

Unraveling the Tapestry of Deception and Personality: A Deep Dive into Multi-Issue Human-Agent Negotiation Dynamics

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ABSTRACT

Exploring the intricacies of human behavior in negotiations is pivotal in developing advanced human-agent interaction systems. This study delves into the complex interplay between deception, personality traits, and self-reported truthfulness in the context of human-agent negotiations, leveraging the IAGO platform [34] to facilitate multi-issue bargaining tasks. Our exploration, which also ventures into the realm of agent avatar gender and personality trait display, is centered around understanding how individual personality traits influence deceptive behaviors and perceptions in negotiations. Our findings establish a significant alignment between participants' self-reported truthfulness and their actual behaviors, underscoring the reliability of self-reports. Moreover, intricate relationships were uncovered between the Big Five personality dimensions—Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism [3, 9]—and human user's self-reported truthfulness, as well as beliefs about the necessity of deception in negotiations. To illustrate, individuals with higher levels of Openness were more likely to report being truthful but also believed more strongly in the necessity of deception for successful negotiations. These nuanced insights into personality-driven behaviors and perceptions are instrumental in fostering the development of adaptive and sophisticated negotiation agents, enhancing the comprehension of dynamics in human-agent interactions. Our findings present refined perspectives on the congruence and potential divergences between perceived necessity and the actual enactment of deceptive behaviors, laying a robust foundation for future investigations in agent personalization and human-agent interactions within negotiation contexts.

KEYWORDS

Human-Agent Negotiation; Deception; Personality Dimensions; Agent Personalization; IAGO Platform

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1 INTRODUCTION

Negotiation, an intricate multi-dimensional interaction, permeates numerous domains and has become a crucial research point in artificial and social intelligence realms. Advanced negotiation has applications across artificial intelligence (AI) subdomains. Human-agent negotiation research has focused both on making agents more effective (by understanding and adapting to human personality) and making agents more realistic (by emulating aspects of human idiosyncrasies) [15, 67]. Extensive research has propelled the development of automated agents and systems designed to elevate social competencies vital for skilled negotiation and enhanced human-agent interactions [19, 30]. Notable advancements like the Conflict Resolution Agent (CRA), GENIUS, and NegoChat have targeted specific domains such as multi-issue bargaining [20, 53]. Others, such as CICERO, have explored different aspects like Diplomacy [37]. This profundity of research has led to advancements in unique features of agent interaction encompassing personality, favor exchange, long-term reasoning, and more.

Utilizing the IAGO platform (Interactive Arbitration Guide Online) as our key research tool, we navigate the complex realm of human-agent negotiations [34]. IAGO, notable for its asynchronous functionality and its precise ability to record detailed negotiation histories, provides an enriched user experience by featuring an avatar capable of displaying emotion (see Figure 1). It provides an essential framework for scrutinizing social cognition and refining interpersonal skills, especially within the challenging paradigm of multi-issue bargaining tasks. This involves participants negotiating over various issues, engaging in preference information exchange, and offer presentations, substantiating it as a vital domain for developing socially adept AIs [62]. The increasing focus towards agents that align with human strategies [55] and those crafted with human-understandable behaviors [66] underscores the indispensability of platforms like IAGO. It not only facilitates the development of socially proficient AIs but also advances agent personalization, ensuring rational and effective human-agent interactions across diverse functional systems.

Agent personalization has emerged as a crucial facet of agent-related research, involving adaptation to individual user characteristics, inclinations, and preferences. This approach has increased efficacy and user satisfaction across various applications [16, 18, 38, 51]. The importance of agent personalization extends across varied research strands exploring the impacts of agent characteristics, like accents [13] and anthropomorphism [23]. Additionally applications in healthcare via virtual caregiver systems [56], computational empathy [43], and insights from affective text analysis [56] elucidate complex aspects of user satisfaction in human-machine dialogues

[33, 45, 49], emphasizing the imperative to probe into the subtle interplay between agent behavior and user characteristics to comprehensively understand agent personalization within support systems.

Exploring personalization in agent support systems allows agents to modify their behavior adeptly, enhancing interaction and negotiation quality [41]. Human behaviors, from overt characteristics like age to subtle ones like personality, impact negotiations significantly [41]. Particularly, emotions such as anger and happiness profoundly influence negotiation outcomes, largely dependent on an individual’s engagement in thoughtful information processing [62]. Notably, gender disparities in negotiation outcomes often favor men due to various factors [58]. While existing research has explored agent personality expression and the dependency of optimal robot personality on task context [29], investigating the impact of user personality on negotiations and agent interactions remains a promising research avenue.

Within the complex interplay between personality, deception, and negotiation, a multifaceted domain is revealed, intertwining psychological dimensions with interaction and negotiation dynamics [6]. The incursion of personality into negotiation, especially deception—a red yet controversial strategy [50, 60]—entwines with the “Dark Triad” of personality traits, notably Machiavellianism, influencing deceptive conduct and bargaining outcomes [14, 28]. The nuanced relationship between deception and Dark Triad traits demonstrates a complexity, where elevated traits do not consistently equate to enhanced deception capabilities [61], necessitating comprehensive, methodical research across varied populations and high-stakes situations [63]. Our study advances the ongoing research that unravels the effects of personality on negotiation outcomes and strategies and underscores the need to integrate human personality into agents. By collecting data on how humans’ behavior is changed by the presence of personality data, we can better create agents that act in similar ways.

To comprehend the complicated relationship between personality, deception, and negotiation, it is essential to meticulously evaluate diverse studies, particularly within non-repeated human negotiation contexts. While previous research has emphasized deceptive behavior alterations in human-agent negotiation predominantly from the agent’s perspective, our study submerges into the complicated nature of human user behavior and its consequential impact on personalized agents. Several studies, such as [23], have highlighted the influence of agent appearance, revealing differentiated perceptions and interactions with agents of varied genders. Additionally, research [4, 64] investigating societal stereotypes and their effects on perceptions of male and female agents shapes our approach to human-agent interactions in negotiations. Our exploration seeks to expand into the complex interplay between humans and agents, striving to understand the human user’s personality traits, while also examining the potential influences of the agent’s avatar gender and agent’s personality traits on negotiation dynamics. In doing so, we ponder upon the correlations between user behavior and perception and evaluate influencing factors regarding deception necessity. Utilizing the IAGO platform, with a focus on multi-issue negotiations, we incorporate the Big Five personality (OCEAN) traits [9] into our analysis.

Our investigation is a systematic attempt to fathom behavioral variability in human negotiations and the dynamics stemming from individual characteristics, intending to discern how human user personality intersects with negotiation behaviors, especially amidst deception and manipulation, and enriches interaction quality in human-agent settings. This thorough exploration through personality traits and negotiation dynamics not only augments our understanding of human-agent interactions but also paves the way for developing more adaptive and effective agent systems in the future. Our contribution seeks to comprehend how user personality influences negotiations and interactions with agents, particularly in contexts enveloped with deception and manipulation. Amidst the aforementioned discussions and identified gaps in existing literature, we formulate the following research questions to guide our investigative journey into the dynamics of personality and negotiation behaviors in human-agent interactions:

- **RQ1:** Is there a correlation between participants’ self-reported truthfulness and their actual deceptive behaviors recorded during the negotiation game?
- **RQ2:** How do specific personality traits influence participants’ self-reported truthfulness during the negotiation game?
- **RQ3:** How do participants’ personality traits impact their beliefs regarding the necessity of deception to achieve a successful outcome in the negotiation game?
- **RQ4:** Does the participant’s gender and gender match with a virtual avatar of the opponent have an effect on their negotiation behavior?
- **RQ5:** Does the presence of personality data for the opponent affect the behavior of the human participant?

2 BACKGROUND

2.1 NEGOTIATION PLATFORM

The cornerstone of our exploration into the entwined realms of personality and deceptive behavior within negotiations hinges upon our choice of a negotiation platform, in particular, our employment of the Interactive Arbitration Guide Online (IAGO)[34]. IAGO realizes the multi-issue bargaining task (MIBT), which is a well-documented task commonly used within negotiation research due to its ability to facilitate defined, focused, and evaluatively tractable negotiation interactions [47, 52]. This environment, where negotiators navigate through a pre-structured set of issues, each with a predefined priority, forms a robust foundation for exploring both human and agent-based negotiation strategies and outcomes.

IAGO emerges as an effective tool amidst various negotiation platforms like GENIUS and NegoChat [20, 53], distinguished by its capacity for synchronous, web-based interactions and its meticulous, data-rich recording capabilities [34]. This platform not only enables real-time, negotiations, reflecting real-world dynamics but also provides an extensive, timestamped log of all actions, emotions, and messages, a feature paramount for in-depth research analysis and for users wishing to validate past negotiation interactions.

The utility of IAGO is further substantiated by its use in various negotiation research contexts, from exploring the dynamics of honesty and exploitation in negotiations [40], validating its effectiveness in reproducing human-human negotiation outcomes

[35], to being utilized as a tool for teaching negotiation tactics [27]. However, our use of IAGO pivots towards uncharted territory, specifically exploring the intricate dynamics of personality and deceptive behaviors within negotiations.

Our unique application of IAGO involves modifications tailored to our specific research objectives, particularly in capturing and analyzing deceptive behaviors in conjunction with personality traits, the details of which will be elucidated in Section 3. While IAGO has been utilized by numerous researchers, our distinct approach focuses on a detailed exploration of personality, deception, and negotiation, intending to unveil novel insights that could not only augment our understanding of human-agent interactions but also facilitate the development of more adept and personalized agent systems in future negotiations, thereby contributing a fresh perspective to the existing body of knowledge within human-agent negotiation research. Our research journey, therefore, is not merely an application of IAGO but an innovative exploration, assuring that our findings both leverage and contribute to the burgeoning field of negotiation platforms.

2.2 Influence and Implementation of Big Five Personality Traits in Negotiation

Negotiation, as an interactive process, is inherently influenced by the personalities of the interacting entities. This complexity is exemplified in various disciplines, notably in psychology, to comprehend human decision-making in negotiation scenarios [7]. The role of personality in negotiation is pivotal; understanding its nuances and impacts forms the bedrock for our exploration into the negotiation strategies and outcomes. For instance, certain personality trait instruments such as Social Value Orientation (SVO) and Machiavellianism (Mach) have been correlated with negotiation style and tendencies toward cooperative or manipulative strategies, respectively [8, 39].

In the broader context, the Big Five (OCEAN) Personality Model or Five-Factor Model (FFM), which organizes personality into five distinct dimensions, has been widely adopted due to its substantial capacity to predict variances in individuals' behaviors, thoughts, and actions [17, 32]. The FFM entails: **Openness to Experience**, signifying a penchant for imagination, culture, and artistic sensitivity; **Conscientiousness**, indicative of thoroughness, a strong work ethic, and organization; **Extraversion**, reflecting sociability and an active, talkative nature; **Agreeableness**, representing attributes like trustworthiness, good-naturedness, and cooperation; and **Neuroticism** (or its converse, Emotional Stability), associated with emotional variability and a propensity toward anxiety and insecurity. These traits have been validated across diverse research scenarios, affirming the FFM as a crucial model in personality research [3, 9]. The detailed insights into each trait serve as a foundational understanding, proving instrumental for both our agent personality representation and user interaction [9].

Numerous studies have extensively integrated the Big Five personality traits into various facets of agent and robot interaction, thereby elucidating the nuanced influences of personality in technological interfaces. Researchers have insightfully mapped human verbal traits onto corresponding nonverbal and verbal behaviors of robots, particularly focusing on the extraversion–introversion

dimension, a pivotal element of the Big Five personalities [1]. Additionally, the exploration into the role of a robot's personality in therapeutic contexts, specifically focusing on the extraversion and introversion personality dimensions, has yielded significant findings regarding the adaptive utility of personality traits in enhancing interaction efficacy in specific contexts [59]. Furthermore, the utilization of the Big Five traits has been extended into diverse research domains, including health games and gamified systems, exploring elements such as gameplay motivation and game preference, thereby demonstrating the pervasive influence and applicability of personality traits across varied interaction paradigms and research contexts [22, 26, 44, 46, 65]. This synthesis of personality, particularly leveraging the Big Five traits, within agent and robotic research provides a robust foundation for developing efficient agent. It underscores not only the significant impact of personality traits but also affirms the multifaceted applications and prevalent utility of the Big Five in sculpting and enhancing human-agent interactions and experiences. Incorporating personality into agent design and interaction has witnessed compelling explorations. The expression of personality in conversational agents through visual and verbal feedback was explored by [31], revealing the complex interplay between agent design and user perception. Another significant research [29] addressed human perceptions of robot personality, emphasizing the influence of task context on optimal personality expressions.

Our research traverses through this multifaceted domain, scrutinizing not only how personality influences negotiation but also how it can be proficiently embedded into agent design and interaction within the negotiation milieu. Furthermore, we delve into an intricate examination of how human personality impacts negotiation behavior and strategies, thereby forging a comprehensive exploration that encapsulates both the human and agent aspects. This dual-faceted approach ensures that we explore the impacts of personality on negotiation dynamics and outcomes from both the human and agent perspectives, contributing to the rich tapestry of knowledge in personality-driven agent design and interaction, and human behavior in negotiation scenarios.

2.3 The Role of Personality in Negotiation Deception

Deception, especially within the realm of negotiation, is connected to various research spheres, significantly impacting areas like war gaming [54] and free-form games like Diplomacy [11]. Understanding deception in negotiation entails diving into both its strategic implementation and its detection, which permeates various interaction contexts and modalities. Seminal works in the field underscore the substantial role and multilayered dimension of deception in negotiations [50, 60]. In the field of human-agent interactions, research extends to analyzing deception through behavior and perception, including studying facial cues in interactions between children and agents [48], and the creation of deceptive language in virtual agents [10]. Moreover, the impact of personality traits, particularly dark traits, on deceptive behaviors has been a focal point of psychological and behavioral research. The Dark Triad traits – Narcissism, Machiavellianism, and Psychopathy – have been scrutinized for their potential correlations and influences on deceptive behaviors

and perceptions [61]. This interplay between personality traits and deception navigates through the intricacies of negotiation strategies and outcomes, providing an ideal environment for investigating and understanding the mechanics of deceptive negotiation practices, both in human-human and human-agent interactions. Our exploration traverses through these multifaceted domains, bridging the understanding of deception in negotiation with the subtle influences of personality traits, aiming to unravel the layered dynamics that shape and are shaped by deceptive practices in negotiation contexts. This endeavor propels our investigation into the impactful domain of personality-driven deceptive negotiation, aiming to carve out insights that can enhance the design and interaction paradigms of agent-based negotiation systems, ensuring relevance and efficacy in real-world, high-stakes negotiation scenarios.

3 SYSTEM DESIGN

Diving into the technological stratum of our project, we utilize the IAGO platform, which provides asynchronous functionality and the ability to identify original lies. In this context, deceptive behavior is considered present if participants convey false preferences or untruthfully indicate the presence of an alternative deal, known as the Best Alternative to a Negotiated Agreement (BATNA) [34, 36]. This platform enables participants to engage in negotiations over various issues, conduct preference information exchanges, and present offers, thereby substantiating itself as a vital domain for developing socially adept AIs.

For our study, we modified IAGO. Our variations introduce four distinct instances or conditions, involving variations of male or female agent avatars and the display (or absence) of personality traits, elucidated via the Big Five (OCEAN) model[9], provided to represent the opponent agent’s personality in a comprehensible pie chart. While the fundamental gameplay and negotiation dynamics remain consistent with the original IAGO setup, these alterations, crafted to mitigate biases, generate diverse scenarios, facilitating a thorough exploration of the impact of user personality on negotiations and agent interactions. An exemplar interface of the game board, illustrating a male avatar alongside a displayed OCEAN personality trait pie chart, can be observed in Figure 1. In this orchestrated environment, we aspire to dissect the delicate aspects of how personality affects agent interactions, navigating through the complexities of deception, strategy, and negotiation dynamics, whilst ensuring that our findings are robust, unbiased, and thoroughly insightful. The web-based nature of IAGO further permits the utilization of remote subject platforms like Amazon’s Mechanical Turk, facilitating a diverse and expansive participant pool, and by extension, a richer dataset for our investigative journey.

4 METHOD

4.1 STUDY DESIGN

We evaluated the effect of showing explicitly quantitative personality traits of the opponent agent to a human player. This was inspired by prior work that underlined the profound impact of social information and emotional dialogue on behavior and user interaction in various settings [2, 12, 33, 45]. Moreover, with a nod towards the influence of agent appearance and avatar gender, as highlighted by past works [23], our design integrates modifications in agent

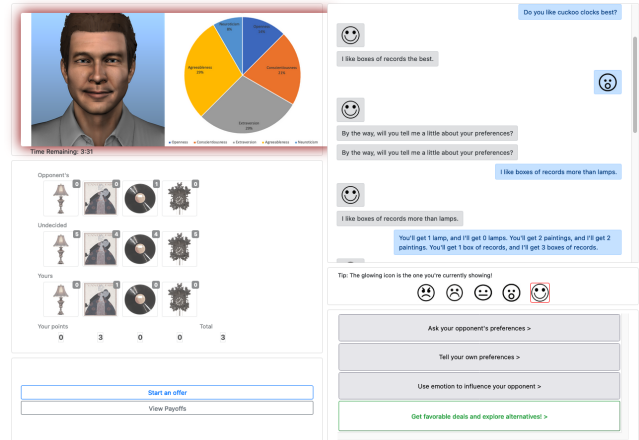


Figure 1: Illustration of the IAGO interface, showcasing a male avatar and an accompanying pie chart delineating Big Five (OCEAN) personality traits. Depending on experimental conditions, variations in avatar gender and personality trait display will be introduced.

avatars. The visibility of personality traits is outlined in the System Design section.

Concurrently, our exploration traverses the domain of the influence of personality on negotiation, buoyed by existing psychological studies highlighting its significance in human-human interactions [6, 57]. Our investigation thus extended into the realm of human-agent interactions, employing the 20-factor OCEAN inventory in a self-reported post-game test [42].

The tailored 2x2x2 design contrasts user gender (self-reported male x female), opponent agent gender (male x female), and personality inventory visibility (opponent agent’s personality displayed on screen or invisible).

Participants (n=258) engaged in the IAGO multi-issue bargaining game, subsequently providing insights into their personality through the 20-factor inventory[42]. This inventory, consisting of 20 statements, was adapted from the cited source. Each statement was evaluated using a 5-point Likert scale (1=Not at all, 5=Completely), enabling participants to self-report diverse aspects of their personality, thereby enhancing our data with intricate personality metrics. Following this, participants also shed light on their deceptive behavior via two formulated self-reported statements:

- **SR-1:** "I was truthful throughout the negotiation game" and
- **SR-2:** "Being deceptive was necessary to achieve a successful outcome in the negotiation game"

Scored from 1 (Not at all) to 5 (Completely), these statements, SR-1 and SR-2 respectively, have been designed to gauge participants’ truthfulness and their perceptions of the necessity of deception in the game.

Additionally, for a subset of participants (n=64), objective ground-truth data regarding deceptive behaviors within the game was collected, categorizing deception as either a lie about preferences or the BATNA, as defined in Section 3. For this subset, we are able to

examine the interaction between ground truth deceptive practices vs. the two self-report statements above.¹

4.2 PARTICIPANTS & RECRUITMENT

Participants, exclusively adults over 18 based in the United States, were enlisted through Amazon Mechanical Turk, applying a HIT score of >95% to ensure the selection of highly rated and active participants. The geographical uniformity of the participant pool was strictly maintained by utilizing MTurk IP checks, thus ensuring the elimination of potential data complexity arising from cultural variables, given that cross-cultural effects were not under investigation. The application of Amazon Mechanical Turk as a participant recruitment method aligns with accepted methodologies for gathering user responses [21, 24].

An initial pool of 260 participants was secured, under an active Institutional Review Board (IRB) protocol, accompanied by three attention check questions. Post a rigorous quality check, which saw participants failing the attention checks being removed, a dropout rate of less than 1% was noted, finalizing the participant count at 258. After providing consent and demographic data, participants were routed through the web-based IAGO platform, were randomly assigned to one of the four conditions, and were subsequently redirected to a final survey and asked to provide responses for the 20 OCEAN personality statements[42], as well as the two self-report statements (labeled SR-1 and SR-2 per above).

4.3 DATA ANALYSIS METHOD

Data analysis was executed utilizing Microsoft Excel and SPSS, with all pertinent data collated via a Qualtrics survey administered through Amazon Mechanical Turk and additional ground truth data concerning deceptive behaviors derived from IAGO logs. The analysis was particularly tailored to assess personality traits, whereby participants were prompted to respond to a set of 20 statements, each aimed at meticulously gauging one of the Big Five personality traits: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism[42]. Each trait was evaluated through four specific statements, and participants articulated their agreement using a 5-point Likert scale. The summation of scores from the four statements corresponding to each trait rendered a singular, ordinal value, ranging from 4 to 20, for each of the five personality traits for every participant, thereby encapsulating a detailed personality profile to be utilized in subsequent analyses.

5 RESULTS

RQ1: Self-Reported Truthfulness vs. Actual Deceptive Behavior. To probe the relationship between self-reported truthfulness (SR-1) and actual deceptive behavior, we categorized participants into two groups based on their behavior in the IAGO game using the 'liedOrNot' variable. This variable assigns '1' to participants who lied and '0' to those who did not. An independent samples t-test was conducted. As encapsulated in Table 1, the findings divulge a significant relationship between SR-1 and actual lying behavior under both equal and unequal variance assumptions, with p values

Table 1: Independent Sample T-Test for Self-Reported Truthfulness (SR-1) against Actual Deceptive Behavior (liedOrNot)

Variable	Variance Assumption	t	df	Two-Sided p
SR-1	Equal variances assumed	3.322	61	.002**
SR-1	Equal variances not assumed	2.790	14.094	.014*

of .002 and .014 respectively. This suggests that participants who reported high truthfulness (SR-1) were indeed more likely to exhibit truthful behavior in the negotiation game.

RQ2: Personality Traits and Self-Reported Truthfulness.

In addressing RQ2, regression analysis was employed to gauge the influence of different personality traits on self-reported truthfulness (SR-1). The results, delineated in Table 2, depict varying levels of significance in the relationship between personality traits and SR-1. Openness ($F(1, 255) = 19.998$, $\beta = 0.270$, $p < 0.001^{***}$) and Conscientiousness ($\beta = 0.276$, $p < 0.001^{***}$) exhibited positive correlations, while Extraversion showed a negative relationship ($F(1, 255) = 4.261$, $\beta = -0.128$, $p = 0.040^*$). These varying relationships demonstrate the intricate manner in which personality traits may be correlated with self-reporting behaviors.

RQ3: Personality Traits and Beliefs on Necessity of Deception.

RQ3 aimed to discern how personality traits might influence beliefs regarding the necessity of deception (SR-2) in the negotiation game. An examination of the data, delineated in Table 3, discloses interesting observations on the relationships between personality traits and beliefs about deception. All personality traits, with the exception of Extraversion, were positively correlated with beliefs in the necessity of deception, indicating a general trend wherein these traits could potentially be associated with stronger beliefs in the necessity of deception during negotiations. Neuroticism, in particular, exhibited the highest beta value $\beta = 0.511$ and was significant at $p < 0.001^{***}$, indicating a notably strong and significant positive correlation with beliefs in the necessity of deception, and thus could be interpreted as having a particularly pronounced influence on such beliefs in the negotiation game scenario ($F(1, 255) = 90.324$). Conversely, Extraversion demonstrated a significant negative correlation with beliefs in the necessity of deception, as evidenced by a beta value of $\beta = -0.434$ and $p < 0.001^{***}$. This suggests that individuals with higher Extraversion might be less inclined to perceive deception as a necessary element in negotiation contexts ($F(1, 255) = 59.121$). The other traits—Openness ($F(1, 255) = 67.965$), Conscientiousness ($F(1, 255) = 26.550$), and Agreeableness ($F(1, 255) = 10.196$)—while also displaying significant relationships with SR-2, warrant a deeper discussion, especially in the contexts where they might intersect or diverge from actual deceptive behaviors.

RQ4 & RQ5: Gender Match, Personality Display, and Deceptive Behavior.

The analysis navigated through the possible interactions between gender match and personality display, specifically focusing on their impacts on self-reported truthfulness (SR-1) and beliefs regarding the necessity of deception (SR-2). In regard to RQ4, ANOVA tests were conducted, exploring the relationships between gender match (genderMatch) and both SR-1 and SR-2 (see Table 4). For SR-1, the test showed no statistically significant influence ($F(3,59)=.750$, $p = .527$). Similarly, the relationship between

¹Of the remaining participants (194), no such data regarding ground truth was collected for a cohort due to a technical glitch. The procedures for these participants were otherwise identical.

Table 2: Correlation of Personality Traits with Self-Reported Truthfulness (SR-1) based on Regression Analysis

Personality Trait	Beta (β)	Significance (p)	F-Statistic	Degrees of Freedom (df)
Openness	0.270	<0.001***	19.998	1
Conscientiousness	0.276	<0.001***	21.099	1
Extraversion	-0.128	0.040*	4.261	1
Agreeableness	0.209	<0.001***	11.609	1
Neuroticism	-0.007	0.536	0.384	1

Table 3: Correlation of Personality Traits with Beliefs about Necessity of Deception (SR-2) based on Regression Analysis

Personality Trait	Beta (β)	Significance (p)	F-Statistic	Degrees of Freedom (df)
Openness	0.459	<0.001***	67.965	1
Conscientiousness	0.307	<0.001***	26.550	1
Extraversion	-0.434	<0.001***	59.121	1
Agreeableness	0.196	0.002**	10.196	1
Neuroticism	0.511	<0.001***	90.324	1

gender match (genderMatch) and SR-2 also lacked a statistically significant impact, with $F(3,59)=1.226$ and $p = .308$. Moving to RQ5, an independent samples t-test evaluated the influence of personality display (persTraitDisplayed) on SR-1 and SR-2, as detailed in Table 5. The results revealed no significant disparities in SR-1 ($t(61)=.638, p_{two-sided}=.526$) or SR-2 ($t(61)=.089, p_{two-sided}=.930$) between the groups. These findings collectively suggest that neither the alignment of gender between the participant and avatar nor the transparency of the opponent’s personality notably sways deceptive behaviors or beliefs within the negotiation arena.

Intersecting Relationships: SR-1 and SR-2. Navigating through the intricate networks formed between SR-1 and SR-2 amid various personality traits, intriguing patterns become perceptible, which are illustrated through line graphs, delineating the mean values of SR-1 and SR-2 across different levels of personality traits (see Figures 2 and 3). The graphs, representing relationships between personality traits and SR-1/SR-2, underline dichotomies and paradoxes in the realm of self-reported truthfulness and beliefs about the necessity of deception.

Focusing on Openness, an interesting dichotomy is sculpted: individuals might simultaneously maintain honesty (validated by a positive trend with SR-1, see Figure 2a) and yet nurture a belief in the necessity of deception (corroborated by a positive trend with SR-2, see Figure 2b). This dichotomy could possibly hint towards an internal conflict or moral ambivalence in negotiation contexts, where individuals uphold their intrinsic honesty but strategically navigate through the moral flexibility of deception within the negotiation arena

Moreover, turning our gaze towards Extraversion, a notable coexistence is evident: despite its negative trend with SR-2, suggesting general disbelief in the necessity of deception, the same cohort might simultaneously exhibit deceptive behavior, as depicted in Figure 3. This contradiction drives the discourse into the realm of strategic pragmatism, where extraverts, while not morally aligned with deception, might deploy it as a tactical maneuver within negotiations. Specifically, Figure 3a might suggest "Higher Extraversion

correlated with higher deception," while Figure 3b communicates, "Higher Extraversion correlated with lower belief in the necessity of deception." This opposing dynamic spotlights the complex, and often conflicting, nature of human behavior and belief, particularly in multifaceted interactions like negotiations

In the elaborate network of negotiating behaviors, the findings herein unfurl a complex interplay between personality traits and deceptive behaviors and beliefs. The study unveils a compelling, perhaps opposing relationship between self-reported truthfulness and beliefs about the necessity of deception across various personality traits. While Openness aligns with self-reported truthfulness, they also oddly nestle with a belief in the necessity of deception, exposing a moral duality (as evidenced in Figures 2a and 2b). On the other side of the spectrum, Extraversion introduces an apparent conflict, where a general disbelief in the necessity of deception coexists with actual deceptive practices (Figures 3a and 3b). These dichotomies and contrasts not only in Openness and Extraversion but also mirrored in traits like Conscientiousness and Agreeableness, weave a complex tapestry that necessitates a deeper dive into the psychological and moral underpinnings of deceptive behaviors and beliefs in negotiations, which will be further unraveled in the subsequent discussion.

6 DISCUSSION

Navigating through the findings, the discussion aims to elucidate the intricate interplay of personality traits, self-reported truthfulness, beliefs about deception, actual deceptive behaviors, and gender match within a negotiation context, weaving in insights from related literature.

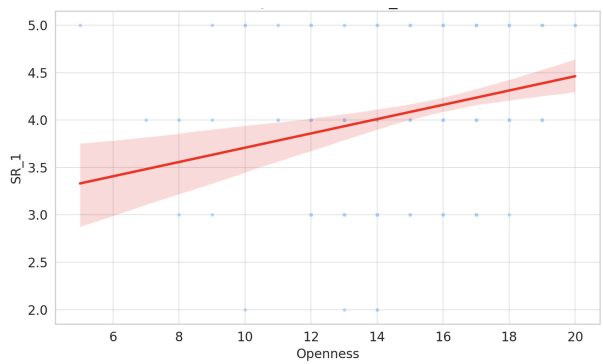
Self-Reported Truthfulness and Actual Deceptive Behavior
A pivotal finding encapsulates the significant relationship between self-reported truthfulness and actual deceptive behavior, affirming the reliability of participants’ self-reports in reflecting their behaviors during the negotiation game. This connection echoes the assertion that "Participants’ self-reports of truthfulness significantly and positively correlate with their actual truthful behaviors,"

Table 4: ANOVA Results for Gender Match (genderMatch) and SR-1/SR-2

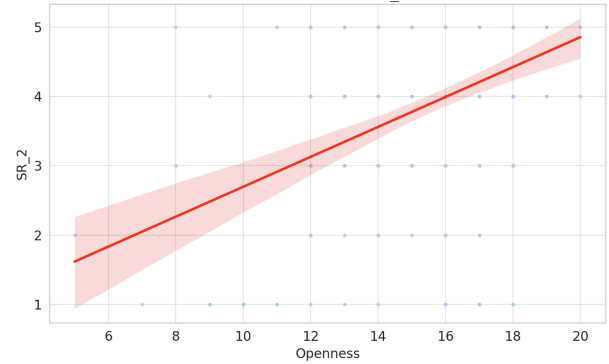
Dependent Variable	Significance (<i>p</i>)	F-Statistic	Degrees of Freedom (df)
SR-1	.527	.750	3,59
SR-2	.308	1.226	3,59

Table 5: Independent Samples t-Test Results for Personality Display (persTraitDisplayed) and SR-1/SR-2

Dependent Variable	Equal Variances	Significance (<i>p</i>)	t-Statistic	Degrees of Freedom (df)
SR-1	Assumed	.526	.638	61
SR-2	Assumed	.930	-.089	61

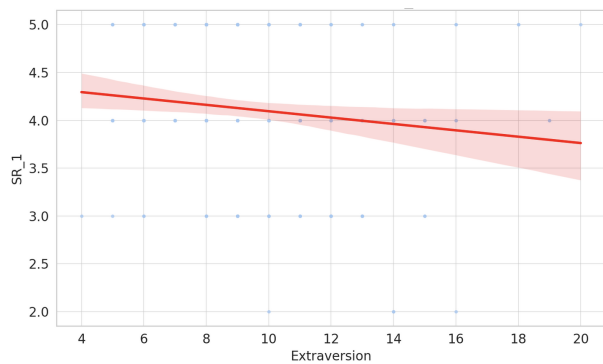


(a) Mean Values of SR-1 Across Different Levels of Openness

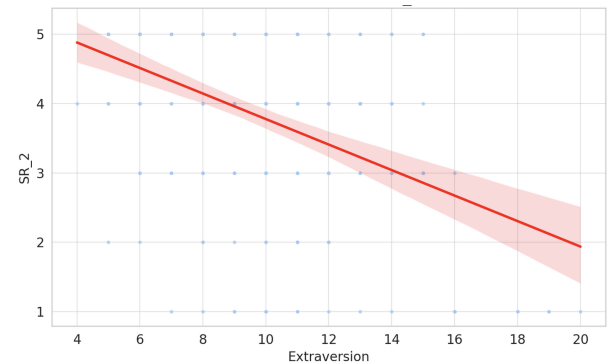


(b) Mean Values of SR-2 Across Different Levels of Openness

Figure 2: Line Graphs Illustrating Relationships between Openness and Negotiation Behaviors



(a) Mean Values of SR-1 Across Different Levels of Extraversion



(b) Mean Values of SR-2 Across Different Levels of Extraversion

Figure 3: Line Graphs Illustrating Relationships between Extraversion and Negotiation Behaviors

thus providing a viable lens through which to explore subsequent relationships and impacts.

Complex Dynamics of Personality Traits The complex connections among personality traits, self-reported truthfulness (SR-1), and beliefs about deception (SR-2) reveal the complexity of personality’s influence on deception. While the positive correlations between Openness, Conscientiousness, and SR-1 are not surprising,

aligning with existing literature that associates high conscientiousness and truthfulness [25], the relationships between these traits and SR-2 expose an intricate duality. Individuals high in Openness and Conscientiousness, while honest, also seem to believe in the necessity of deception. Such a dichotomy may hint at an internal conflict or moral ambivalence in negotiation contexts, reflecting potential situational shifts in moral standing, where negotiation dynamics may alter perceptions of the morality of deception [60].

In light of [23], the findings that individuals high in Conscientiousness self-report truthfulness yet also believe in the necessity of deception might seem paradoxical, given that low Conscientiousness is usually associated with a higher likelihood of deceptive behavior due to reduced concern for consequences. This contrast underscores the complexity of the relationship between personality traits and deception, perhaps hinting at other influencing factors in negotiation contexts, such as strategic or situational considerations, that warrant further exploration

Extraversion: Navigating Between Morality and Strategy

The findings concerning Extraversion curate a fascinating paradox where participants, despite expressing disbelief in the necessity of deception (SR-2), might still exhibit deceptive behavior. According to [5], individuals high in Extraversion could be more comfortable taking risks or manipulating others for their own benefit, which might explain the actual deceptive behaviors observed. Furthermore, the same source suggests that their sociability and attunement to social cues might make them adept at detecting deception in others, potentially influencing their disbelief in its necessity. Thus, extraverts might deploy deception as a pragmatic strategy, despite not morally aligning with it, intertwining moral belief and strategic pragmatism within negotiations.

Gender and Personality Display: Subtle Influencers

While the research did not uncover significant findings regarding the impact of gender match and personality display on deceptive behavior, it's pivotal to acknowledge the potential subtleties that might be at play. Previous research underscores varied perceptions and interactions with agents of different genders [23], suggesting that further exploration, potentially with varied contexts or negotiation stakes, might reveal nuanced influences of these variables on negotiation dynamics. Additionally, despite our findings, insights from Lee et al. [31], which observed notable impacts of personality displays in conversational agents on perception, suggest that the influences of personality display on negotiation dynamics, particularly in digital interactions, might still hold a subtle, yet unexplored, sway in certain contexts and warrants further investigation in future research.

In synthesizing the findings, this research weaves a complicated tapestry of personality characteristics, self-perception, moral views, and dishonest actions through theoretical and pragmatic negotiating scenarios. The study uniquely juxtaposes ground truth deception with self-report among numerous personality characteristics to confirm theoretical underpinnings and reveal paradoxes and complex specifics, notably in human-agent interactions. Thus, while navigating the complex mazes of deception, truthfulness, and personality in negotiation, the study illuminates the multifaceted dynamics at play and subtly suggests uncharted avenues for future research to better understand negotiation dynamics.

7 LIMITATION & FUTURE WORK

As one delves into the complex dynamics of personality facets and strategic deceit within negotiations, the inherent challenges become apparent. These limitations include the possibility of biases in self-reported metrics and the extensive data collection necessary to comprehensively capture personality-driven behaviors. The insights procured herein, albeit illuminating, gently nudge towards

unexplored realms that invite further scrutiny, particularly leaning into the incorporation of diverse negotiation scenarios. Future explorations might traverse these domains, involving a spectrum of negotiation contexts and employing various platforms to not only validate and potentially expand the applicability of the current findings but also unveil additional dynamics and subtleties in the intricate weave of personality-driven behaviors and beliefs in negotiations. This forward-gazing expedition, while rooted in the current insights, heralds a more enriched and nuanced comprehension of the multifaceted interactions occurring within human-agent negotiation environments.

8 CONCLUSION

The study thoroughly looks into the complex relationship between personality traits and deceptive behaviors in human-agent negotiations. In doing so, it sheds light on the correlation between self-reported truthfulness and actual behaviors as well as uncovers intriguing contradictions and duality within personality-driven negotiation behaviors and beliefs. Notably, the findings hold substantial contributions to the field of human-agent interaction by providing empirically-backed insights into the reliability of self-reports in reflecting actual negotiation behaviors, an aspect pivotal for the validity of future research employing self-report metrics. Moreover, the uncovered nuanced relationships between personality traits, such as the moral duality in Openness and Conscientiousness and the strategic deception in Extraversion, not only enrich the theoretical understanding of personality's influence on negotiation behaviors and beliefs but also provide a robust foundation for developing intelligent negotiation agents. These agents, informed by the complex relationships and contradictions demonstrated in this exploration, could potentially navigate negotiations with adaptive strategies, attuned to the multifaceted and sometimes conflicting interplay of personality traits, moral beliefs, and strategic behaviors. Consequently, the findings expand our current understanding and offer a solid foundation for further research into the unexplored areas of psychological, moral, and strategic elements in human-agent negotiations. This research guides future discussions toward developing more sophisticated, adaptive, and psychologically informed human-agent interaction systems.

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