TBFF: M = 14.35, SD = 19.05), compared to the deliberative ones (TBFF: M = 2.90, SD = 6.59), in focusing their attention onto the partners’ hands. It was also possible to note that, with regard to indexes such as FC and OL, intuitive

participants were more focused on faces whereas balanced individuals had higher values in such indexes for the AOI of hands (Table 4).

Table 4. Mean (SD in Parentheses) Values of Attention Focussing Indexes by Intuitive and Balanced Decision-Makers

Visual behaviour index	AOI	Intuitive	Balanced
FC	Face	38.85 (28.49)	24.92 (19.74)
	Hands	0.54 (0.87)	1.33 (1.94)
OL	Face	40.35 (8.11)	27.44 (16.50)
	Hands	0.21 (0.37)	0.49 (0.70)

Participants’ visual behaviour differed also when they were looking at videos believing that the responder was telling the truth or was lying, but this happened only when proposers were looking at older responders’ presentations. Considering Elijah, differences emerged when participants were looking at his false presentation: those who believed him to be truthful observed more his face than those who believed he was lying (Table 5). As far as Armanda is concerned, differences emerged as well only when examining her false presentation: people who believed her to be telling lies focused on her hands (Table 5).

Table 5. Participants’ Visual Behaviour According to the Responder’s Perceived Truthfulness

Elijah (False presentation) - AOI = face			
OL	M (SD)	t ₉	
“He is lying”	14.47 (9.43)	-2.88	p < .05
“He is telling the truth”	42.56 (2.41)		
Armanda (False presentation) - AOI = hands			
FFD	M (SD)	t ₉	
“She is lying”	0.16 (0.17)	2.52	p < .05
“She is telling the truth”	0.00		
FC	M (SD)	t ₉	
“She is lying”	0.71 (0.70)	2.50	p < .05
“She is telling the truth”	0.00		

4. Discussion

The first interesting finding of this study is related to the evaluation of truth. Participants tended to perceive information provided by their partners in the Ultimatum Game as truthful. The only remarkable exceptions concerned the two videos of Armanda. This woman was always considered false by most participants. Actually, if we consider the percentages of truth evaluation without the ratings on Armanda’s videos, the percentages are even more impressive: 75% judged the information as true and only 25% as false. This finding is coherent with the literature, which suggests that people are poor at detecting lies. A meta-analysis of 206 studies showed an average hit rate of 54%, which is surprising given that chance performance is 50% [37]. The exception constituted by Armanda can be explained considering that she was the female character far from our sample mean age, and hence participants could have perceived her as more distant, tending to judge her as liar. This interpretation can be supported considering that the other female character (Esther), who was close to our sample’s age range, was mostly described as sincere. Hence, young adults could tend to believe that their peers are sincere because lying to a peer is perceived as more stressful and as a more severe moral infraction [38]. Another possible explanation makes reference to Armanda’s personal characteristics: she tended to speak very quickly, moving her hands and she was cold and unemotional, so showing indicators that

people associate to lying [32]. Given the general tendency to trust their partners, it is worth noting, however, that our participants were rather able to discriminate when responders were lying, since the percentages of the response “Is telling the truth” decreased when proposers were faced to false videos.

Comparing individuals’ responses according to their decision-making style, it appeared that intuitive persons gave more accurate judgments. This could be explained referring to the task itself, which required a very quick evaluations (each video was less than 2 minutes long) and answers: intuitive people may had been advantaged by this requirements. Actually, when tasks cannot be performed through analysis, when they are complex and time pressure is high, intuition may be the more advantageous decision style [39,40].

The second finding is that proposer’s behaviour is affected by his/her perception of the partner and that the effect is modulated by stylistic differences. In fact, the sum of money offered to the responders depended on the judgement of veracity and the decision-making style. Considering the opinions about truthfulness, people tended to offer less when they believed that the responders were lying and this was particularly true when the partners were women. This result, along with the highest difference in offer found when Esther (young woman) was perceived as a liar, could be explained referring to our peculiar sample, composed mostly by women and keeping in mind that a lie told by a peer is considered as a more severe moral infraction [38].

Decision-making style had a strong influence in relation to the false video of Armanda, in response to which deliberative individuals offered much more than the other ones. This may be due to the fact that information provided was more complex than in other videos and analytic people tended to trust more this format, which was perceived as closer to their own way of thinking. In all other situations, balanced participants tended to propose higher amounts to the partners. This can be explained hypothesising that intuitive persons were advantaged in this task and tended to calibrate better their offers, resulting in lower offers; on the other hand, the deliberative style was found to be positively correlated with basic beliefs [41] and such beliefs can lead people to be more conservative in offering money to people who could be lying.

Participants' visual behaviour differed when they were looking at true and false videos and when believing that the partners were telling the truth or were lying, but this happened only when looking at older respondents' presentations. It was probably easier for our sample to hypothesise that an older person was lying to them. When exploring a video believing that the character was telling the truth, people focused more on his/her face, probably trying to confirm their conjectures. This is explained by the fact that people are more attracted to this area of the body when they are listening to a person and this is especially true while they are evaluating, with a positive attitude, the truthfulness of what they are told [42]. The opposite behaviour might occur when people are looking at a partner who they do not suppose to be honest.

By analysing eye movements we highlighted interesting patterns of visual behaviour. Among the 12 indexes considered (6 for the AOI of face and 6 for the AOI of hands), most of them showed significant differences among videos or video X condition interaction effects. Participants' visual behaviour changed in different conditions. It was actually possible to describe a strong general trend: while watching false presentations, participants were more focused on the hands rather than on the face, whereas the opposite was true of sincere responders. It seems, therefore, that people, when suspect that their partner is lying, focus on hands' movement, probably to look for signs of nervousness, whereas they pay more attention to the face when they presume to receive true information, and this is coherent with previous results [32].

Examining participants' visual behaviour also highlighted some differences based on individual style. Deliberative decision-makers tend to focus more on hands; in contrast, intuitive individuals are more interested in exploring faces. This is especially true for intuitive decision-makers when looking at men's presentation and for deliberative persons when looking at women's presentations.

5. Conclusions

This pilot study allowed us to confirm almost all the initial hypotheses and it was also possible to explore more deeply some issues. Our first hypothesis - according to which people, when facing a lying player, would tend to lower their offer - was confirmed, mostly with female

partners. This finding, however, needs to be explored more, maybe using a sample balanced by gender.

The second hypothesis, on the other hand, was fully confirmed: data highlighted that participants applied different visual strategies when exploring different videos and differences were due to believing the respondents were lying or telling the truth.

Decision-making style affected visual behaviour, thus confirming hypothesis 3a. Hypothesis 3b was only partially confirmed. According to the hypothesis, when faced with Armanda, intuitive participants gave her less money than deliberative participants. In all other cases the balanced individuals offered more, whereas no significant differences emerged between deliberative and intuitive decision-makers. It is likely that, whereas deliberative persons tend to be more thoughtful, intuitive ones are more able to detect lies (see hypothesis 3c), and hence offer less money to the liars. Hypothesis 3c was also confirmed: intuitive participants gave more accurate responses in the lie-detection task, even if the difference was not statistically significant.

In conclusion, the study supported the notion that lie detection is crucial in economic decisions involving the interaction with other people and that visual behavior, as well as stylistic differences, plays a mediating role.

However, though the reported results appear to be promising and add a few relevant information about the role of visual behaviour in the Ultimatum Game, different aspects of the study should be investigated involving a larger sample of participants which allows investigators to test the possible effects of participants' gender.

Statement of Competing Interests

The authors have no competing interests.

References

- [1] Chen, S.F.S., Monroe, K.B. and Lou, Y.C., "The effects of framing price promotion messages on consumers' perceptions and purchase intentions". *Journal of Retailing*, 74, 353-372, 1998.
- [2] Kahneman, D. and Tversky, A., "Prospect theory: An analysis of decision under risk", *Econometrica*, 47, 263-291, 1979.
- [3] Powell, K., "Economy of the mind", *PLoS Biology*, 3, 312-315, 2003.
- [4] Kenning, P. and Plassmann, H., "Neuroeconomics: An overview from an economic perspective", *Brain Research Bulletin*, 67, 343-354, 2005.
- [5] Sanfey, A.G., Loewenstein, G., McClure, S.M. and Cohen, J.D., "Neuroeconomics: cross-currents in research on decision-making", *Trends in Cognitive Science*, 3, 106-116, 2006.
- [6] Antonietti, A., "Cognitive styles assessment", in *Encyclopaedia of psychological assessment*, Sage, London, 2003, vol. I, 248-253.
- [7] Betsch, C., and Kunz, J. J., "Individual strategy preference and decisional fit", *Journal of Behavioral Decision Making*, 21, 532-555, 2008.
- [8] Falk, A., and Fischbacher, U., "A theory of reciprocity", *Games and Economic Behaviour*, 54, 293-315, 2006.
- [9] Hauselhuhn, M.P., and Mellers, B., "Emotion and cooperation in economic games", *Cognitive Brain Research*, 23, 24-33, 2005.
- [10] Turner, R. E., Edgley, C., and Olmstead, G., "Information control in conversations: Honesty is not always the best policy". *Kansas Journal of Sociology*, 11, 69-89, 1975.
- [11] Scott, G., *Playing the lying game: Detecting and dealing with lies and liars, from occasional fibbers to frequent fabricators*, Praeger/ABC-CLIO, Santa Barbara (CA), 2010.

- [12] Egan, L. C., "Self-deception is adaptive in itself", *Behavioral and Brain Sciences*, 34, 19-20, 2011.
- [13] Von Hippel, W., and Trivers, R., "The evolution and psychology of self-deception", *Behavioral and Brain Sciences*, 34, 1-16, 2011.
- [14] Knapp, M. L., *Lying and deception in human interaction*, Pearson Education, Boston (MA), 2008.
- [15] Levine, T. R., Kim, R. K., and Hamel, L. M., *People lie for a reason: An experimental test of the principle of veracity*, Unpublished manuscript, Michigan State University, 2009.
- [16] Suddendorf, T., "Evolution, lies, and foresight biases", *Behavioral and Brain Sciences*, 34, 38-39, 2011.
- [17] Ford, C. V., King, B. H., and Hollender, M. H., "Lies and liars: Psychiatric aspects of prevarication", *American Journal of Psychiatry*, 145, 554-562, 1998.
- [18] Bok, S., *Lying: Moral choice in public and private life*, Vintage, New York, 1999.
- [19] Carlson, S. M., Moses, L. J., and Hix, H. R., "The role of inhibitory processes in young children's difficulties with deception and false belief" *Child Development*, 69, 672-691, 1998.
- [20] Carlson, S. M., and Moses, L. J., "Individual differences in inhibitory control and children's theory of mind" *Child Development*, 72, 1032-1053, 2001.
- [21] Walczyk, J. J., Roper, K. S., Seemann, E., and Humphrey, A. M., "Cognitive mechanisms underlying lying to questions: Response time as a cue to deception", *Applied Cognitive Psychology*, 17, 755-774, 2003.
- [22] Walczyk, J. J., Schwartz, J. P., Clifton, R., Adams, B., Wei, M., and Zha, P., "Lying person-to-person about life events: A cognitive framework for lie deception", *Personnel Psychology*, 58, 141-170, 2005.
- [23] Gombos, V. A., "The cognition of deception: The role of executive processes in producing lies", *Genetic, Social, and General Psychology Monographs*, 132, 197-214, 2006.
- [24] Talwar, V., and Lee, K., "Social and cognitive correlates of children's lying behavior", *Child Development*, 79, 866-881, 2008.
- [25] Evans, A. D., Xu, F., and Lee, K., "When all signs point to you: Lies told in the face of evidence", *Developmental Psychology*, 47, 39-49, 2011.
- [26] Ekman, P., *Telling lies: Clues to deceit in the marketplace, politics, and marriage*. Norton and Co., New York, 2009.
- [27] Vrij, A., and Semin, G. R., "Lie experts' beliefs about nonverbal indicators of deception" *Journal of Nonverbal Behavior*, 20, 65-80, 1996.
- [28] Ekman, P., O'Sullivan, M., and Frank, M. G., "A few can catch a liar" *Psychological Science*, 10, 263-266, 1999.
- [29] Vrij, A., *Detecting lies and deceit: Pitfalls and opportunities* (2nd ed.), Wiley, New York, 2008.
- [30] Iannello, P., and Antonietti, A., "Reciprocity in financial decision-making: Intuitive and analytical mind-reading strategies", *International Review of Economics*, 55, 167-184, 2008.
- [31] DePaulo, B. M., "Spotting lies: Can humans learn to do better?", *Current Directions In Psychological Science*, 3, 83-86, 1994.
- [32] Sporer, S. L., and Schwandt, B., "Moderators of nonverbal indicators of deception: A meta-analytic synthesis". *Psychology, Public Policy, and Law*, 13, 1-34, 2007.
- [33] Betsch, C., "Preference for intuition and deliberation (PID): An inventory for assessing affect and cognition based decision-making", *Zeitschrift für Differentielle und Diagnostische Psychologie*, 25, 179-197, 2004.
- [34] Betsch, C., "Chronic preferences for intuition and deliberation in decision making: Lessons learned about intuition from an individual differences approach", in H. Plessner, C. Betsch, and T. Betsch (Eds.), *Intuition in judgment and decision making*, Lawrence Erlbaum Associates, Mahwah (NJ), 2007.
- [35] Raffaldi, S., Iannello, P., Vittani, L., and Antonietti, A., "Decision-making styles in the workplace: Relationships between self-report questionnaires and a contextualised measure of the analytical-systematic vs. global-intuitive approach", *Sage Online*, 2012.
- [36] Richetin, J., Perugini, M., Adjali, I., and Hurling, R., "The moderator role of intuitive vs. deliberative decision making for the predictive validity of implicit and explicit measures", *European Journal of Personality*, 21, 529-546, 2007.
- [37] Bond, C.F. Jr., and DePaulo, B.M., "Accuracy of deception judgments", *Personality and Social Psychology Review*, 10, 214-234, 2006.
- [38] Grover, S. L., "Lying to bosses, subordinates, peers, and the outside world: Motivations and consequences", in J. Greenberg and J. Greenberg (Eds.), *Insidious workplace behavior*, Routledge/Taylor and Francis Group, New York, 207-235, 2010.
- [39] Wilson, T.D., *Strangers to ourselves: Discovering the adaptive unconscious*, Harvard University Press, Cambridge (MA), 2002.
- [40] De Vries, M., Holland, R., and Witteman, C.L.M., "Fitting decisions: Diffuse affect and intuitive vs. deliberative decision strategies", *Cognition and Emotion*, 22, 931-943, 2008.
- [41] . Catlin, G., and Epstein, S., "Unforgettable experiences: The relation of life events to basic beliefs about self and world", *Social Cognition*, 10, 189-209, 1992.
- [42] Hartwig, M., and Bond, C.R., "Why do lie-catchers fail? A lens model meta-analysis of human lie judgments", *Psychological Bulletin*, 137, 643-659, 2011.