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**THE ROLE OF NEED FOR COGNITIVE CLOSURE AND EMOTIONS
IN SHAPING THE HUMAN SOCIAL INTERACTIONS AND
DRIVING THE INTERGROUP DECISION BEHAVIOUR**

FINAL DISSERTATION

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List of Abbreviations

ACC	Anterior Cingulate Cortex
AI	Anterior Insula
Av1	Avatar #1
Av2	Avatar #2
Av3	Avatar #3
EC	Empathic Concern
FG	Fusiform Gyrus
fMRI	Functional Magnetic Resonance Imaging
IRI	Interpersonal Reactivity Index
prMFC	posterior rostral Medial Frontal Cortex
NCC	Need for Cognitive Closure
PFC	PreFrontal Cortex
SPM	Statistic Parametric Mapping
UG	Ultimatum Game
VE	Virtual Environment
VR	Virtual Reality

List of Publications

Chiesa P.A., Liuzza M.T., **Acciarino A.**, Aglioti S.M. (2015). Subliminal Perception of others' physical pain and pleasure. *Experimental Brain Research*, 1-10.

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Fiori, F., Candidi, M., **Acciarino, A.**, David, N., & Aglioti, S. M. (2015). The right temporo parietal junction plays a causal role in maintaining the internal representation of verticality. *Journal of Neurophysiology*, jn-00289.

1. Introduction

1.1 - Need for Cognitive Closure as Epistemic Motivation

The Need for Cognitive Closure (NCC), a psychological motivational construct between the cognitive and the social domain, has been originally introduced by Arie Kruglanski (1980) in a scientific article on epistemics. NCC theory has been applied to a variety of phenomena in the field of social cognition (see Kruglanski & Webster, 1996) and of cognitively driven group dynamics (see Kruglanski, Pierro, Mannetti, & De Grada, 2006). NCC is defined as the desire for “an answer on a given topic, any answer . . . compared to confusion and ambiguity” (Kruglanski, 1990, p. 337). It constitutes a core motivational construct of Kruglanski’s theoretical framework of lay epistemics, a theory about the process of knowledge formation and consolidation (e.g., Kruglanski, 1980, 1989; Kruglanski, Dechesne, Orehek, & Pierro, 2009; Kruglanski, Orehek, Dechesne, & Pierro, 2010). NCC’s magnitude is determined by the perceived costs and benefits of being “closed”. A known trigger for high situational NCC is time pressure that people daily experience (e.g., Bukowski, von Hecker, & Kossowska, 2013; Kruglanski & Freund, 1983, Richter & Kruglanski, 1998; Roets & Van Hiel, 2011a). The attainment of closure cut off the necessity for further information processing when it is difficult and/or aversive. For example, if a task is boring or not interesting (e.g., Webster, 1993a), if performance is impeded by external stressors such as environmental noise (e.g., Kruglanski, Webster, & Klem, 1993), or if processing is tiresome (e.g., Webster, Richter, & Kruglanski, 1996), people may also experience an increased desire to reach closure (see Kruglanski, 2004; Kruglanski & Webster, 1996 for an overview). Kruglanski and Webster (1996) portrayed the motivation toward cognitive closure as lying on a continuum between a high need to attain closure and a high need to avoid it. For instance, in circumstances where information processing is experienced as intrinsically rewarding or of high interest (e.g., Webster, 1993b), people are more motivated to postpone or avoid closure. In addition to transient states induced by situational determinants, the NCC also represents a dimension of stable individual temperamental differences (Webster & Kruglanski, 1994). Individuals with high levels of dispositional NCC are characterized by a preference for order and predictability, afforded by secure knowledge that is stable across circumstances and unchallenged by exceptions. High NCC individuals also experience an urgent desire to reach firm decisions, reflected in their need for decisiveness, and their discomfort feeling toward ambiguity,

experiencing situations lacking closure as aversive. Finally, they are closed-minded, resistant to information inconsistent with their firm opinions, and reluctant to have their knowledge challenged (Roets, Kruglanski, Kossowska *et al.*, 2015). To measure “trait” NCC, Webster and Kruglanski (1994) developed the NCC scale, which was later revised by Roets and Van Hiel (2007), and cross-culturally adapted (Mannetti, Pierro, Kruglanski *et al.*, 2002). Both the original and the revised scale include the five initially proposed expressions of NCC: 1- preference for order, 2- preference for predictability, 3- decisiveness, 4- aversion for ambiguity, and 5- closed-mindedness. Several studies have shown consistently that the effects obtained with the individual difference measure converge with those obtained with the situational manipulations of NCC (e.g., see Roets, Van Hiel, Cornelis, & Soetens, 2008; Webster & Kruglanski, 1994). Such convergence supports the claim that motivation for closure is a psychological mindset with a variety of determinants including situational conditions and chronic personality tendencies, with temperamental and genetic origins, as well as stemming from cultural norms and habits (see Kruglanski & Webster, 1996). The construct of NCC fits within the long history of psychological research and theorizing on individuals’ tendency toward closed- versus open-mindedness and shares features with related concepts such as intolerance of ambiguity (Eysenck, 1954; Frenkel-Brunswik, 1949), uncertainty orientation (Sorrentino & Short, 1986), openness to experience (McCrae & Costa, 1985), and need for cognition (Cacioppo & Petty, 1982). NCC is distinct from these other notions due to its explicitly motivational foundations, rather than cognitive or personality ones (see Kruglanski, 2004; Kruglanski & Webster, 1996). Empirically, NCC yields modest relations with these variables, and yields unique relations with third variables (see e.g., Cornelis & Van Hiel, 2006; Kruglanski & Webster, 1996; Onraet, Van Hiel, Roets, & Cornelis, 2011; Roets & Van Hiel, 2011b).

When the level of situational or trait NCC is high, the absence of closure represents a stressful divergence from a desired state. Roets and Van Hiel (2008) found that, in a decision-making context, individuals high (but not low) in NCC showed higher levels of distress both in terms of increased systolic blood pressure and increased heart rate during the task, and in terms of increased retrospectively reported distress. In a follow-up study (*ibidem*) where closure was not readily attainable, high (but not low) NCC individuals showed a progressive increase of galvanic skin response (*GSR*), which is considered a measure of the general arousal, when not conclusive solutions were obtained. Also, for high NCC individuals, this stressful absence of closure tends to promote activities aimed at the attainment of closure, and influence the individuals’ choices and preferences (Kruglanski & Webster, 1996; p. 264); these affect

information processing, knowledge formation, and decision-making. Theoretically, high NCC was said to prompt two general tendencies, known as “urgency” and “permanence” (Kruglanski & Webster, 1996). Urgency denotes an inclination to seize quickly on information that seems to bring about closure. Individuals with high levels of NCC may often jump to judgments based on partial or inconclusive evidences. Permanence, in contrast, denotes the inclination to maintain closure by holding onto or freezing on the acquired knowledge. This *freezing* process reinforces the consolidation of such knowledge, and protects it against the threat of ambiguous information. Both “gate-keeping” tendencies serve to escape the aversive lack of closure, by terminating this state quickly (urgency), and by keeping it from recurring (permanence). One of the most straightforward consequences of the inclination to seize and freeze elicited by NCC pertains to the extent to which people categorize information and develop hypotheses. Indeed, the desire to reach closure quickly, and to subsequently maintain it, should lead people to take in consideration less information than necessary when making judgments. Mayseless and Kruglanski (1987) asked participants to identify a series of briefly presented, individual digits. Participants were allowed to request repeated presentations of the digit to be identified. The extent of informational search was highest in the need to avoid closure condition (induced by manipulation of the fear of invalidity), intermediate in the control condition, and lowest in the NCC condition (induced by instructions stressing the formation of unambiguous opinions, rather than the importance of being correct). This effect later was corroborated by Roets and colleagues (2008) across different NCC manipulations (i.e., noise, time pressure, and fear of invalidity), and was cross-validated with the dispositional measure of NCC (Roets et al., 2008; Roets & Van Hiel, 2006). The moment when a belief “crystallizes” and turns from conjecture to a subjectively firm and true “fact” (Kruglanski & Webster, 1996) represents the demarcation point that separates seizing from freezing tendencies. A joint operation of both seizing and freezing tendencies may underlie the NCC effects. Indeed, most decisions involve both pre- and post-crystallization stages, and seizing and freezing processes are strongly aligned because the motivation to quickly reach the closure or ending the aversive lack of it, and the motivation to remain in this state or preventing the aversive lack of closure from recurring, are strongly interlaced. NCC differences in information sampling and categorization are most prominent under conditions where epistemic motivation is most relevant for behaviour (see Wright & Kirby, 2001). In another study, (Mayseless & Kruglanski, 1987) where presented to participants enlarged pictures of common objects, taken at unusual angles to mask their specific structure, and asked participants to list all hypotheses about the identity of the object. The number of generated hypotheses was the smallest in the high NCC

condition, intermediate in the control condition, and largest in the need to avoid closure condition. In addition to these effects, the NCC, through the instigation of seizing and freezing tendencies, has effects on a number of classic phenomena in social and cognitive psychology (Kruglanski & Webster, 1996). It was shown that high NCC induced through time pressure inflates primacy effects (Kruglanski & Freund, 1983; Freund, Kruglanski, & Shpitzajzen, 1985; Heaton & Kruglanski, 1991; Webster & Kruglanski, 1994; Webster et al., 1996), increases the tendency to base judgments on stereotypes (Dijksterhuis, van Knippenberg, Kruglanski, & Schaper, 1996; Jamieson & Zanna, 1989), and heightens assimilation of numerical estimates to anchor values (Kruglanski & Freund, 1983). It was also demonstrated that NCC increases attributional biases (Webster, 1993a) and the effects of priming (Ford & Kruglanski, 1995). Each of these effects reflects an urgency driven reliance on accessible early information, and a permanence driven disregard of later information. Stereotypes and other early salient cues provide initial bases for judgments. Moreover, because repeated exposure is assumed to increase the perceived plausibility of an initial hunch, the strong reliance on such initial “information” under high NCC can also strengthen exposure effects, as demonstrated in a series of studies (Kruglanski, Freund, & Bar-Tal, 1996). Seizing and freezing also translate into interpersonal phenomena, such as negotiation, where high NCC individuals are shown to be more influenced by focal points when setting limits and making concessions, and to rely strongly on stereotypic and preliminary perceptions of their opponents (DeDreu, Koole, & Oldersma, 1999). In addition, different studies examined NCC effects in intra- and inter-group contexts. Kruglanski and colleagues (2006) integrated these social NCC effects under the hypothesis of group-centrism. Specifically, it has been revealed that individuals with high NCC levels tend to prefer an autocratic group decision structure, in which consensus is stable and closure affordable, deriving from the disproportionate influence of the group’s leaders (De Grada, Kruglanski, Mannetti, & Pierro, 1999; Pierro, Mannetti, De Grada, Livi, & Kruglanski, 2003). The group-centric tendency manifest under high NCC also finds expression in pressure toward opinion uniformity, including a firm rejection of opinion deviates (Kruglanski & Webster, 1991), a distaste for diversity of membership, as well as aversion toward *Outgroups* whose actions or opinions may threaten the *Ingroup*’s point of view (Pierro et al., 2003; Shah, Kruglanski, & Thompson, 1998). In line with this, Livi and colleagues (2015) found that groups composed of individuals high (*vs.* low) on NCC exhibited greater stability of group norms across different generations of group members. Because groups provide shared knowledge that is easily accessible, high NCC individuals are wishful to embrace the attendant epistemic security and to protect it from outside influences as well as from inside threats. Group-centrism

can be considered the result of reliance on easily accessible, shared *Ingroup* knowledge as well as derogation of new *Outgroup* information. Differential effects of seizing and freezing can also play an important role in the acculturation processes of immigrants. In particular, Kosic, Kruglanski, Pierro, and Mannetti (2004) examined the impact of NCC on the acculturation of Croatian and Polish immigrants in Italy. Consistently, acculturation patterns were interactively determined by immigrants' NCC and the reference group in which they found themselves upon their arrival. Specifically, if the immigrants arrived in the host country together with other co-ethnics, higher levels of NCC were linked with a stronger tendency to adhere to the culture of origin (freezing) and thus decreased their tendency to assimilate to the host culture. By contrast, if on arrival they found themselves without other co-ethnics, higher levels of NCC augmented their tendency to embrace and adapt to the host culture and consequently reduced their adherence to the culture of origin. These findings indicate that, with the aim to reduce the considerable uncertainty associated with arrival in a new country, high NCC immigrants may turn to whichever cultural reference framework is most able to provide closure; in the group of co-ethnics, *freezing* on the culture of origin provides most immediate closure, whereas in the absence of the co-ethnic reference group, assimilation to the host country (*seizing*) provides closure best.

Other behavioural studies have demonstrated that high NCC is related to an increased focus on a specific part of the cognitive field, suggesting that it affords cognitive selectivity and the ability to shut out irrelevant noise (Kossowska, 2007a, 2007b; Kruglanski & Webster, 1996; Pica et al., 2013, 2014). It has also been revealed that NCC reduces the incidence of uncertainty and conflictuality by privileging answers that accommodate precedent experience, representing a goal pursuit that turns attention away from discrepancy. These psychological differences between high and low NCC individuals may map onto two cognitive processes: attentional control (Lackner, Santesso, Dwyan, Wade & Segalowitz, 2013) and conflict monitoring (Botvinick, Braver, Barch, Carter, & Cohen, 2001). Kossowska and colleagues (2015) investigated whether NCC is related to selective attention, as reflected in Event-Related Potentials (*ERPs*) during a classical Stroop task (1935) as well as a Visual Distractor Task (*VDT*). In this latter task, a small letter against an emotional picture was presented in a random location on the computer screen. The required response was determined by a cue shown just before the picture. Both of the tasks involved competition between target and irrelevant features, and require participants to answer to one dimension of a stimulus rather than another stronger and conflicting one. Therefore, these tasks require feature selection and allow to study early allocation of attention to the selected feature of the stimuli. The selective attentive control

is usually indexed by *N1* component of the *ERPs* (Herrmann & Knight, 2001), a negative visual evoked component with peak at 150-200ms, in the direction of greater deviations in *N1* for increased focus on attended stimuli and increased suppression of attentional response to unattended ones (Singhal, Doerfling, & Fowler, 2002). This study revealed that individuals with higher NCC levels allocate more attention to the selected stimuli of features, and this behaviour is related to higher *N1* amplitude both in Stroop (bilaterally) and VDT (right-sided). In addition, Kossowska, Czarnek, Wronka, Wyczesany, and Bukowski (2014) have shown that high (*vs.* low) NCC is related to conflict monitoring process, defined as a general mechanism for detecting when one's habitual response tendency is mismatched with responses required by the situation (Yeung, Botvinick, & Cohen, 2004). Specifically, low NCC level was associated with higher conflict-related neural activity when response inhibition was required. The ElectroEncephaloGraphic (*EEG*) activity was recorded as participants completed a Stroop task. Conflict-related Anterior Cingulate Cortex (*ACC*) activity was indexed by two *ERP* components: error-related negativity (*ERN*), a negative evoked component with peak at 80-150ms, and the *N2* component, a negative wave with peak at 200-350ms. Low NCC level was strongly and negatively correlated with *ERN* amplitudes, as well as with *N2* amplitudes when participants performed incongruent *vs.* congruent trials. To summarize, high NCC was related with higher neural activity when selection processes occurred (increased *N1* component), while also predicting lower conflict-related activity (decreased *ERN* and *N2* components). These results suggest that a speeded neural response to a distracting stimulus in high NCC individuals, disengaging attention from task-irrelevant information, confers some advantage in acting as a barrier against anxiety and uncertainty and minimizing the experience of error (Hajcak, 2012; Weinberg, Riesel, & Hajcak, 2012). On the other hand, the greater selective focus on the target exhibited by high NCC individuals may exact a toll on flexibility due to freezing. In a study by Viola and colleagues (2014), it has been used the *Flanker Task* (Eriksen & Eriksen, 1974) to investigate this hypothesis. Participants were instructed to answer to a centrally presented target but they had to disregard surrounding flanker stimuli, congruent or incongruent with the target one. It was found that high NCC individuals exhibited lesser cognitive flexibility, operationally defined as a reduced response time to incongruent *vs.* congruent relations between target and flanker stimuli if the preceding trial was incongruous (*vs.* congruous). Of particular interest, these differences were mediated by decreased cortico-cortical connectivity between the *ACC* and the dorsolateral prefrontal cortex (*DLPFC*) as assessed by a generalized PsychoPhysiological Interactions (*gPPI*) analysis. Such reduction of the functional connection between the *ACC* and *DLPFC* regions has previously been related to

impairment of mechanisms for adaptation to conflict (Botvinick, Nystrom, Fissell, Carter, & Cohen, 1999; Kerns *et al.*, 2004).

1.2 - Emotions' role in Cognition and Decision Making

As a large body of scientific research documents, moods and emotions can influence cognitive processes (see Clore, Schwarz, & Conway, 1994; Forgas, 1995; Schwarz & Clore, 1996). Emotions influence attention (Vuilleumier, 2005), decision-making (Bechara, Damasio *et al.*, 1999), memory (Phelps, 2006), physiological responses (Cacioppo *et al.*, 2000; Levenson, 2003), and social interactions (Keltner & Kring, 1998). However, even as they shape a lot of intrapersonal and interpersonal processes, emotions are subject to modification. The successful regulation of emotion is related to important psychological, social, and physical outcomes (Gross, 2002; Abelson *et al.*, 2005; Gross, 2007). Conversely, difficulties with emotion regulation have been considered as a mechanism underlying mood and anxiety disorders (Campbell-Sills & Barlow, 2007). Understanding the impact of different types of emotion regulation on experience, behaviour, and neural dynamics, may inform clinical practice and research. Gross' model of emotion regulation (1998) distinguishes between antecedent-focused strategies, which modulate early emotional tendencies, before they give rise to full responses, and response-focused strategies, which modulate the emotional responses themselves once they have arisen.

Individuals are more likely to recall information from memory that is congruent rather than incongruent with their current feelings (e.g. Bower, 1981; Isen, Shalcker, Clark, & Karp, 1978). Also, they may use their affective response to a target as a basis of judgement, asking themselves how they feel about a specific think. Individuals are likely to evaluate any target more positively when they are in a happy rather than a sad mood. Such evaluations are not obtained when they are aware that their feelings are due to an unrelated source (see Schwarz & Clore, 1988, 1996). Both mood-congruent recall and the use of one's feelings as a basis for judgements, influence decision-making by affecting the accessibility and evaluation of valenced features of the current situation. Moreover, individuals in a happy mood tend to overestimate the likelihood of positive outcomes, and to underestimate the likelihood of negative ones, *vice versa* for individuals in a sad mood (e.g. Johnson & Tversky, 1983; Nygren, Isen, Taylor, & Dulin, 1996). In addition, affective states influence information processing (Schwarz, 2000). As largely documented, individuals who are in a happy mood are more likely

to adopt a heuristic processing strategy that is characterised by *top-down* processing, with high reliance on pre-existing knowledge structures and little attention to the details. In contrast, individuals who are in a sad mood are more likely to adopt a systematic strategy, characterised by *bottom-up* processing with little reliance on pre-existing knowledge and considerable attention to details (Schwarz & Clore, 1996). These differences have been observed across a wide range of content domains, including processing persuasive messages (e.g. Schwarz, Bless, & Bohner, 1991), using stereotypes in impression formation (e.g. Bodenhausen, Kramer, & SuÈsser, 1994), and reliance on scripts for behavioural sequences (e.g. Bless et al., 1996). Consistent with the more detail-oriented processing style fostered by negative moods, Luce and colleagues (1997) have shown that decision-making process under increasing negative emotion becomes more extensive and proceeds more by focusing on one attribute at a time. These differences in processing reflects that our thought processes tend to meet the requirements of the current situation, which are in part signalled by our personal affective state (Schwarz, 1990). Negative affective states may signal that the current situation is problematic and may elicit a processing style that pays attention to the specifics of the problematic situation. In contrast, a positive affective state may signal a good environment that allows us to rely on our daily routines and pre-existing knowledge structures. Consistent with these assumptions, mood effects on processing style are deleted when the informational value of the mood is questioned through misattribution manipulations (Sinclair, Mark, & Clore, 1994), as much as has been observed for judgements (Schwarz & Clore, 1983). In the field of the *Theory of Games* (von Neumann & Morgenstern, 1944), individuals in a happy mood are likely to heuristically imitate the behaviour of other players, whereas individuals in a sad mood base their moves on a systematic analysis of the structure of the game (Schwarz, 2000). These processing strategies result in cooperative or competitive behaviour under different conditions, challenging the assumption that being in a positive mood would generally increase individuals' cooperativeness.

The relationship between emotions and decision-making is bidirectional, and the positive or negative outcome of a decision can affect the decider's personal feelings. Appraisal models of emotion can be applied to predict which outcomes are likely to elicit which emotion. In contrast, we may experience regret even when we get what we expected, but realise that another course of action would have been better than the effective one. In literature, regret and disappointment are the emotions that have received most attention in the decision-making field, focused on how the anticipation of regret and disappointment may influence individuals' decisions.

Bell (1982, 1985) and Loomes and Sugden (1982, 1986) proposed that individuals are motivated to avoid the experience of regret and decide in a way that reduces the likelihood of this negative emotion. Because people experience more regret for acts of commission rather than omission (Gilovich & Medvec, 1995), one of the more problematic consequences of anticipated regret is a preference for action over inaction (Baron, 1994). Parents may hesitate to vaccinate their child when the vaccine could be potentially fatal, even under conditions where the likelihood of a fatal side effect is only a fraction of the death rate from the disease (Ritov & Baron, 1990). The role of anticipated feelings in decision-making is not limited to the emotions of regret and disappointment. As March (1978) showed, all decisions involve predictions of future feelings, but our attempts to predict future feelings are full of uncertainty, and we often get it wrong, resulting in suboptimal decisions (Loewenstein & Schkade, 1999). Erroneous predictions are particularly likely when individuals in a “cold” state are asked to predict how they would feel and act in a “hot” one (e.g. when hungry or sexually aroused) (Loewenstein, 1996). So far, research into the prediction of future feelings has been primarily conducted by researchers in decision-making and consumer. Incidental emotions (i.e., unrelated to the target object) have been shown to influence how much people eat (Grunberg & Straub, 1992), help (Manucia, Baumann, & Cialdini, 1984), trust (Dunn & Schweitzer 2005), procrastinate (Tice, Bratslavsky, & Baumesiter, 2001), or price different products (Lerner, Small, & Loewenstein 2004). Given individuals’ general difficulties with the prediction of future feelings, one may think that extensive experience with an emotion-eliciting situation would increase the validity of his/her own predictions affecting future similar situations, but this is not always true (Loewenstein & Schkade, 1999), and memories of past feelings are themselves subject to systematic biases. Furthermore, most of the emotional changes experienced in our daily lives are mild and short term. Even when a strong emotion is experienced, its intensity fades away in a matter of seconds or few minutes (Ekman 1999). It seems logical that the impact of emotions on decision-making should also be brief: as the emotional state rapidly recedes to the background, so should its impact on decision-making. In contrast to this view, Andrade and Ariely (2009) demonstrated that the influence of mild incidental emotions on decision-making can live longer than the emotional experience itself.

1.3 - Intergroup Dynamics, NCC and Emotions

One of the most powerful ideas in contemporary social psychology is that the self is largely defined in terms of group memberships. Social categorization into specific groups, like all categorization processes, highlights the similarities within groups and the differences among them.

In several scientific fields has been explored how bias toward *Outgroup* can be manifested as different emotions (e.g. Cottrell & Neuberg, 2005; Fiske, Cuddy, Glick, & Xu, 2002; Mackie, Devos, & Smith, 2000; Smith, 1993). For example, researchers in the stereotype tradition have linked stereotypes of incompetence or interpersonal parting to pity, contempt, or envy (Fiske *et al.*, 2002). From another perspective, researchers focusing on context-specific judgments showed that perception of *Outgroup* strength or weakness relative to the *Ingroup* generated negative emotions, such as anger, disgust, or fear (Mackie *et al.*, 2000). Cottrell and Neuberg (2005) focused on a specific kind of appraisal threat, and distinct emotions toward *Outgroups*. They predicted and found correlational evidence for the notion that *Outgroup* activate specific threats, such as contamination or harm, and these threats are associated respectively with disgust and anger. They argue that intergroup emotions are elicited by threat appraisals, because groups pose evolutionarily significant ‘socio-functional threats’, including competition (for resources), attack, disease, and non-reciprocation. High levels of dispositional NCC also lead individuals to an aversion toward *Outgroup* members, who are seen as threatening for the whole *Ingroup* dimension (Shah, Kruglanski & Thompson, 1998), and also NCC pushes to make judgments based on prevailing stereotypes (Dijksterhuis, van Knippenberg, Kruglanski & Schaper, 1996; Jamieson & Zanna, 1989). In general, NCC seems to be a sort of motivational antecedent of intergroup hostility (e.g., Golec, 2002; Shah *et al.*, 1998; Kruglanski, Shah, Pierro & Mannetti, 2002; Kruglanski & Webster, 1996), like, for example, in the form of authoritarianism and prejudice toward immigrants (Dhont, Roets & Van Hiel, 2013), and it also seems to be a promoter of *group-centrism* (Kruglanski, Pierro, Mannetti & De Grada, 2006) because of its role on categorizing *Outgroup* people.

2. Need for Cognitive Closure and Negative Emotions toward *Ingroup/Outgroup* individuals in Bargaining Behaviour

2.1 - Introduction

Hickson & Pugh (1995) stated that culture shapes “everything”. The most accepted model of cultural differentiation is Hofstede’s one (1980; 2010), which started from four to six final dimensions: 1) Power Distance (different solutions for human inequality), 2) Uncertainty Avoidance (level of stress due to facing an unknown future), 3) Individualism vs Collectivism (integration of individuals into primary group), 4) Masculinity vs Femininity (division of emotional roles between women and men), 5) Long Term vs Short Term Orientation (people are focused on present or future and past), and 6) Indulgence vs Restraint (gratification versus control of basic human desires related to enjoying life). Because every individual is unique and different from each other, the concept of culture can be used meaningfully just by comparison (Hofstede, 2010).

According to Brown’s idea (2000), the concept of Social Identity Theory (SIT, Tajfel & Turner, 1979; Turner & Tajfel, 1986), that is the portion of an individual’s self-concept derived from perceived membership in a relevant social group, needs to take account of behaviour and negative emotions. Subsequently, the Self-Categorisation Theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) described specifically the process of shifting to see the self in terms of membership in a salient group with which one also identifies. It leads people to self-stereotyping themselves as interchangeable members of the significant group. SIT itself could be considered as a theory of emotion (Spears, Leach, van Zomeren, Ispas, Sweetman & Tausch, 2011), but recently the interest about the role of emotions in intergroup relationships increased (Mackie & Smith, 2015). This interest has culminated in the Intergroup Emotion Theory (IET, Mackie, Maitner, & Smith, 2009; Mackie, Silver, & Smith, 2004; Mackie & Smith, 2002; E. R. Smith & Mackie, 2006, 2008; E. R. Smith et al., 2007), which describes systematically the uniquely group-level nature of the categorisation, identification, and appraisal antecedents of intergroup emotions, and their consequences on intergroup relations. In literature, the assumption that every nation has its own distinctive, influential and describable culture, is largely argued (McSweeney, 2002). Hickson & Pugh (1995) stated that culture shapes “everything”. The *Intergroup Emotion Theory* (IET, Mackie, Maitner, & Smith, 2009; Mackie, Silver, & Smith, 2004; Mackie & Smith, 2002; E. R. Smith & Mackie, 2006,

2008; E. R. Smith et al., 2007) describes systematically the uniquely group-level nature of the categorisation, identification, and appraisal antecedents of intergroup emotions, and their consequences on intergroup relations. As already explained in *Chapter 1*, intergroup dynamics are also under the significant influence of NCC (Kruglanski, 1980). This consideration made us thinking that maybe the perceived cultural similarity of other populations than ours, negative emotions towards other nationalities, and individual levels of NCC, could have a considerable weight on bargaining behaviours, like the decision to either accept or reject economic offers made by players from different parts of the world. Considering the motivational nature of the NCC psychological construct, our hypothesis is that its levels could change individuals' bargaining behaviour toward *Ingroup* and/or *Outgroup* members, shaping the motivation to accept or reject an economic offer. We decided to use the *Ultimatum Game* (UG, Güth, Schmittberger & Schwarze, 1982) to assess intergroup behaviour through possible differences in rejection rate. In this game, considering a fixed starting amount of money, one player (*proposer*) has to decide how to share it with a second player (*receiver*). The *receiver* can either accept (in this case both players receive the amount proposed) or reject (in this case nobody gets money) the offer. According to *Rational Choice Theory* and *Expected Utility Theory*, a rational *proposer* should always offer the lowest amount (typically 10%) and a rational *receiver* should accept all the *proposer's* offers, instead of receiving no money because of rejection (Gabay, Radua, Kempton & Mehta, 2014; Glimcher, Camerer, Fehr & Poldrack, 2009). However, players do not typically display such a behaviour: they're prone to accept more fair or close-to-fair offers (40-50%) and to reject lower ones (Gabay et al., 2014). This deviance from the ideal rational behaviour, as shown in literature, is due to the strong influence of negative emotions on judging the other player and his/her offers (Bosman, Sonnemans & Zeelenberg, 2001). For example, the emotion of *Disgust* seems to play a crucial role in shaping the UG irrational behaviour (Chapman, Susskind & Anderson, 2009). It seems that, when an individual in the role of *receiver* has to decide if accept or reject unfair offers (e.g., starting from 10\$, the *proposer* offers 1\$ and keeps for himself 9\$) at the UG, he/she shows an activation of the "*Levator Labii Aequae Nasi*" facial muscle, which is considered the main feature of the facial expression of disgust (Rozin & Fallon, 1987), as it is evoked by unpleasant tastes and pictures of contaminants (Chapman et al., 2009). Also, the emotion of *Anger* seems to be involved in the acceptance process at the UG. Pillutla and Murnighan (1996) stated that the anger resulting from perceived injustice is a better predictor of a rejection behaviour than the unfairness per se. Furthermore, the probability of rejection of an unfair offer at the UG is positively related to the intensity of anger (Bosman, Sonnemans, & Zeelenberg, 2001). At the

intrapersonal level, anger is associated with competition, while at the interpersonal level it's more variable, because it sometimes elicits cooperation, sometimes competition and some other times it has no effects at all (Van Kleef, van Dijk, Steinel, Harinck & Van Beest, 2008). It has also been shown that, in small groups, the *Fear* that an unfair offer could be rejected drives *proposers* to split equally the resources at the UG almost always (Huck & Oechssler, 1999).

2.2 - Study1

The principal aims of this research are 1) to investigate, in a sample of Italian people, cultural differentiation in terms of perceived *Closeness* and *Similarity* toward their own nationality and 11 other ones, 2) to understand if levels of negative emotions (*Disgust*, *Anger* and *Fear*) towards these nationalities are linked to NCC's levels, and 3) to investigate if bargaining behaviour depends on this motivational construct. The first two parts of this study (*Study1.a* and *Study1.b*) will help us to discriminate between nationalities, creating an *Ingroup/Outgroup* differentiation from the point of view of our Italian participants. As explained in *Chapter1*, group membership, as a social form of categorization, highlights similarities within groups and differences among them. Taking into account the crucial role played by emotions (specially negative emotions) in intergroup dynamics, our hypothesis was that the same nationalities considered as *Similar* in *Study1.a* were the same rated as more disgusting, anger-triggering and fearful (*Study1.b*). We decided to test *Similarity* and emotional ratings separately to avoid the direct influence of one on the other (for example, a participant who defined a nationality as *Similar*, could be influenced by this answer in giving a rating about the negative emotions it elicitates to him). The last part of *Study1* (*Study1.c*) will directly investigate if levels of NCC are linked to the decision to accept or reject offers, and if this decision is also influenced by the membership of the proposer. Our hypothesis is that individuals with high levels of NCC could reject significantly more offers from the *Outgroup* nationalities than from the *Ingroup* ones (compared to individuals with low levels of NCC), considering the influence of this psychological construct on the group centrism, the prejudice and stereotypes, and the motivation and decision-making.

2.2.1 – Study1.a: Perceived Closeness and Similarity of Different Nationalities for Italian Participants.

Procedure

We built an on line survey using *Survey Monkey* (Survey Monkey Inc., Palo Alto, California, USA. www.surveymonkey.com), in which we asked 76 Italian participants (age: *Mean* =27.5, *SD*=±6.8, range 20-68 ys), to indicate, on a 7-points Likert Scale, how they consider 12 different nationalities *Close* (from 1, “distant”, to 7, “close”) and *Similar* (from 1, “different”, to 7, “similar”) to their own one. Specifically, they were asked how they consider each nationality close and similar in terms of culture and moral standards. The chosen nationalities were: Italian (participants’ own one), Spanish, English, Irish, Swedish, Swiss, Albanian, Romanian, Pakistani, Chinese, Arab and Romani.

Results

We analyzed all our data (*Study1.a*, *Study1.b* and *Study1.c*) using R Studio (<https://www.R-project.org/>) and SPSS 21 (IBM Corp., 2012). We performed the general mean and the standard deviation for both *Closeness* and *Similarity* per each nation considered here. We found that Italian nationality has been identified as the closest (*Mean*=6.65, *SD*=.80) and the most *Similar* (*Mean*=6.65, *SD*=.80) from the 76 Italian participants. Following, we found Spanish, English, Swiss, Irish and Swedish nationalities, while the ones perceived as further and more dissimilar were Albanian, Romanian, Pakistani, Chinese, Arab and Romani nationalities (see *Figure2.2.1*).

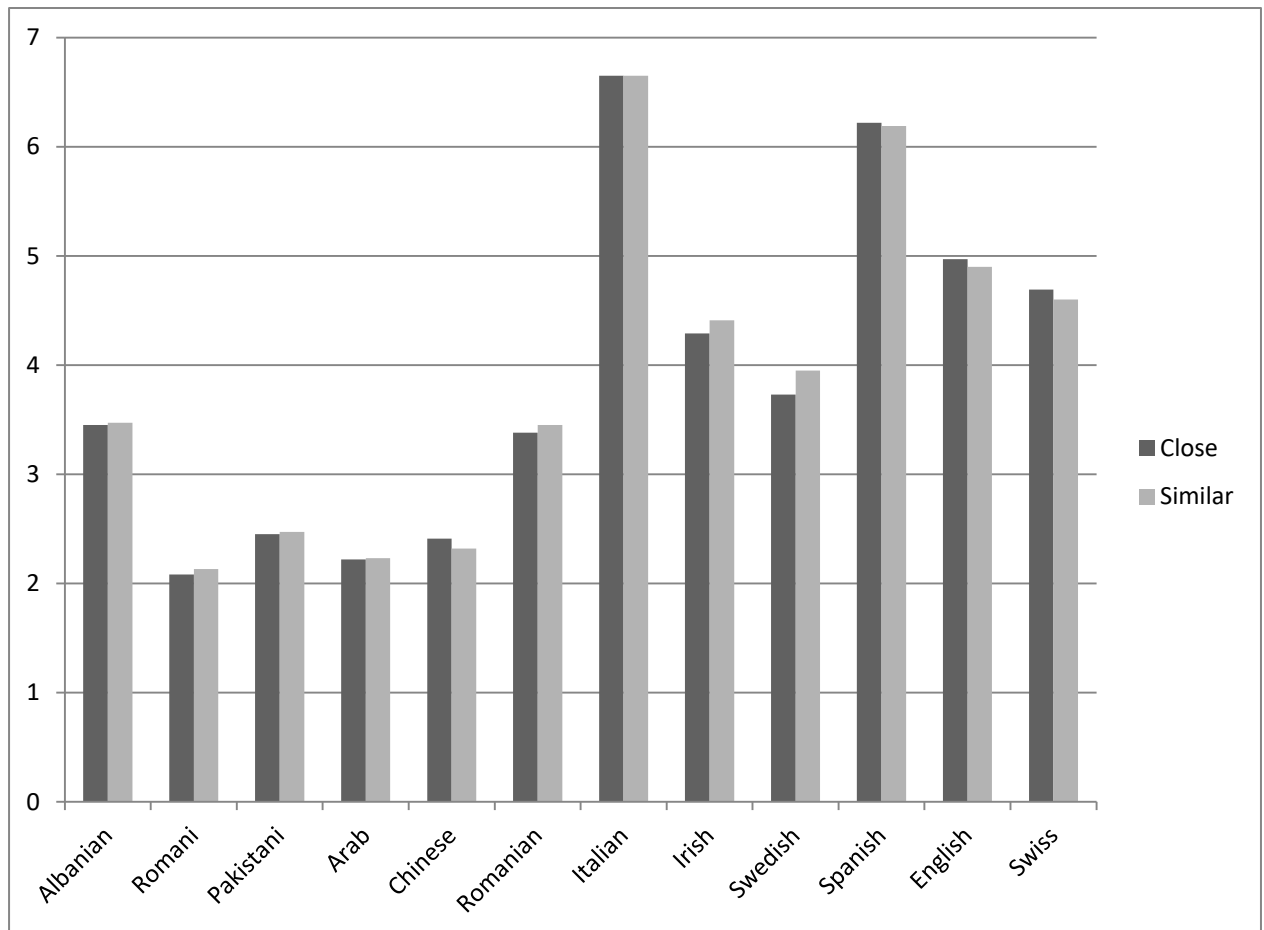


Figure2.2.1: Levels of perceived Closeness and Similarity for each nationality taken into account. On the Y-axis there are the points of the Likert scale for both Closeness and Similarity, on the X-axis the 12 different nationalities considered here.

For a summary of means and standard deviations, see *Table2.2.1*. Testing for normality with Shapiro-Wilk test, we found that, for each nation, both *Similarity* and *Closeness* are normally distributed. We found a strong direct correlation between them ($r=.998$, $p<.01$ two-tailed), as they were measuring the same construct. In fact, performing a univariate factor analysis, we extracted only one principal component (that explains 99.9% of the total variance), so we can state that both *Closeness* and *Similarity* measured the same factor. This is really important, because assures us that participants have not misunderstood the meaning of the word “*Closeness*”, for example giving it a more geo-political meaning. Considering that *Similarity* and *Closeness* measures the same factor, from here on we will call it just “*Similarity*”.

	<i>Closeness</i>		<i>Similarity</i>	
	<i>mean</i>	<i>SD</i>	<i>mean</i>	<i>SD</i>
Albanian	3.45	1.56	3.47	1.54
Romani	2.08	1.33	2.13	1.46
Arab	2.22	1.31	2.23	1.36
Chinese	2.41	1.33	2.32	1.33
Pakistani	2.45	1.25	2.47	1.27
Romanian	3.38	1.73	3.45	1.66
Irish	4.29	1.29	4.41	1.27
Italian	6.65	0.8	6.65	0.8
Spanish	6.22	0.79	6.19	0.82
Swedish	3.73	1.49	3.95	1.46
English	4.97	1.28	4.9	1.27
Swiss	4.69	1.62	4.6	1.62

Table 2.2.1: Means and Standard Deviations of both Closeness and Similarity for each considered nationality.

Discussion

In this first study, we found that *Similarity* and *Closeness* were measuring the same factor. This is probably due to the form of the question we asked to our participants: “*How much do you consider this nationality as culturally and socially Close to yours?*”. This question is hardly to misunderstand, and *Closeness* can’t be confused as a geographical closeness. We also found that Italian participants perceive differently similar to them the 12 considered nationalities. They perceived their own nationality (Italian) as the most similar, but we found that the others were perceived dissimilar at different levels. The ones perceived as more similar are all occidental nationalities (Spanish, English, Swiss, Irish and Swedish), while the nationalities perceived as more dissimilar are: three Asian (Chinese, Pakistani and Arab), one geographically European (Albanian), one of the EU (Romanian) and one stateless (Romani). Then we can say that EU nationalities (Note: this data were collected before the Brexit results), with the only exception of Romanian one, are perceived by Italians as more culturally and

morally similar to their own culture and society. Probably, the only explanation for the fact that two “European” nations (one just geographically and the other both geographically and politically) are considered so *Dissimilar* is linked to the immigration phenomenon: in 2011 Romania and Albania were respectively the 1st (1,110,848 immigrants) and the 2nd (515,808 immigrants) country from which immigrants came to Italy (Zanfrini, 2013), and in 2001 they were respectively at the 3rd and the 2nd place (*ibidem*), so their immigration story is deeply rooted in Italy’s story.

2.2.2 – Study 1.b: Disgust, Anger and Fear toward other nationalities

In this second study we wanted to investigate the interaction between NCC and emotions, especially negative ones (*Disgust, Anger and Fear*), towards the same nationality that we divided in *Similar* and *Dissimilar* in *Study1.a*. Our hypothesis was that the less *Similar* nationalities trigger higher levels of these three negative emotions than the more *Similar* ones, and that individuals with higher levels of Need for Cognitive Closure are more prone to rate negatively the *Dissimilar* nationalities.

Procedure

155 Italian adults (128 males) (age: *Mean*=25.1, *SD*=±10.8, range 18-65 ys), recruited using *CrowdFlower* (www.crowdflower.com), were asked to answer a questionnaire built on *Survey Monkey* (Survey Monkey Inc., Palo Alto, California, USA. www.surveymonkey.com). From the original sample of 196 subjects, 43 participants (33 males) were removed from the analysis because they didn’t answer correctly to the check-question (“*How much do you like the sun? (If you’re reading carefully, instead of put a tick on a box, write ‘I read carefully’ in the space below)*”), or because they were not Italian (they were from Spain and Romania).

Ratings

Participants were asked to judge each nationality (the same 12 as *Study1*) in terms of *Anger, Disgust* and *Fear*, with the question “*How much do you think to feel an emotion of DISGUST/ANGER/FEAR in respect to each of these groups?*”. We put the survey on line two different times to enlarge the starting sample size, but the second time we decided to change the original 5-points Likert scale with a 16-points one (we were looking for an answer closer to a *Visual Analogue Scale*’s one, easier to score in terms of percentage, because in *Survey Monkey*

it is not possible to build a VAS), so part of the final sample answered using the first scale and the other part using the second one. To manage with this difference, we performed all the analysis on the extracted percentage of *Disgust*, *Anger* and *Fear* for each participant.

Questionnaire

Participants had also to answer to the *Need For Cognitive Closure* scale (NCC, Webster & Kruglanski, 1994; Kruglanski *et al.*, 2013) in its 15-items version (Roets & Van Hiel, 2007). They had to answer using a 6-points Likert scale (from 1, “completely disagree”, to 6, “completely agree”).

Each subject received a 0.50€ payment just for participation. Ratings and NCC scale were presented in a randomized order.

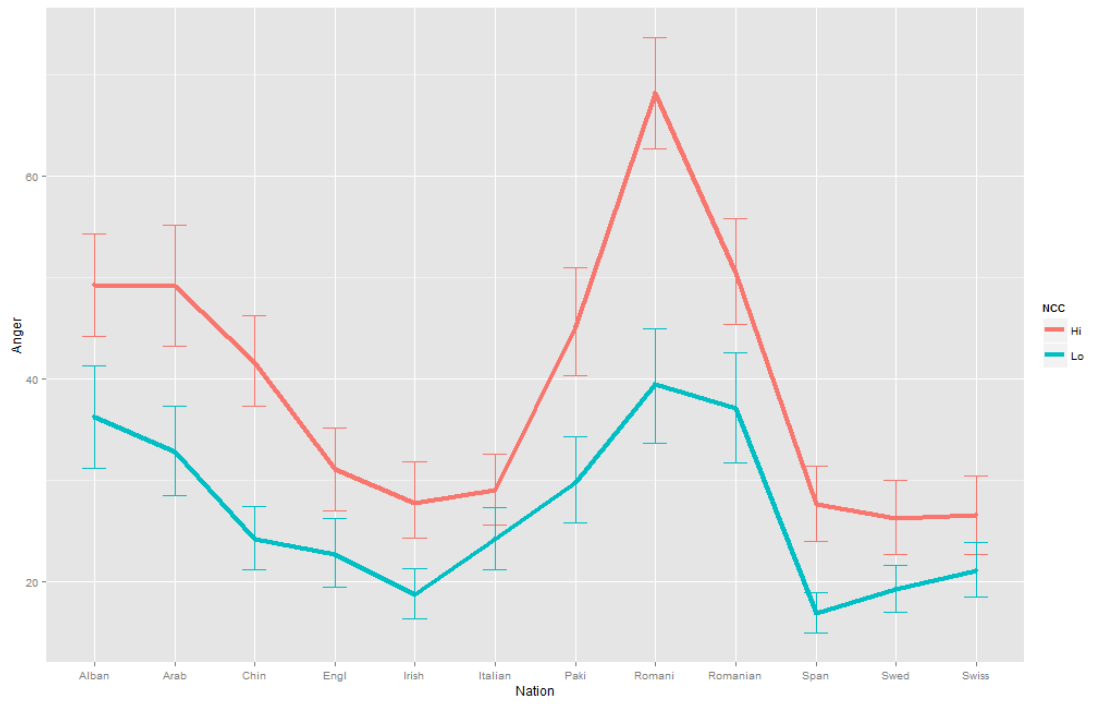
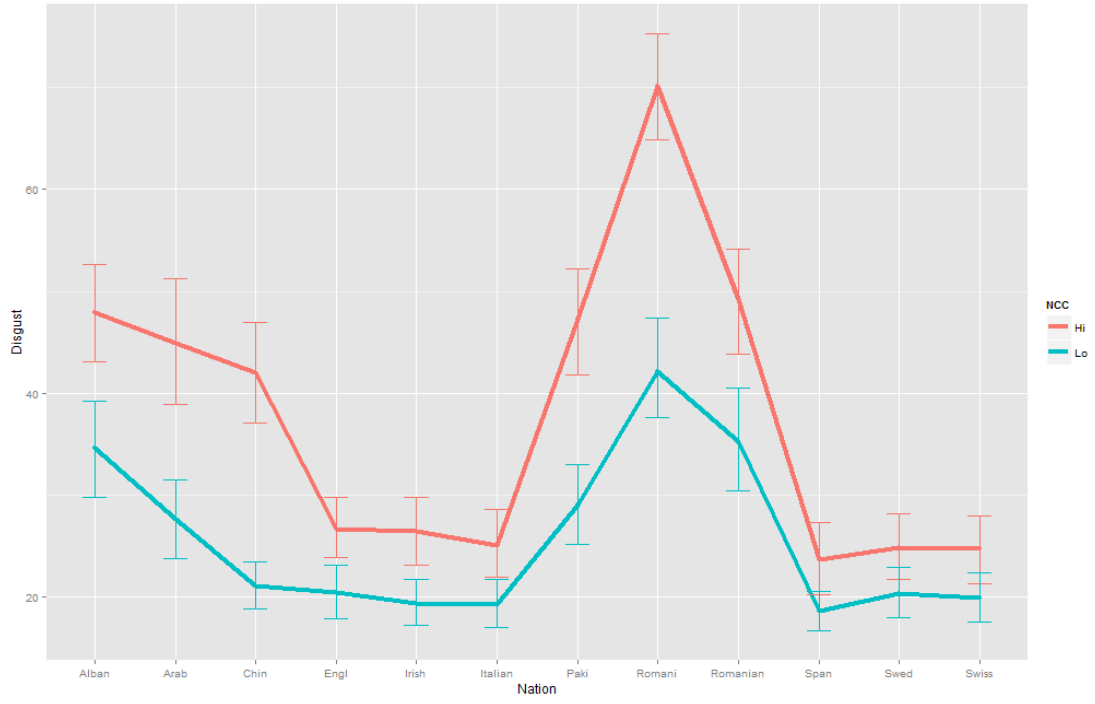
Results

Performing a one-way analysis of variance (ANOVA), with the nationality as factor, we found a main effect of all the three negative emotions considered, *Disgust* ($F=54.2, p<.001$), *Anger* ($F=41.02, p<.001$) and *Fear* ($F=63.61, p<.001$). We also found all positive correlations between the three emotions considered: *Anger-Disgust* ($r=.990, p<.01$), *Disgust-Fear* ($r=.975, p<.01$) and *Fear-Anger* ($r=.988, p<.01$). For an overview of the ratings' percentage see *Table 2.2.2*. Because of these strong correlations between the three emotions ratings, we performed a t-test of the general negative emotions score for *Similar* and *Dissimilar* nationalities, finding a significant difference between the two groups ($p<.001$). Considering NCC levels (min=35, max=88), we decided, on the base of the NCC scale (Cronbach's Alpha=.865), to extract two sub-samples, one considering just participants in the 1st quartile of the distribution (low levels of NCC, “*Lo-NCC*”), and the other considering the last quartile of the distribution (high levels of NCC, “*Hi-NCC*”), excluding participants placed in the intermediate quartiles.

Nation	% Disgust	% Anger	% Fear
Albanian	42.0%	42.8%	46.9%
Romani	57.9%	56.6%	56.5%
Arab	38.0%	41.4%	46.5%
Chinese	31.5%	31.9%	32.2%
Pakistani	37.6%	35.9%	40.6%
Romanian	42.5%	42.8%	44.2%
Irish	22.0%	21.4%	22.3%
Italian	23.9%	27.1%	26.8%
Spanish	21.7%	20.6%	21.2%
English	21.8%	21.0%	21.0%
Swedish	23.3%	23.7%	22.9%
Swiss	22.9%	23.2%	21.7%

Table 2.2.2: Percentage of 1) Disgust, 2) Anger and 3) Fear ratings for each nationality.

As shown in *Figure 2.2.2*, the *Hi-NCC* sub-sample (41 participants selected) rated all the nationalities more *Disgust/Anger/Fear*-eliciting than the *Lo-NCC* one (44 participants selected), especially Romani nationality.



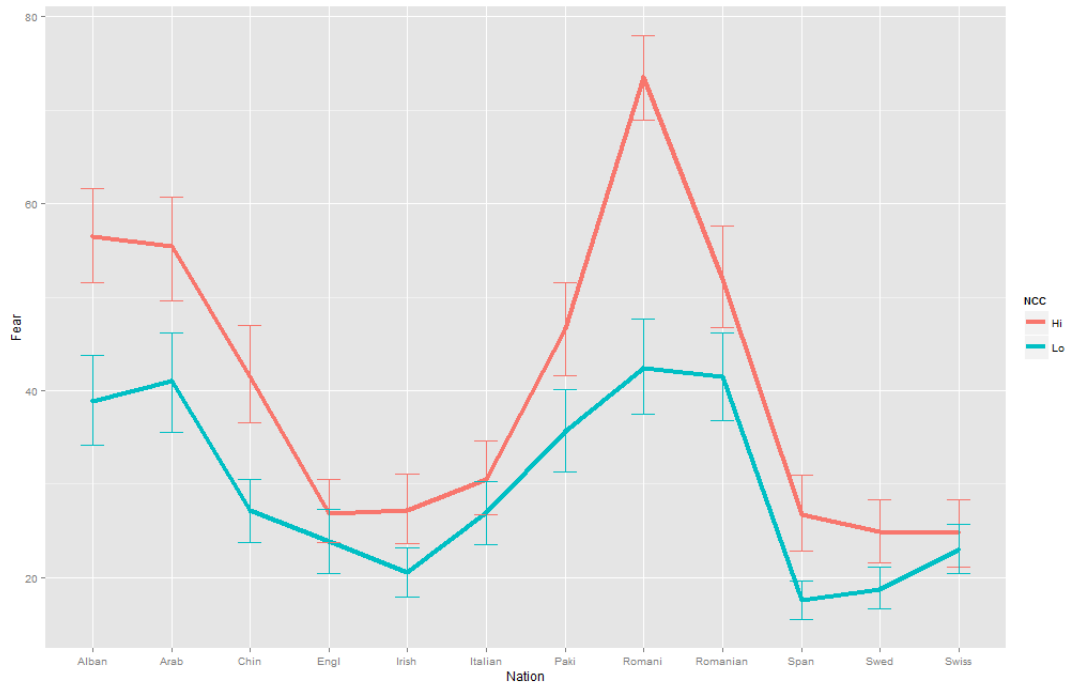


Figure 2.2.2: Different trends between Hi-NCC and Lo-NCC participants for 1) Disgust (upper panel), 2) Anger (middle panel) and 3) Fear (lower panel) ratings for all the 12 nationalities considered.

Discussion

In *Study 1.b* we found that Italian nationality, which was considered the more *Similar* in *Study 1.a*, has been not assessed as the less *Disgust/Anger/Fear-eliciting* one in *Study 1.b*. All the other five *Similar* nationalities received lower ratings of *Anger, Fear* and *Disgust*. This result needs a deeper investigation, but this is not the principal aim of this work. We also found that, in general, *Lo-NCC* sub-sample tended to give lower ratings of all the negative emotions toward every nationality, with smaller differences compared to the *Hi-NCC* sub-sample. A very recent study (De keersmaecker, Van Assche & Roets, 2016) has shown that individuals with high levels of NCC feel less favourable toward cultural fusion at both abstract and concrete level, and assign culturally fused stimuli to one discrete culture, rather than identifying them as culturally “hybrid”. This could also explain in part why Albany and Romany are considered so *Dissimilar* and received higher ratings for all the three emotions. It’s important to take into account that these emotions are different, and that are linked to different behavioural outcomes. Maybe what we really found is a general negative attitude towards the *Dissimilar* nationalities, expressed with higher ratings for the three negative

emotions chosen here. Taken together, *Study 1.a* and *Study 1.b* tell us important information about dispositions toward the different nationalities considered here, but what about the interaction with them? In *Study 1.c* we will investigate interactive behaviour using the UG with our participants in the role of *receivers* and virtual *proposers* from the 12 nations considered before.

2.2.3 – Study 1.c: The Bargaining Behaviour Towards Similar and Dissimilar

Individuals

In this third study we wanted to investigate if the NCC trait, because of its motivational nature, plays a crucial role in deciding to accept or reject offers by *proposers* of *Similar vs Dissimilar* nationalities. Our hypothesis was that Hi-NCC individuals tend to reject more when the proposer is *Outgroup* than *Ingroup*.

Procedure

143 healthy Italian adults (75 males) (age: *Mean*=33.7, *SD*=±8.7, range 18-62 ys), recruited using *CrowdFlower* (www.crowdfunder.com), were asked to play online the Ultimatum Game and to answer a questionnaire, all built on *Survey Monkey* (www.surveymonkey.com). We used a multiple choice question just to check if participants were paying attention to the whole task (see *Study 1.b*). From the original sample of 188 subjects, 45 participants (27 males) were removed from the analysis because they didn't answer correctly to the check-question, or because they were not Italian (they were from Spain, Peru, Romania, Finland, Poland and USA). Each subject received a 0.50€ payment just for participation, and other 0.50€ if they answered in a certain way to a given question (see below).

Ultimatum Game.

In our study, all the participants always played the role of *receivers* against virtual *proposers* split in two different groups (considering results obtained in *Study 1.a* and *Study 1.b*): “*Similar*” (Italian, Irish, Spanish, English, Swedish and Swiss *proposers*) and “*Dissimilar*” (Albanian, Romani, Arab, Chinese, Pakistani and Romanian *proposers*). All the virtual *proposers* could split the starting fixed amount (10€) in four different ways: a) take 5€ for himself and give 5€ to the participant (5:5), b) take 6€ for himself and give 4€ to the participant (4:6), c) take 7€ for himself and give 3€ to the participant (3:7), and d) take 9€ for himself and give 1€ to the participant (1:9) (as in Chapman *et al.*, 2009). (see an example in *Figure 2.2.3*). This experimental design has the following structure: 4

(offers: 5:5 vs 4:6 vs 3:7 vs 1:9) x 2 (group membership of the *proposer*: *Similar* vs *Dissimilar*). In addition to the starting 0.50€ real retribution given to participants just because of their voluntary involvement in the study, we gave other 0.50€ to whom answered “*accept*” to the fair offer (5:5) made by the Swiss *proposer*, telling them, at the beginning of the procedure, that a random trial would be extracted and, if he/she accepts, it would be paid 0.50€ more. This was just to push participants to complete all the on-line experiment.

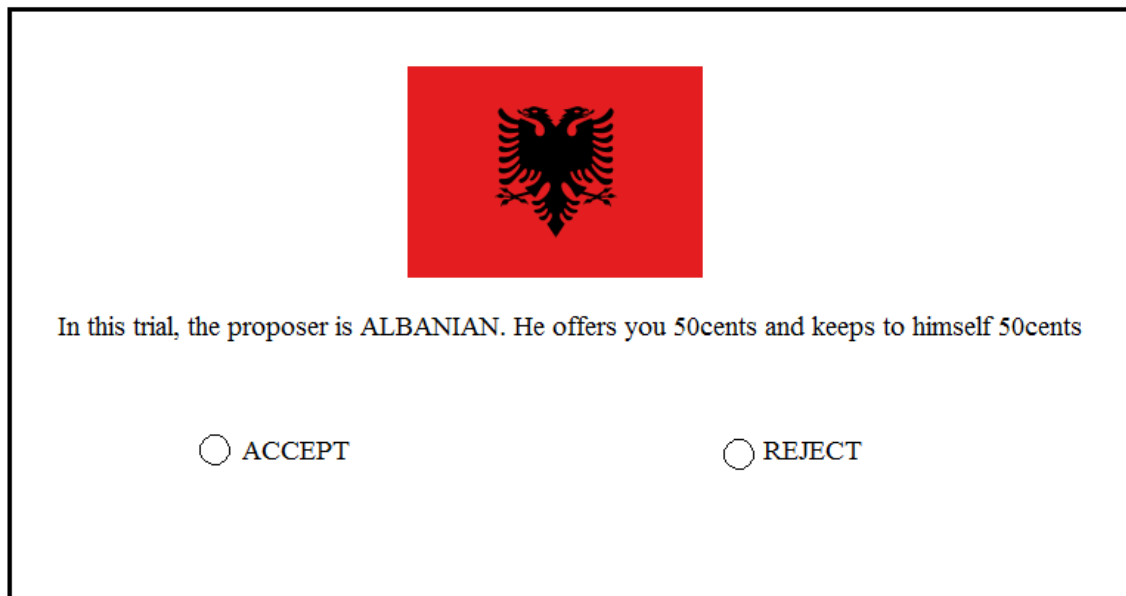


Figure 2.2.3: Example of an UG stimulus. In this case, the virtual player is from Albany, and he's giving 50cents to the participant (offer 5:5).

Questionnaire.

As in *Study 1.b*, participants had to answer to the *Need For Cognitive Closure* scale (NCC, Webster & Kruglanski, 1994; Kruglanski *et al.*, 2013) in its 15-items version (Roets & Van Hiel, 2007). Ultimatum Game's offers and Questionnaire were presented in a randomized order.

Results

We performed a nested mixed-models analysis (“lme4” R package), starting with a model having participants' ID number and *proposer's* nationality as fixed effects. We found a general higher rejection proportion for the *Dissimilar* (Albanians, Romani, Arabs, Chinese, Pakistanis and Romanians) compared to the *Similar proposers* (Italians, Irish, Spanish, English, Swedes

and Swiss) (Figure 2.2.4). This difference was significant for three offers: 4:6 ($z=3.409$, $p<.001$), 3:7 ($z=3.019$, $p<.01$) and 1:9 ($z=3.595$, $p<.001$) (not for the offer 5:5, with $z=1.187$, $p=.23$). Implementing in the starting model the interaction between the offer and the NCC levels (Cronbach's Alpha=.869), we found a strong interaction effect ($p<.001$), so we decided to select two sub-samples from the original one: i) individuals with low levels of NCC (*Lo-NCC*, 1st quartile of the distribution for the NCC scale), and ii) individuals with high levels of NCC (*Hi-NCC*, last quartile), as in *Study 1.b*.

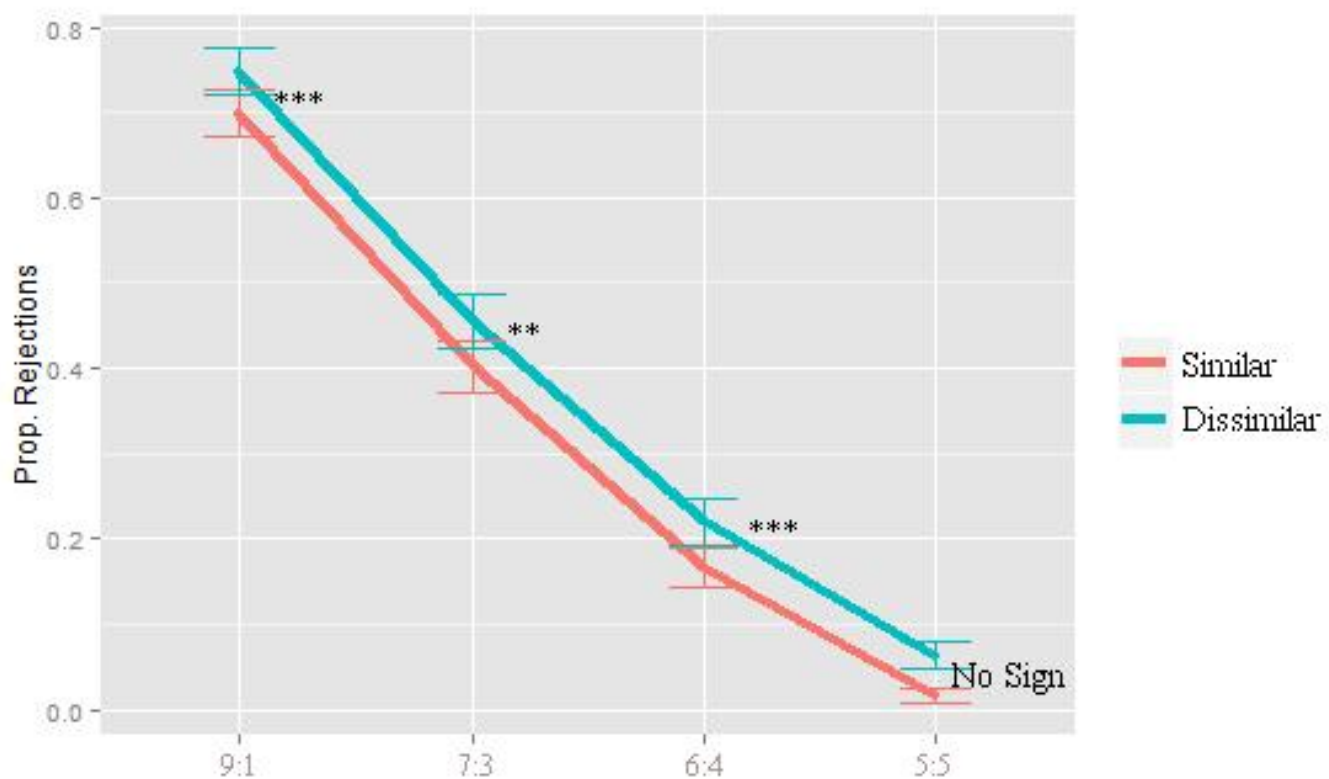


Figure 2.2.4: General rejection trend for Similar vs Dissimilar groups in all the offers.

*= $p<.05$, **= $p<.01$, ***= $p<.001$.

Then, we analysed the proportion of rejection of the four offers for both *Similar* and *Dissimilar* groups in the two sub-samples. In the new model with the *Hi-NCC* sub-sample (39 participants selected), we found a difference in the proportion of rejection between the *Similar* (less rejected) and the *Dissimilar* (more rejected) groups for the offers 4:6 ($z=2.146$, $p<.05$) e 1:9 ($z=3.197$, $p<.01$), but not for the fair offer 5:5 ($z=.803$, $p=.42$) and for 3:7 ($z=1.808$, $p=.07$). Considering the model with *Lo-NCC* sub-sample (40 participants selected), we didn't found

significant differences for *Similar vs Dissimilar* nationalities for any offer (5:5, $z=.922$, $p=.35$; 4:6, $z=1.457$, $p=.14$; 3:7, $z=.154$, $p=.87$; 1:9, $z=1.314$, $p=.19$;) (Figure 2.2.5).

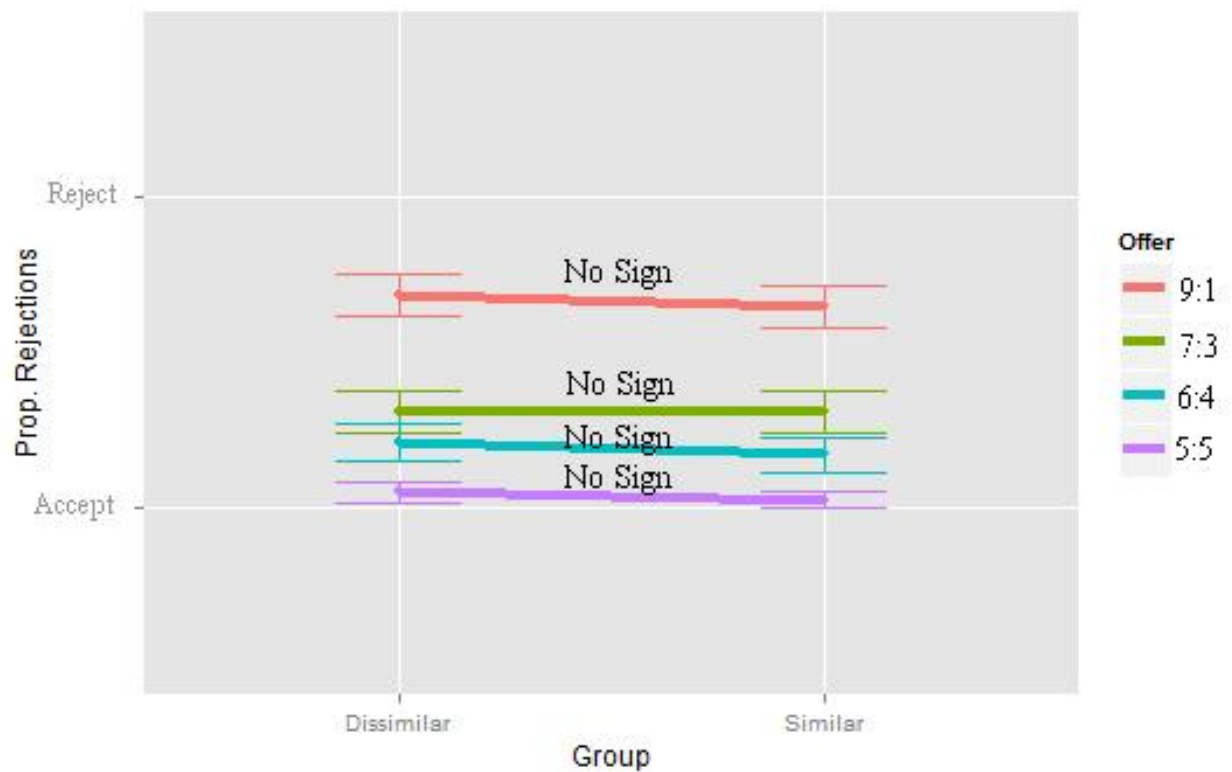
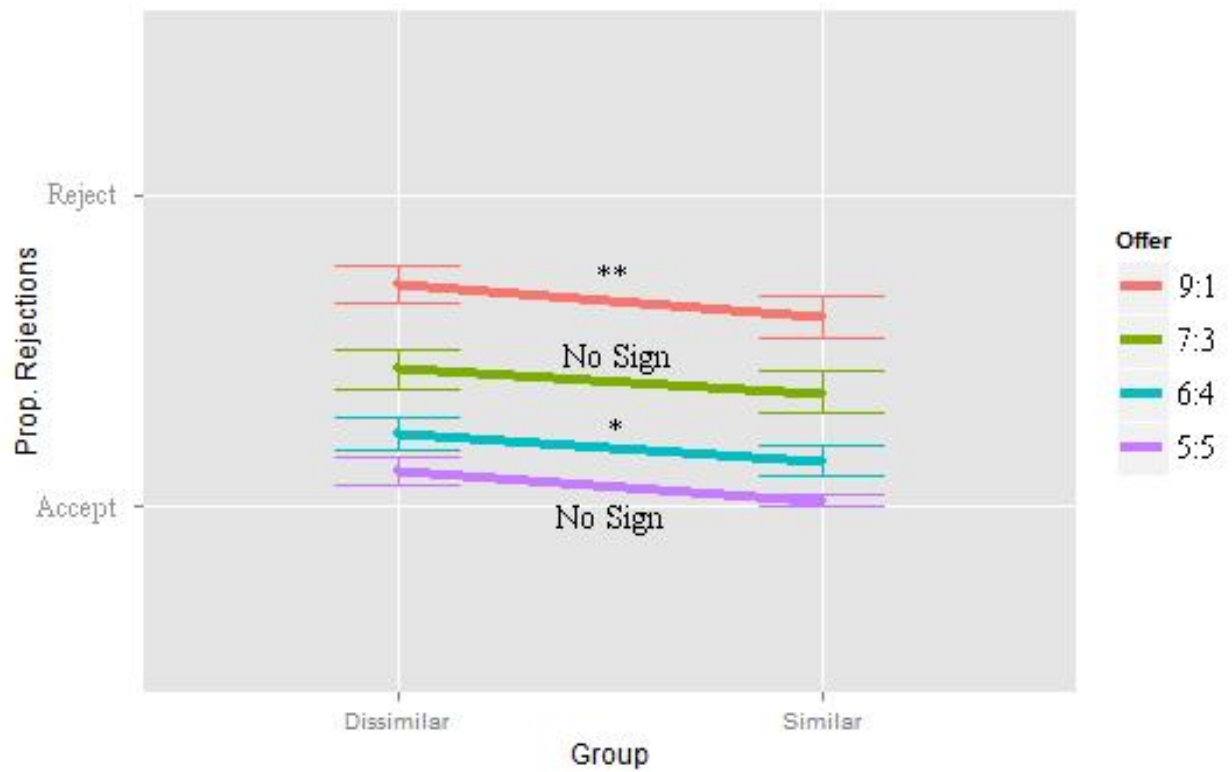


Figure 2.2.5: Differences in Rejection rate for Positive vs Negative groups in all the offers (up panel = “Hi-NCC” subsample; down panel = “Lo-NCC” subsample).

*= $p < .05$, **= $p < .01$, ***= $p < .001$.

Discussion

In general, the more the offer was unfair, the more it was rejected. We found a higher rejection rate when the *proposer's* nationality was one of the more *Dissimilar* and the more *Disgust/Anger/Fear-eliciting* ones (see *Study 1.a* and *Study 1.b*). This is true for all the offers except for the 5:5 fair offer (50% of the starting amount), for which we didn't find any difference considering the similarity. After the extraction of the two sub-samples, as hypothesized, we found that individuals with low levels of NCC behave in the same way for both *Similar* and *Dissimilar proposers*, with no significant differences in none of the offers. On the other hand, individuals with high levels of NCC rejected more the 1:9 (10% of the starting amount) and the 4:6 (40% of the starting amount) offers when the *proposer* was *Dissimilar*, while there was no difference for the other two offers. The p-value of the difference between *Similar vs Dissimilar* in the rejection rate, for the *Hi-NCC* subgroup, of 3:7 offer is .07, so we can state that it is not significant, but that it follows the trend of the other offers (in R, p-values close to significance are labelled with the “.” symbol, and this was the case).

2.2.4 – General discussion

In this research, we investigated the role of perceived *Similarity*, three negative emotions (Anger, Disgust and Fear), and levels of Need for Cognitive Closure in shaping the attitudes towards different nationalities, and, more in specific, in bargaining behaviour of Italian *receivers*, using the Ultimatum Game. In *Study 1.a* we saw that Italian individuals tend to consider European countries more *Similar* to them in terms of culture and moral standards, except for Albania (which is not part of the EU but is geographically sited in Europe) and Romania. We argued this result taking into account the Italian immigration flow of the last fifteen years (Zanfrini, 2013). *Study 1.a* also tells us that the two constructs (*Closeness* and *Similarity*) we considered for our on-line survey underpin the same factor, so the more a nationality is perceived as *Similar*, the more it's also perceived as culturally (not geographically) *Close*. In *Study 1.b* we wanted to understand if nationalities seen as more *Dissimilar* are also perceived as more *Disgust/Anger/Fear-eliciting*. As expected, we found that the *Dissimilar* nationalities

(Albanian, Romani, Arab, Romanian, Chinese and Pakistani) are also the ones that in general elicit more *Disgust*, *Anger* and *Fear* in our Italian sample. This is interesting considering the different nature of these three emotions: Disgust helps us to avoid possible contaminants (also “moral” contaminants), Anger elicits a fight-or-fly response, while Fear pushes individuals to avoid possible dangerous stimuli. Extracting the two sub-samples, *Hi-NCC* and *Lo-NCC*, we can see that both are more prone to feel all the three negative emotions toward the Dissimilar nationalities, but the first one gave general higher ratings compared to the second one. This result is in line with literature about *Ingroup-Outgroup* dynamics, in which is highlighted that high levels of NCC correlate with stronger stereotyping attitudes, prejudice toward immigrants (Dhont *et al.*, 2013), and, more in general, a group-centric behaviour (Kruglanski *et al.*, 2006) and, consequently, an intergroup hostility (e.g., Golec, 2002; Kruglanski, Shah, Pierro & Mannetti, 2002). It is interesting to underline results about Romani nationality in both *Study1.a* and *Study1.b*: it is considered as the most *Dissimilar* and the most *Disgust/Anger/Fear*-eliciting nationality, and it is the one in which the difference between *Hi-NCC* and *Lo-NCC* participants’ emotional ratings are the biggest. This could be an interesting starting point for further investigations about the relationship between Italian and Romani cultures, considering the levels of individual Cognitive Closure, but this was not the main aim of our studies. In *Study1.c*, we assessed the bargaining behaviour at the UG of an Italian sample that had to play the role of *receiver* with *proposers* from the same countries considered in *Study1.a* and *Study1.b*. We found a significant difference in the rejection rate between *Similar* (less rejected) *vs Dissimilar* (more rejected) nationalities for all the offers, except for the most fair one (the *proposer* offers 50% of the total amount to the *receiver*). This is probably due to the fact that 5:5 was the most convenient offer a player could receive in our UG, and, in literature, it is accepted most of the times (e.g., Civai, Crescentini, Rustichini & Rumiati, 2012; Corradi-Dell’Acqua, Civai, Rumiati & Fink, 2013; Güth *et al.*, 1982; Rilling & Sanfey, 2011); so we could consider the non significant difference between *Similar vs Dissimilar* as a matter of costs against benefits. Probably, a 50% offer was seen as too good to reject, regardless of the *Similarity* and the emotions elicited by the *proposer*’s nationality. It is possible that at a certain point it became clear to participants that the highest offer they could receive was 50% of the total amount, and that it was counterproductive to reject it. The extraction of the *Hi-NCC* and *Lo-NCC* sub-samples shows us different results. In literature, individuals with high levels of NCC show a higher general arousal, measured through Galvanic Skin Response (GSR, Roets & Van Hiel, 2008; Roets *et al.*, 2015). Taking into account that skin conductance activity is

higher also when an individual receives an unfair offer at the UG, and it's related to the rejection rate of unfair offers (Van't Wout, Khan, Sanfey & Aleman, 2006), we could speculate that *Hi-NCC* sub-sample rejected more the 1:9 offer by *Dissimilar proposers* also because of a higher negative arousal raised up by the *Dissimilar* nationalities. Using the third-party punishment paradigm (Fehr & Fischbacher, 2004), Hao, Yang & Wang (2016) found that sharing and altruistic punishment behaviours are both related to a higher emotional arousal. This could help us to better delineate an emotional-motivational frame for the rejection of the offer 1:9 in the UG in *Study1.c*, but it needs further investigation using the third-party punishment paradigm. What remains unclear to explain is the significant difference in rejection rate between *Hi-NCC* and *Lo-NCC* sub-samples when they receive 4:6 (40% of the total amount) offer by the *Similar* (less rejected) vs *Dissimilar* (more rejected) *proposers*. The real contradiction is that, for the less fair offer 3:7 (30% of the total amount), there are no significant differences between *Similar* vs *Dissimilar proposers* neither for *Hi-NCC* nor for *Lo-NCC* participants, but, as already explained, there was a close-to-significant trend ($p=.07$). This is probably solvable enlarging the sample size, that is around 40 individuals per each sub-sample, and a further investigation is needed. A possible explanation that connects all the results in *Study1* could be that individuals with high levels of NCC are more threatened by *Outgroup* members, that are perceived as *Dissimilar*, and induce general negative emotions that drive more rejections of offers by the *proposers* from these nationalities. This work is an introduction to the use of economic games in the investigation of dispositional Need for Cognitive Closure. With this kind of tasks, it is possible to assess motivational differences due to NCC levels in negotiation and bargaining behaviour between different groups, investigating intergroup biases and prejudice from a strong motivational point of view.

2.3 - Study2: The Role of Need for Cognitive Closure in Bargaining Behaviour: an *Ingroup/Outgroup* fMRI Study.

The study proposed here, with a between design (participants with high levels of NCC, "*Hi-NCC*", and with low levels of NCC, "*Lo-NCC*"), aims to find neural differences in bargaining behaviour at the Ultimatum Game (UG, Güth *et al.*, 1982), with *Ingroup* vs *Outgroup* *proposers*, for *responders* with different levels of NCC. As already explained in *Chapter1*, just one fMRI study has been performed looking for differences between *Hi-NCC* and *Lo-NCC*

(Viola *et al.*, 2014), but the task used in this study was a merely cognitive one (*Flanker Task*), not directly linked with motivation and bargaining. As well known, NCC directly influences several cognitive processes, like information processing, action monitoring, unaware preliminary judgments and need for cognition (see Roets *et al.*, 2015). Here we try to find neural basis of motivation for both *Hi-NCC* and *Lo-NCC* sub-samples, considering its epistemic nature. We can consider this study as an exploratory one, so we didn't define precise Regions Of Interest (ROIs) at the beginning, but we hypothesized a role of the frontal cortex, because of its involvement in decision-making and action monitoring. Another reason why we decided not to define ROIs is that we didn't want to assess differences between fair and unfair offers (the most used contrast in UG literature, see Gabay *et al.*, 2014), but we focused on the intermediate offers, in which we thought that Ingroup/Outgroup membership could have a stronger influence than the offers per se. Defining ROIs starting from studies interested in different contrasts could negatively affect our results, so we decided for a more explorative approach.

Procedure

37 neurotypical healthy right-handed adults (18 males) (age: *Mean*=25.34, *SD*= ± 3.92, range 19-34 ys), selected from a starting database of 198 participants who answered the NCC scale (Cronbach's Alpha=.848) questionnaire (Webster & Kruglanski, 1994; Kruglanski *et al.*, 2013), were recruited. The whole sample (NCC score *Mean*=148.259, *SD*= ± 21.661) was made by 17 *Hi-NCC* (last quartile of the distribution, from 162 to 205) and 20 *Lo-NCC* (first quartile of the distribution, from 82 to 134) participants. From the original sample of 39 participants, 2 of them were excluded due to technical issues. The stimuli used are pictures of males and females with neutral expression from the Karolinska database (72 pictures, 36 males and 36 females). The total amount of neutral faces in this database is 70 (35 males and 35 females), so we modified one male (image #58) and one female (image #27) pictures, changing hair colour and modifying skin luminance. None of the participants noticed that two images were repeated. In a cover story, we say to participants that the pictures were taken from an older experiment from 2014, and that they depict participants who played as *proposers* at the UG, and that we modelled and reproduce their real behaviour with a 97-98% accuracy. Stimuli have a purple or beige frame, and the participant has to wear a purple or beige t-shirt, in a counterbalanced order. We decided for these two colours after an on-line survey in which, from a sample of 83 individuals, we asked to report their emotions (from 1, very negative, to 10, very positive) toward different colours (see *Figure 2.3.1*). The aim of this colour manipulation was to induce

a minimal *Ingroup/Outgroup* categorization of the fake *proposers*. We told to our participants that the *proposers* of the older experiment answered the same questionnaire as they did (NCC scale), and that if their t-shirt's colour was matched with the picture's frame, they had similar personological and dispositional features, if not, *vice versa*.

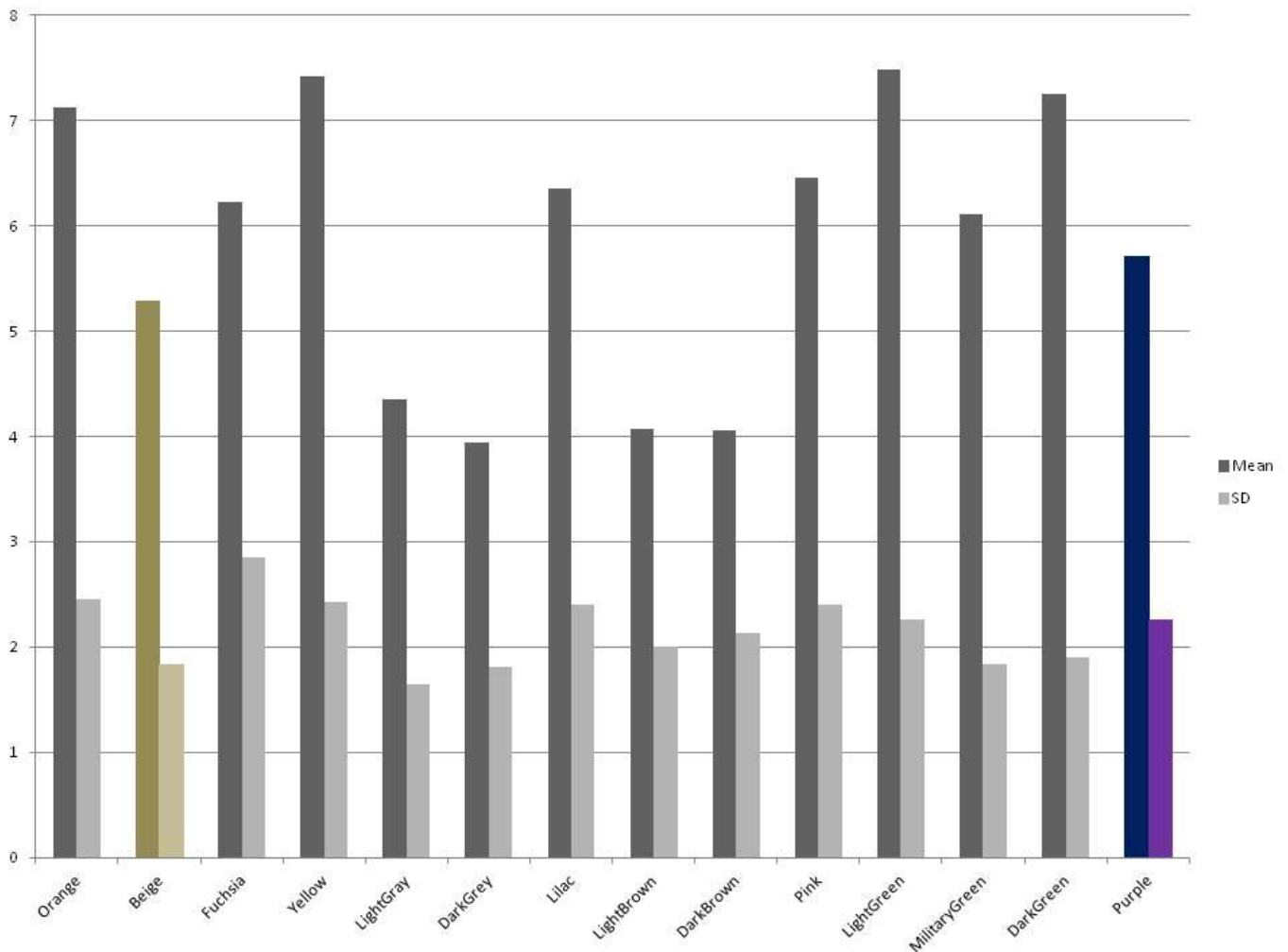


Figure 2.3.1: Means and Standard Deviations of positive/negative emotions toward colours. Beige and Purple are the more neutral ones. On the Y-axis there are the points of the Likert scale, on the X-axis there are the different colours proposed.

Participants had to play as *receivers* (to decide if accept/reject the offer) for 3 functional Magnetic Resonance Imaging (*fMRI*) sessions (around 9.4 minutes per each session), with a 5-6 minute break between each of them. Starting from an amount of 10 virtual Euros, the possible offers by the fake *proposers* were: take 5€ for himself and give 5€ to the participant (5:5), b) take 6€ for himself and give 4€ to the participant (4:6), c) take 7€ for himself and give 3€ to the participant (3:7), and d) take 9€ for himself and give 1€ to the participant (1:9) (as in Chapman *et al.*, 2009). We decided to use these possible offers to stay in line with *Study1.c*. The offers

were not perfectly balanced: the 3:7 and 4:6 offers were presented two times the 5:5 and 1:9 ones, because we hypothesized a higher variability between *Hi-NCC* and *Lo-NCC* sub-samples in the intermediate offers than in the fair and unfair ones. Participants viewed the stimuli with a mirror that reflected the image from the projection screen placed at the head of the scanner bed.

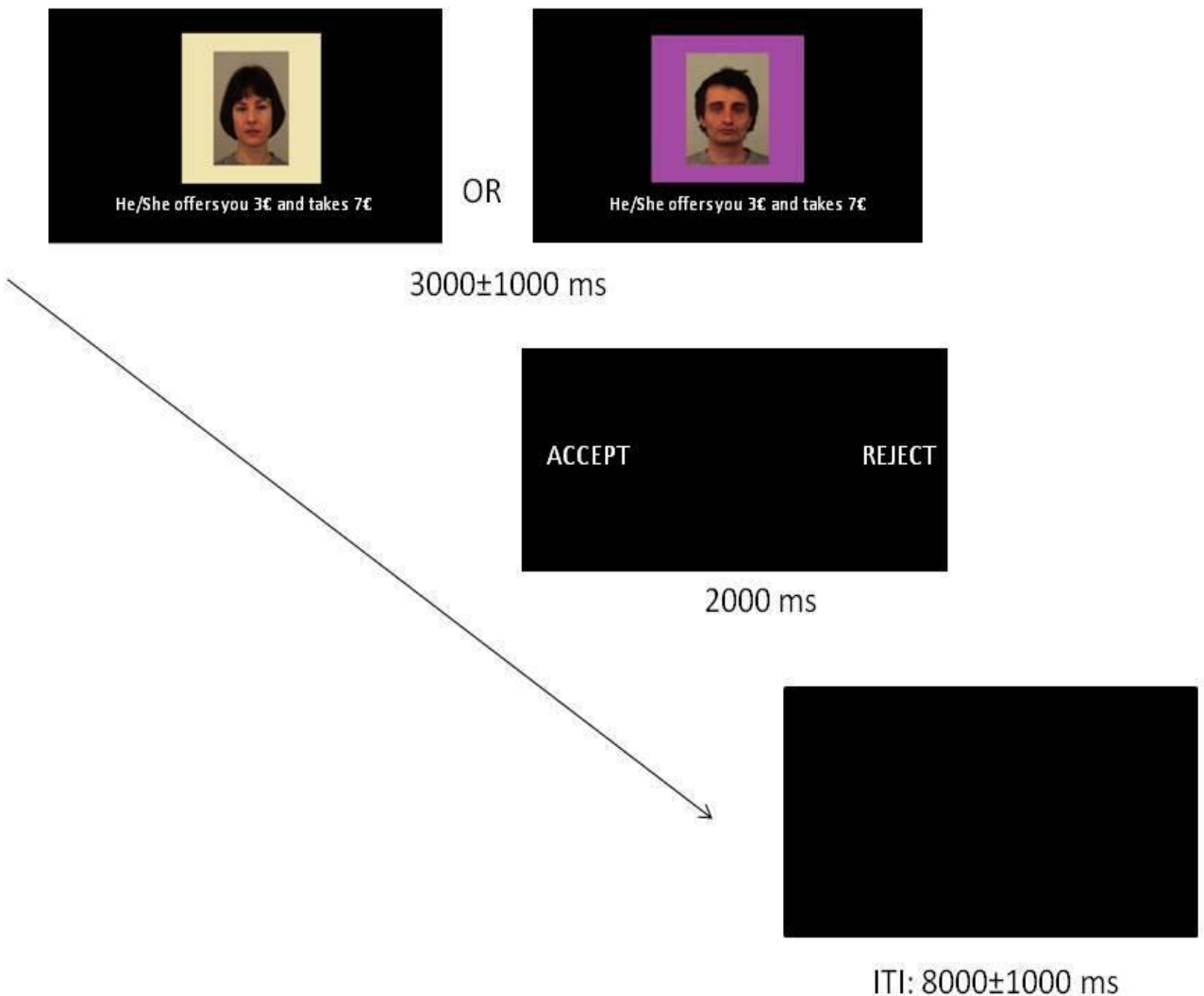


Figure 2.3.2: Example of experimental procedure with 3:7 offer.

Before the *fMRI* sessions, we administered to participants a brief example (12 trials) of the experiments to make them familiarize with it out of the scanner. In this preliminary part, after every trial, we added a four alternative forced options question about the emotion it elicited more in the participant between *Anger*, *Disgust*, *Fear* and *Happiness*. *fMRI* images were acquired on a 3T Siemens Allegra MR system (Siemens Medical Systems,

Erlangen, Germany) operating at Santa Lucia Foundation, using a standard head coil. A control computer located outside the MR room generated stimuli by running in-house software written in Cogent 2000 (developed at FIL and ICN, UCL, London, UK) and implemented in MATLAB (The MathWorks Inc., Natick, MA, USA). Echo-planar functional MR images (TR=2.08s, TE=2.015s, flip angle=70°, 64×64 image matrix, 3×3 mm in-plane resolution, 32 slices, 3 mm slice thickness with a 0.8mm gap, sequential excitation order) were acquired in the AC-PC plane using blood-oxygenation-level-dependent (*BOLD*) imaging. From the superior convexity, sampling included all the cerebral cortex.

Preprocessing and fMRI Data Analysis

Functional magnetic resonance images were pre-processed and analyzed using SPM12 (Wellcome Department of Cognitive Neurology, London, UK). Functional MR images from each subject were first re-oriented to the AC-PC plane, then spatially corrected for head movement, using a least-squares approach and six-parameter rigid body spatial transformations, and temporally corrected for slice timing, using the middle slice acquired in time as a reference. Functional data were then spatially normalized using an automatic nonlinear stereotaxic normalization procedure (final voxel size: 2×2×2 mm) and spatially smoothed with a three-dimensional Gaussian filter (8 mm full width at half maximum). The spatial normalisation process for each participant was based on one of his/her own image.

Images were analyzed using a standard random-effects procedure. At the first stage, the time series of functional MR images obtained from each participant was analyzed separately. The effects of the experimental paradigm were estimated on a voxel-by-voxel basis, according to the general linear model (GLM) extended to allow the analysis of *fMRI* data as a time series. The onset of each trial constituted a neural event that was modelled using a canonical Hemodynamic Response Function (*HRF*), chosen to represent the relationship between neuronal activation and blood flow changes.

At the second stage, linear compounds of subject-specific images of parameters estimates were entered in group analyses in which every subject was treated as a random effect. The resulting statistical parametric maps (T statistics) were thresholded at $p < .001$.

Behavioural results

In the preliminary familiarization part, we analyzed the emotions elicited by each *Ingroup/Outgroup* offers for both *Hi-NCC* and *Lo-NCC* sub-samples. In *Figure 2.3.3* we reported the percentage of Anger, Disgust, Fear and Happiness rated by *Hi-NCC* and *Lo-NCC* participants for each of the four offers both from *Ingroup* and *Outgroup proposers*.

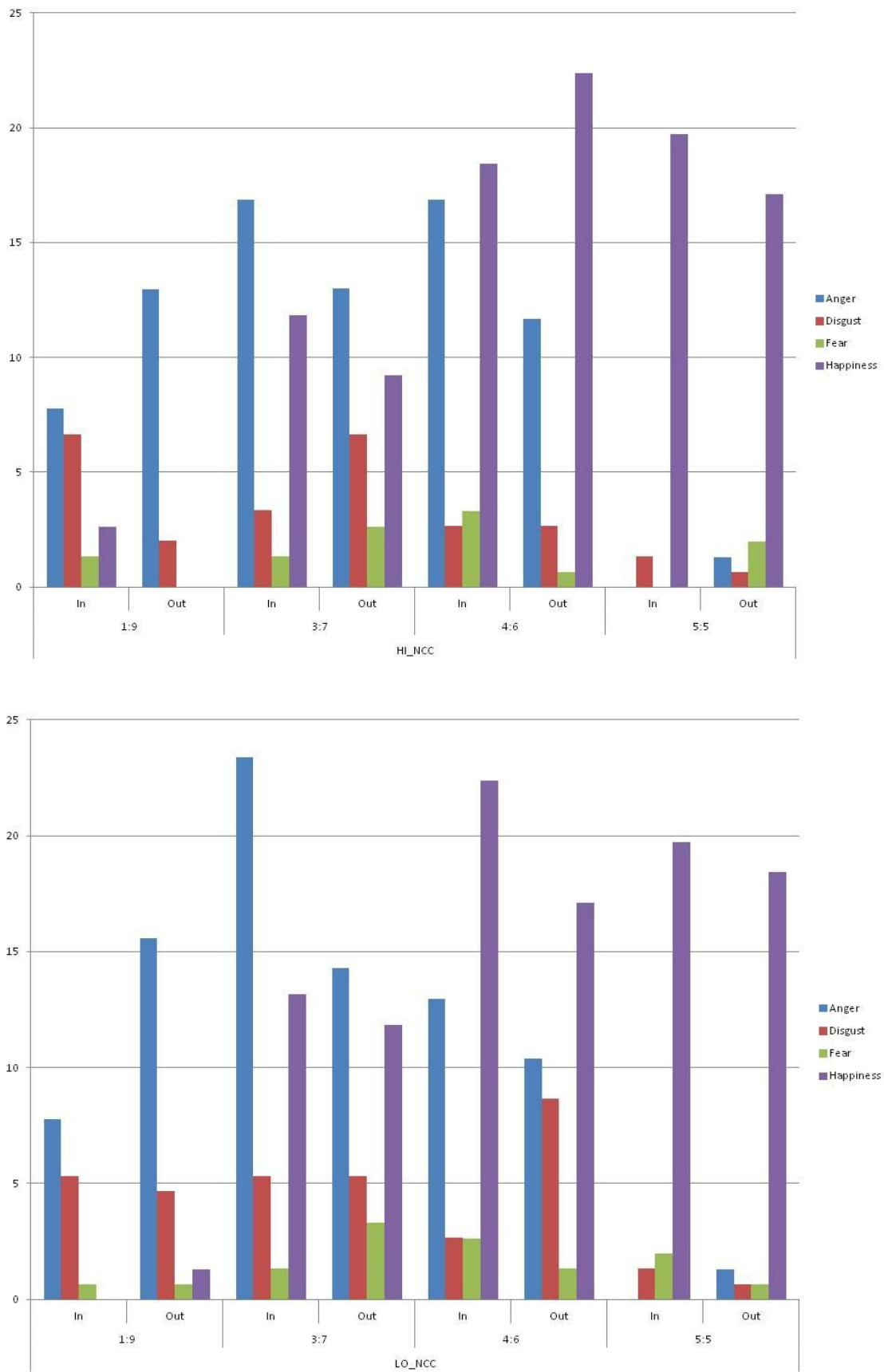


Figure 2.3.3: Percentages (Y-axis) of every emotion rated by both Hi-NCC (upper panel) and Lo-NCC (lower panel) per each received offer.

We analyzed the rejection rate per each offer by *Ingroup* vs *Outgroup* proposers for both *Hi-NCC* and *Lo-NCC* sub-samples (4 offers X 2 proposers X 2 NCC levels). We performed a one-way ANOVA, finding out that the offer 3:7, by both *Ingroup* and *Outgroup* proposers, was rejected significantly more by *Hi-NCC* sub-sample than *Lo-NCC* one (*Ingroup*: $F(7.311)$, $p=.011$, $\text{Eta}^2=0.173$; *Outgroup*: $F(4.511)$, $p=.041$, $\text{Eta}^2=0.114$). The results remained the same after *Welch* and *Brown-Forsythe* robust tests of equality of means. Results are showed in *Figure 2.3.4*.

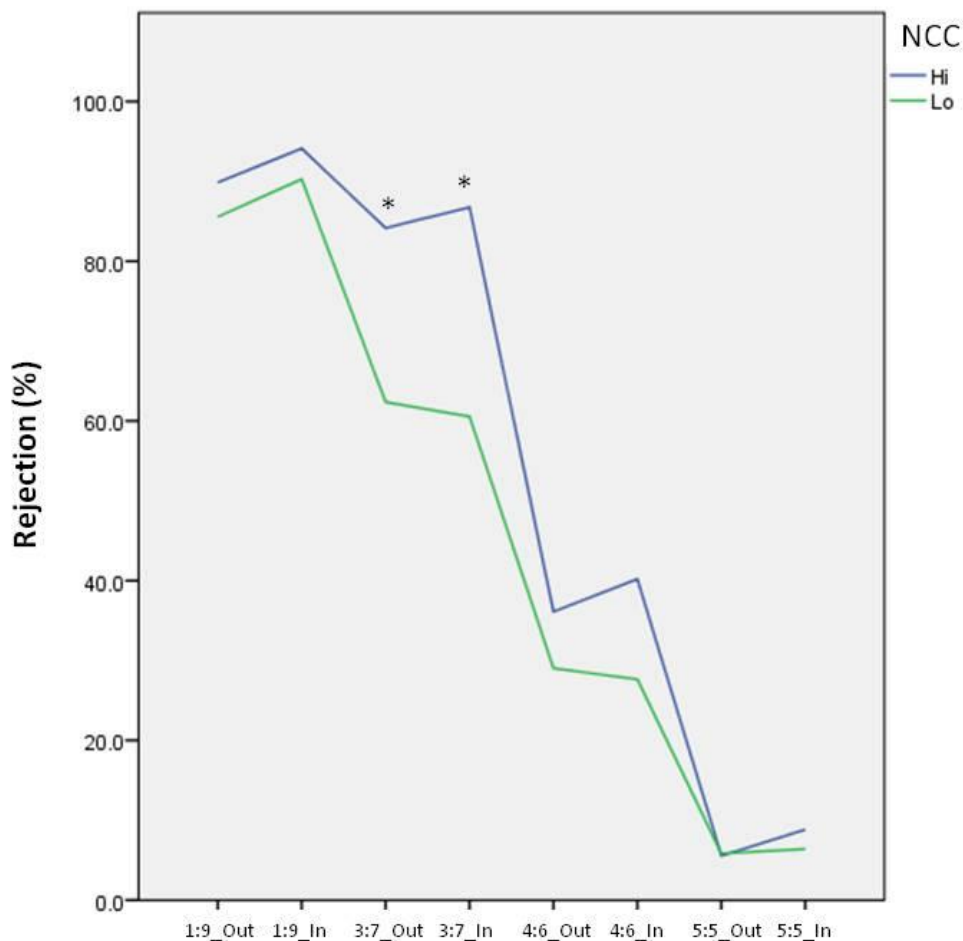


Figure 2.3.4: Percentages of Rejection Rate by Hi-NCC and Lo-NCC sub-samples per each offer (1:9, 3:7, 4:6 and 5:5) made by Ingroup vs Outgroup proposers.

*= $p < .05$.

Functional neuroimaging results

We performed t-contrasts per each offer (1:9, 3:7, 4:6 and 5:5) by both *Ingroup* and *Outgroup* proposers for the two NCC sub-samples.

Regardless of the offer, we found a significant difference in the *Lo-NCC* group when facing an *Ingroup* member compared to an *Outgroup* one, but we didn't find the same difference in the *Hi-NCC* sub-sample. Specifically, without considering the offers, we found a significant cluster ($p(\text{FWR-corr}) < .001$, $p(\text{FDR-corr}) = .003$) in the internal part of the Superior Frontal Gyrus (SFG), more precisely in the posterior rostral middle frontal cortex (prMFC), bilaterally activated when participants with low levels of NCC plays at the UG with an *Ingroup* (vs *Outgroup*) proposer (see *Figure 2.3.5*). This activation was not present for *Hi-NCC* sub-sample.

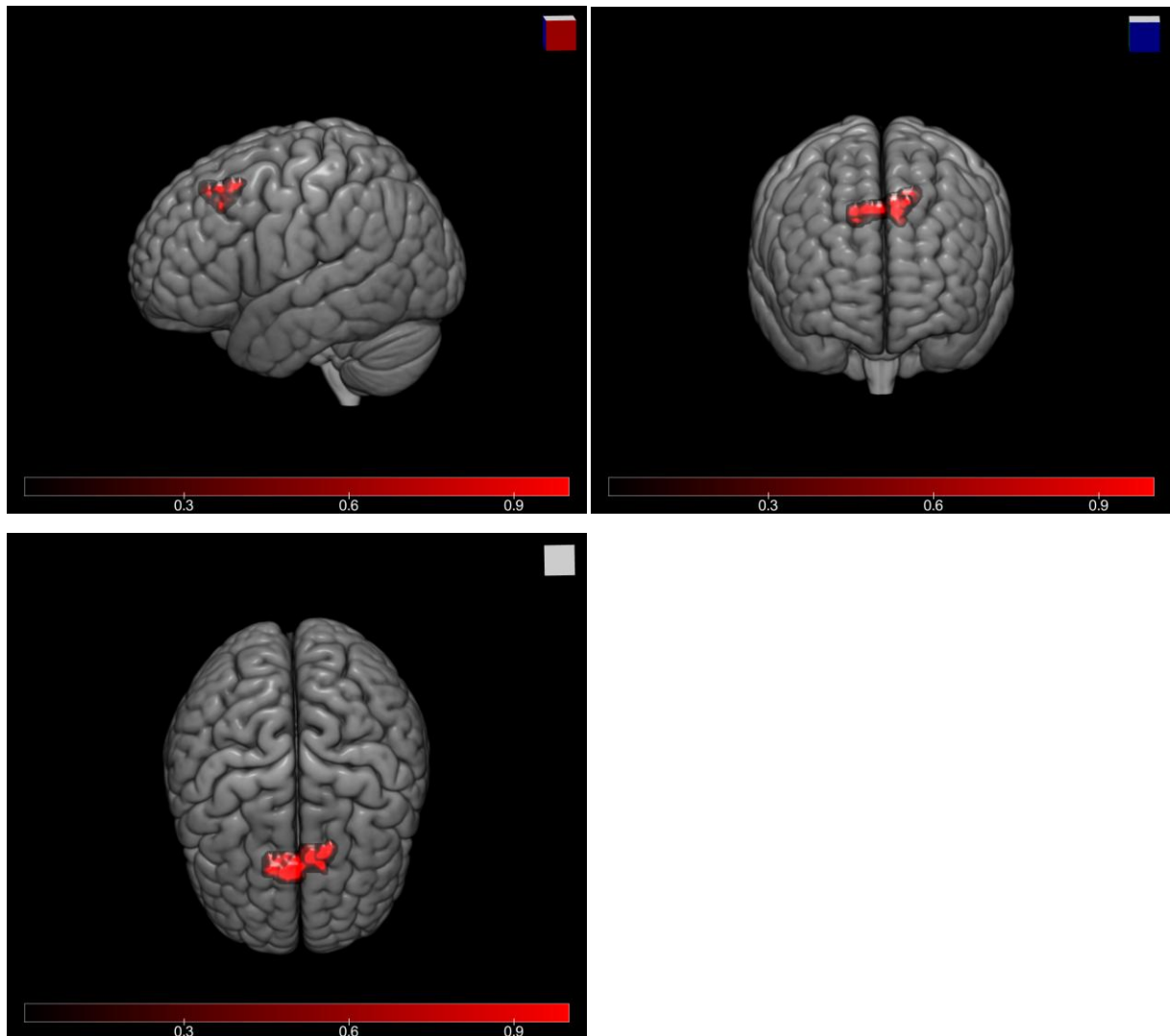


Figure 2.3.5: 3D render (obtained with MRICrogl) of the activation of Superior Frontal Gyrus in Lo-NCC sub-sample for Ingroup proposers.

We also found a significant difference between *Hi-NCC* and *Lo-NCC* groups just for the 4:6 offer when proposed by an *Outgroup* member, but not for all the other offers. Specifically, we

found a significant cluster ($p(\text{FWR-corr})=.005$, $p(\text{FDR-corr})=.008$) in the right posterior portion of the Fusiform Gyrus (FG), activated for the *Hi-NCC* participants but not for the *Lo-NCC* ones (see *Figure 2.3.6*).

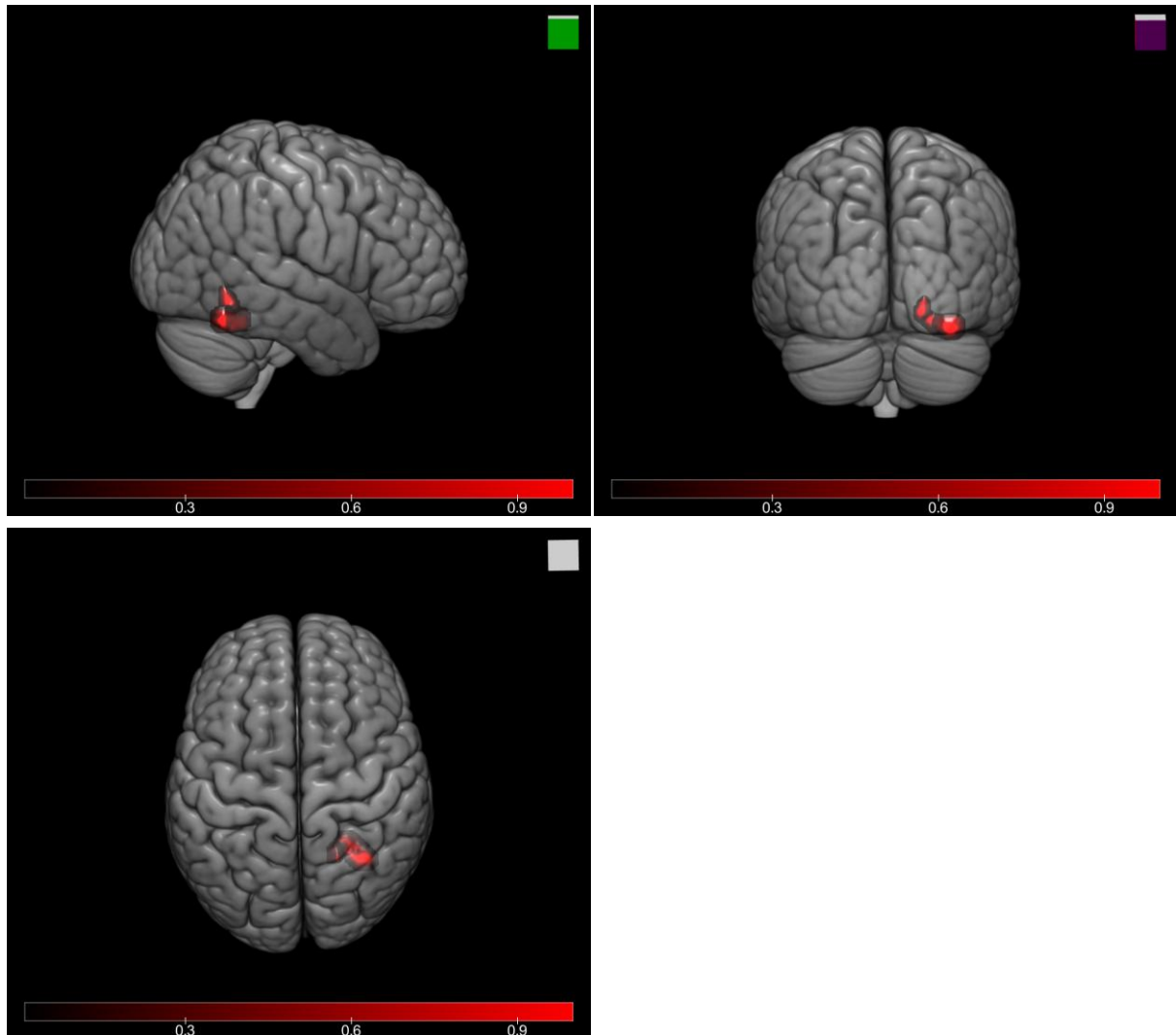


Figure 2.3.6: 3D render (obtained with MRICrogl) of the activation of Fusiform Gyrus in Hi-NCC sub-sample for the offer 4:6 proposed by Ongroup members.

Discussion

In a recent meta-analysis about brain activations during the UG, it has been shown that anterior insula (AI), anterior cingulate cortex (ACC), supplementary motor area (SMA) and cerebellum are activated in response to unfair offers (Gabay, Radua, Kempton & Mehta, 2014), and that AAC, SMA and Putamen are activated during the decision of rejecting rather than accepting UG offers (Gabay *et al.*, 2014; Sanfey, Loewenstein, McClure & Cohen, 2006). In literature, the activity of the Superior Frontal Gyrus (SFG) and the medial frontal cortex

(MFC) has been widely investigated and related to different behavioural outcomes. The posterior rostral MFC (prMFC), as reviewed by Amodio and Firth (2006), is involved in action monitoring processes (Botvinik, Cohen & Carter, 2004). Specifically, it seems to be involved in 1) conflict monitoring, 2) error monitoring, and 3) response selection, and all of these processes might depend on a single underlying sub-process generated by the prMFC (Amodio & Firth, 2006). Another crucial role is played by this region on the perception of monetary gain/loss. More in detail, Gehring and Willoughby (2002), in an ERPs study, found that the middle frontal areas are sensitive to money loss compared to money gain. Taking into account these roles of the MFC, we can say that *Lo-NCC* individuals are more sensitive to monetary loss at the UG when the *proposer* is *Ingroup*, and that probably they are performing a more accurate response selection process, aimed to avoid the monetary loss. Considering that at the UG, if the receiver rejects the offer, none of the two players receive money, probably it could lead to a “intra-group” preoccupation of community money loss. This interpretation is in line with the well documented tendency to work for the ingroup micro-efficiency (Schwartz-Shea & Simmons, 1990). Maybe, individuals with low levels of Need for Cognitive Closure have a stronger tendency to avoid group money loss. This is a purely speculative interpretation, but could open a new scientific path to walk.

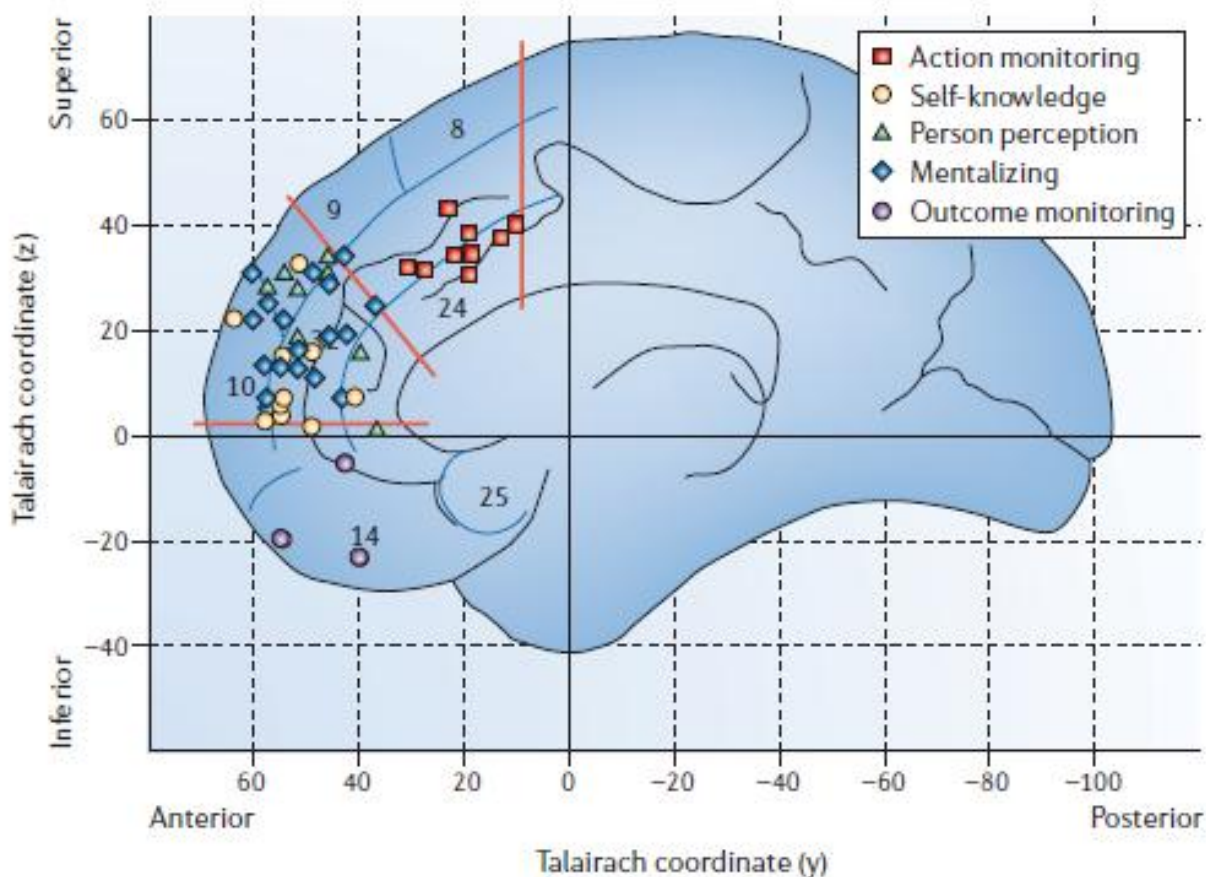


Figure 2.3.7: Functional map of the medial frontal cortex (taken from Amodio & Firth, 2006)

This result is not in line with our preliminary hypothesis, that *Hi-NCC* individuals could show a stronger activation of frontal regions in receiving offers from *Outgroup proposers*. As already explained at the beginning, this study is mostly explorative, so our initial hypothesis was not really strong, and we didn't focus too much on it. The activation of the FG, specifically the *Fusiform Face Area (FFA)*, is associated with the perception of human faces (Kanwisher, McDermott & Chun, 1997), but has also been found a FG greater activation in response to "co-operators" involved in a socially interactive game with the participants (Singer, Kiebel, Winston *et al.*, 2004). A possible explanation for the activation of this area in the 4:6 offer by *Outgroup proposers* could be due to the fact that *Hi-NCC* participants start to consider as a co-operator an *Outgroup* member when he proposes a quite fair offer. Maybe the 5:5 offer was too fair to elicitate any kind of significant difference in FG activation, and also it was administered half of the times compared to the 4:6 offer. These results appear still confusing, but they allow to begin further investigations about neural basis of motivation under an *Ingroup/Outgroup* point of view.

2.4 – Conclusions

In this two studies we have seen how dispositional levels of NCC can shape the intergroup relationships and the bargaining behaviour. The constellation of behavioural results that we obtained are in line with the scientific literature, adding also important information about how NCC could be crucial in facing the others and find the best response to social stimulations, both from *Ingroup* and *Outgroup* members. We also found interesting and new neuroimaging data that are in part counterintuitive, but that could open unexplored aspects of the relationship between the motivational construct of NCC and the brain activity during a social interaction. Also, these results drive us to the investigation of the relationship between the Need for Cognitive Closure and the attitude toward a money gain or loss (specially in a social context like the Ultimatum Game, that allow us to study behavioural outcomes of socio-economic epistemic motivation). Now we know that MFC and FG play a crucial role in bargaining behaviour, and that this role is mediated by NCC levels. An interesting future direction could be the analysis of connectivity between these areas and the other areas associated with acceptance and rejection at the UG. It will be also interesting to use other economic games (e.g., Trust Game, Dictator Game), and to put participants in the role of proposer at the UG, to investigate this motivational behaviour (and underpinning neural substrates) from another point of view.

3. General Discussion

In the present two studies, we aimed to investigate the intergroup relations and the role of NCC and emotions in shaping and driving them. With *Study1* (1.a, 1.b and 1.c), we found that at an UG in which they played as *receivers*, participants with high (vs low) levels of NCC tended to reject more offers from *Outgroup* proposers (considered less culturally *Similar* from themselves), from the most *Disgust/Anger/Fear*-eliciting nationalities. In *Study2* we found a higher rejection rate by *Hi-NCC receivers* for both *Outgroup* and *Ingroup* just for the offer 3:7, but the group manipulation was weaker than in *Study1*. We found an interesting middle frontal activation in the *Lo-NCC* sub-sample when the proposer was an *Ingroup* one, regardless of the offer. For the *Hi-NCC* sub-sample, we found an activation of the Fusiform Gyrus for the offer 4:6 proposed by *Outgroup proposers* (an offer which is close to the fairest one 5:5). Taken together, these studies underline the close relationship between emotions and cognitive closure in shaping the idea of the “others” as *Ingroup* or *Outgroup*, and in driving concretely the motivational behaviour and the decision-making style in line with this idea. This field absolutely needs further investigations to be better understood, and to open a safer path to the unveiling of the intergroup relationships.

APPENDIX A: The Arithmetic of Emotional Contagion

1– Introduction

“Ideas, sentiments, emotions, and beliefs possess in crowds a contagious power as intense as that of microbes” (Gustave Le Bon, 1896). In support of this statement, there are several studies about crowds’ behaviour. For example, it’s well described a flocking mechanism inside crowds and groups, which is comparable with the one observed in fishes and birds (Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin & Cook, 2001). *Flocking* is defined as an almost simultaneous movement across time and space of ecologically proximate individuals (Dobrev, 2005). Crowds have also a sort of collective decision-making style, shaped by *informational cascades* that induce decision-makers to ignore their own private information in favour of imitating others who faced the same decision earlier on (Huck & Oechssler, 1999; Bikhchandani, Hirshleifer & Welch, 1992). Informational cascade leads to a *herding* phenomenon, that represents behavioural patterns correlated across individuals (Devenow & Welch, 1996). Herding can also cause a systematic erroneous decision-making by entire populations (*ibidem*). In literature, the role of individual and shared emotions in giving rise to this kind of behaviour is quite neglected (Szanto, 2015). In shaping shared emotions, the single individual is not extinct, but we found both an 1) individual subject and a 2) plural subject, a “*we-subject*” (Stein, 1922). This *we-subject* is not an extra-entity, it is a plural subject not ego-like, but a “social integrate” of individuals (Pettit, 2003; Szanto, 2014). About the structure of a shared emotion, there are two distinct intentional directions: 1) a supra-individual emotional focus that is shared and also targeted and experienced as shared, and 2) an intention directed towards the sharing of an experience of emotion itself (Szanto, 2015). Considering this *we-subject* with a plural emotional state (individual and social), it is to take into account the so called “emotional contagion” phenomenon. Contagiousness of emotions is considered in literature since a long time (Darwin, 1872/1965; Jung, 1968; Reik, 1948). The term “Emotional Contagion” describes a complex process as a collection of aware perceptions, social evaluations and unaware automatic sub-processes (Hatfield *et al.*, 1994). These unaware sub-processes are called “Primitive Contagion”, defined as the automatic mimicking and synchronisation of own facial expressions, vocalisations, postures and gestures of another individual, converging emotionally with him/her (Hatfield *et al.*, 1994; Hsee *et al.*, 1990). Emotional Contagion seems to play a mediation role between facial mimicry (the tendency to automatically imitate, with own facial muscles, the expression on the face of the interlocutor)

and accuracy in recognising emotions watching videos of individuals who express them (Krieglmeyer & Deutsch, 2010). In literature, most of the results show that women are more reactive with mimicry in respect to men (Dimberg & Lundqvist, 1990; Kring & Gordon, 1998), and they are also more prone to be emotionally infected (Doherty *et al.*, 1993). More recently, Wild and colleagues (2001) didn't found gender differences in emotional contagion (they considered just happiness and sadness), but they found that pictures of women with happy faces evoke in both male and female individuals a higher level of happiness than pictures of happy men, and the same goes for sadness. Individuals regulate their own emotional responses considering the situational context. In Lang's point of view (Lang, 1995; Lang & Bradley, 2008), emotions can be considered as "action dispositions" that quickly prepare the organism for an appropriate response toward significant emotionally charged stimuli. A largely debated example of this active point of view of emotions, is that the perception of positive stimuli facilitates an approach behaviour, while the perception of negative stimuli facilitates an avoidant behaviour (Krieglmeyer & Deutsch, 2010). It is possible to measure this behaviour in different ways (*Measures of Approach-Avoidance Behaviour*, MAAB). One of the most used task for measuring the approach/avoidance behaviour is the *Joystick Task*, in which if the participant pulls backward the joystick he's approaching with the stimulus, while if he pushes it forward he's avoiding the stimulus (es. Chen & Bargh, 1999; Rinck & Becker, 2007). Later, this task has been modified adding the illusion that the stimulus moves off when the joystick is pushed forward, and it moves up when the joystick is pulled backward. This variant task is called *Feedback-Joystick Task* (Seibt, Neumann, Nussinson & Strack, 2008).

2 – Virtual Reality for Studying Social and Affective Phenomena

To introduce the salience of virtual reality (VR) in studying emotions social interactions between plural agents, it is necessary to describe two critical phenomena: "Togetherness" and "Co-presence". The term togetherness (Durlach & Slater, 2000) is referred to the sense of being with other people in the same shared Virtual Environment (VE). For example, we can consider four different individuals, each one with his own virtual station and virtual avatar that can move into a shared VE. Co-presence is the sense of being in front of a virtual audience compared to being with a real one (Slater *et al.*, 1999). It has been shown that different kind of virtual audience can influence a public speaker's performance. People with phobia of public speaking are characterized by an increase of self-reported anxiety (measured with a five-questions

questionnaire), self-focus attention on somatic responses and an enhancement of the heart rate (Slater *et al.*, 2006). Also, a virtual audience which looks bored and disappointed can trigger an anxiety response compared to the normal level of public speaking confidence (Pertaub *et al.*, 2002). These two phenomena frame well the effect of VR in manipulating and re-structuring the social domain, creating a realistic social context. Taken together, all these findings underline the comparability between experiencing a real social environment and a virtual one. VR also allows researchers in psychology and neuroscience to test social situations that, in real life, could be considered immoral and unethical, without evident negative effects on participants. A clear example of this kind of social VE is given by the remake of an old Milgram's 1960s paradigm, in an environment with avatars instead of real actors (Slater *et al.*, 2006). In the original experiment, with the goal to investigate obedience to an authority figure who asked to cause pain to a stranger, the participant had to deliver an electrical shock (that was fake) at different intensities to an actor who pretended to being hurt. Most of the participants did hurt the actor delivering him high electric shocks, sometimes until he pretended to get faint (Milgram & van Gasteren, 1974). In the virtual reality study, in which the participants knew that both the avatar and the shock they were delivering were fake, results showed that they perceived the situation as real, at a subjective behavioural and physiological (skin conductance and heart rate were analysed) level (Slater *et al.*, 2006). A circular correlation between the sense of presence and emotions has been demonstrated (Riva *et al.*, 2007). Immersing an individual into a VE with an avatar which performs facial expressions, works as well as non-immersive procedures for the study of emotion recognition by facial expressions (Faita *et al.*, 2016), specially when the avatars show naturalistic dynamic expression changes (Faita *et al.*, 2015). It was found that the feeling of presence was greater when an individual was immersed into an "emotional" VE (for example, an 'anxious' park vs a 'relaxing' one), and, on the other hand, the subjective emotional state was influenced by the level of presence (*ibidem*). It has been also demonstrated that the avatars' emotional connotations can change the preference of participants on them, inducing an empathic response (Rodrigues *et al.*, 2009). VR methods allow researchers to manipulate participants' socio-affective dimension in a way that is practically not possible in the real environment, inducing changes in *ingroup/outgroup* prejudice and stereotypes, eliciting emotions and moods, and making people interact and collaborate in new ways. We decided to develop a VR procedure for Study 3 to have a laboratory experience both well controlled and as ecologic as possible.

3 – Influence of Emotional Contagion on Approach/Avoidance

Behaviour: An empirical study.

The main purpose of this project was to investigate if there is a group-effect on emotional contagion. Specifically, we wanted to see if a single participant's emotion and approach/avoidance behaviour is different when he has to face one avatar (*one-to-one*) or three of them (*one-to-many*). Our hypothesis was that being emotionally contaminated by a facial expression could interfere with a mere cognitive task in terms of accuracy and Reaction Times (RTs).

This could be a first step to the understanding of the way in which emotions are shared between single individuals and groups. It could help to understand organizations' dynamics and crowd herding and flocking behaviours, and also informational cascade process. In previous studies about Emotional Contagion, most of the times there were used stimuli like static pictures of faces or dynamic 2D videos of the transition from a neutral expression to an emotive one. Virtual Reality (VR) could help us to create a more naturalistic context, maintaining at the same time the scientific accuracy of a laboratory experiment.

Procedure

A total of 30 neurotypical right-handed male participants (age: $Mean=22.63$, $SD= \pm 2.91$, range 18-30 ys) has been tested. We've created three different male avatars using the software *iClone 6*. For each of them, we developed three different animations: 1) neutral (the avatars just blink twice and open/close the mouth going back to a neutral expression), 2) angry, and 3) happy. We choose the emotions of anger (negative emotion) and happiness (positive emotion) because of their well documented Superiority Effect to be identified in a crowd (Hansen & Hansen 1988; Craig *et al.* 2014), and, considering anger, because of an also known Threat Superiority Effect (Fox & Damjanovic, 2006). For this study, we used the "*PowerWall*" apparatus (see *Figure A.1*), a 1m X 1.5m retroprojected screen, with a 3D projector on the back. Using a pair of *Optoma* 3D active glasses, participants saw stimuli as they were popping-out from the screen (around 20cm out of it). On the glasses, there were three infra-red markers, tracked by four *Optitrack* cameras on the four corners on the screen, in order to maintain the shape and position of the stimuli always stable with participant's head position.

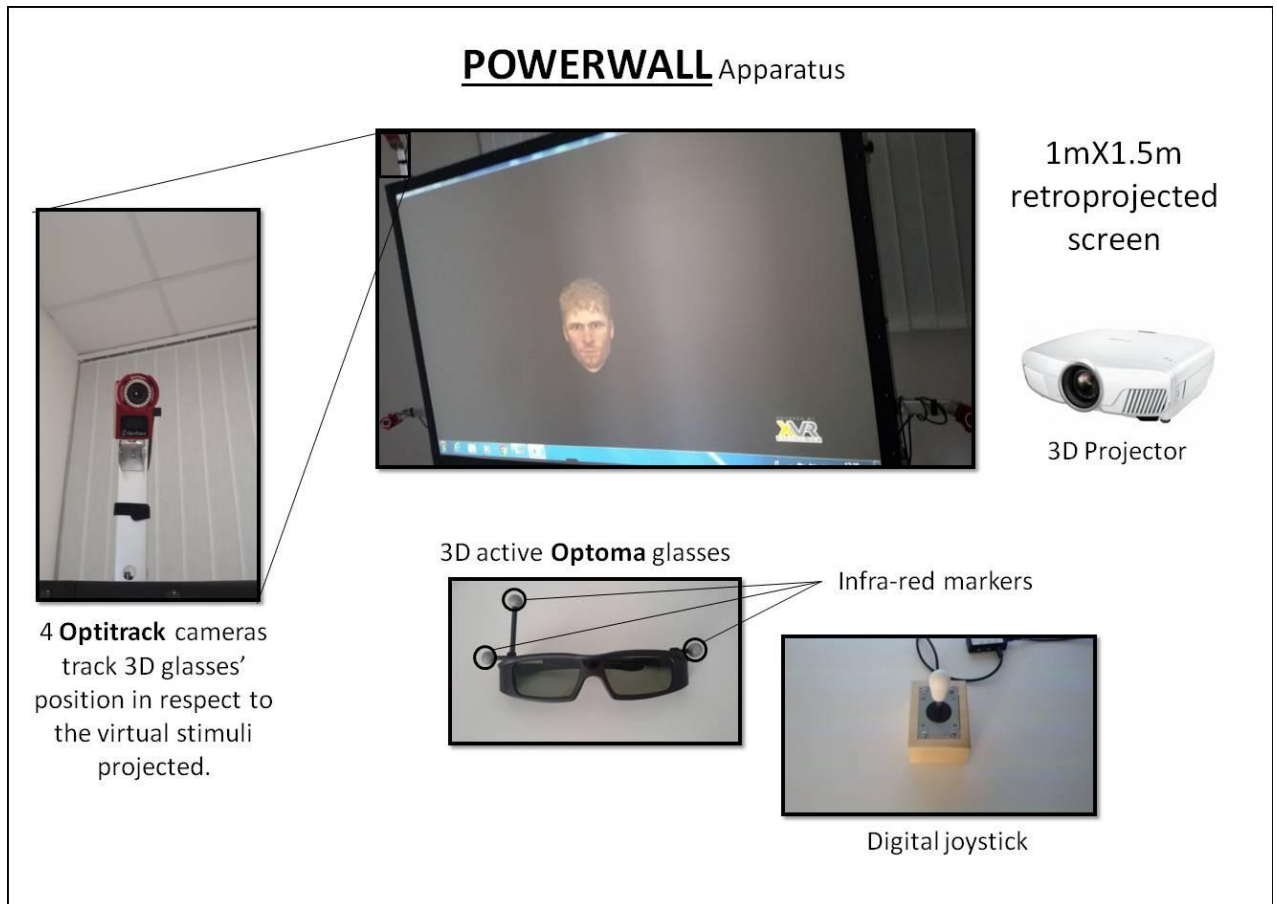


Figure A.1: Experimental setup used for Study3.

We developed also two tones with neutral valence using *Audacity*, respectively with a frequency of 880Hz (acute tone) and 440Hz (low tone), with a sinusoidal structure and a 300ms duration.

Participants had to face, depending on the trial, one or three avatars performing one of the three expressions. The experiment was structured in two blocks with different instructions: in Block A they had to push the joystick forward, as fast and accurate as they can, when the acute tone was presented, and they had to pull backward the joystick when the low tone was presented, while in Block B they had to do the opposite. Pushing the joystick, the avatars were set to move toward the participant (20cm on the Z-axis), while pulling it the avatars were set to move away from him (-20cm on the Z-axis). This kind of task is called “*Feedback-Joystick Task*”, and it has been already used in literature (Seibt, Neumann, Nussinson & Strack, 2008). We decided to use this task because going forward could also be interpreted by participants as withdrawal, and going backward as bringing the stimulus closer. Every block was made by a total of 72 stimuli, 36 single avatars and 36 groups, and the two blocks were counterbalanced between subjects. There was a 5-minutes break between the blocks, and both before and after the procedure,

participants answered to some questions (see below). The total experimental session had a duration of about one hour. Our starting hypothesis was to find slower RTs when participants had to pull the joystick but the expression (of both one or three avatars) was happy, and when they had to push the joystick but the group of three avatars was angry. We also predicted a more variable response for one single angry avatar, considering that anger, as demonstrated (eg., Marsh, Ambady & Kleck, 2005; Heuer, Rinck & Becker, 2007), can induce both approach and avoidance behaviour.

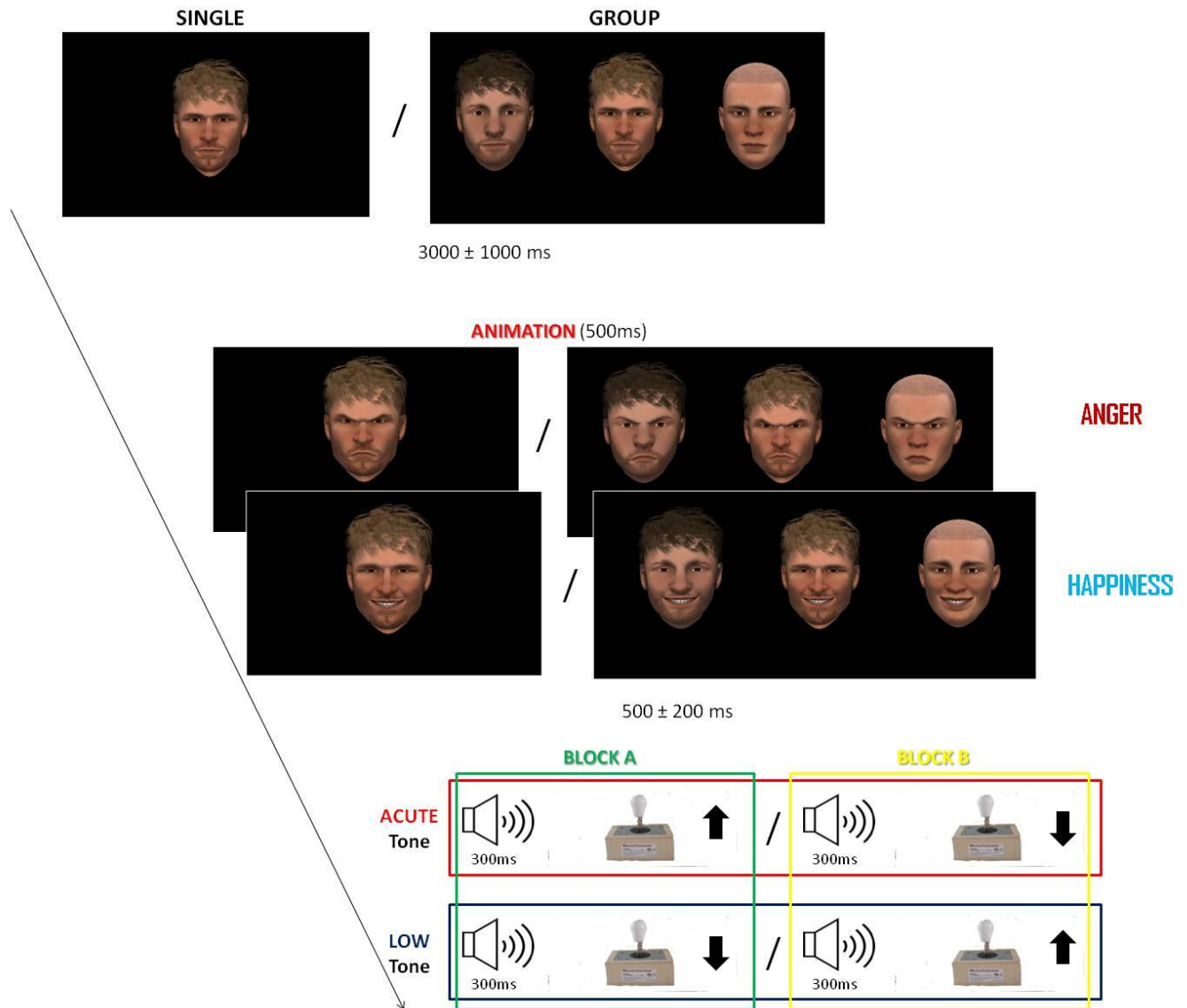


Figure A.2: Schema of the experimental procedure used in Study3.

Questionnaires.

Before the experimental session, participants were asked to answer to six selected items of the *Emotional Contagion Scale* (Doherty, 1997): 2, 3, and 11 for happiness, and 5, 7 and 10 for anger (from 1 = never, to 4 = always), and to the 7 items of *Empatic Concern* subscale (*EC*) of

the *Interpersonal Reactivity Index* (IRI, Davis, 1980), on a 5-point Likert scale (from A = does not describe me well, to E = Describes me very well).

Ratings

We asked participants four questions about the three animations for each avatar (4questionsX3avatarsX3animations):

“Do you think the avatar was expressing an emotion? If yes, what emotion?”

*“How much do you consider this expression **Realistic**?”*

*“Do you consider this expression **Positive, Negative** or **Neutral**?”*

*“How much do you consider this expression **Intense**?”*

For the second and the fourth questions, participants had to answer on a 9-points likert scale, from 1 (not realistic/intense at all) to 9 (extremely realistic/intense). Then, we asked them two questions about the three avatars:

*“At first sight, how much this person could seem to you **Trustworthy** in real life?”*

(Todorov, Pakrashi & Oosterhof, 2009)

*“If he was a real person, how much could you consider him **Attractive**?”* (Willis & Todorov, 2006)

Participants had to answer on a 9-points likert scale, from 1 (not realistic/intense at all) to 9 (extremely realistic/intense).

Results

Following the analysis method of RTs for approach/avoidance to emotional faces performed by Heuer and colleagues (2007), we subtracted, for every subject per each condition, the approach median RTs from the avoidance one, and, after a *Shapiro-Wilk* test that confirmed that RTs of most of the conditions were normally distributed, we performed a one-sample *t-Test* on these scores. We obtained a total of 6 conditions: 1) Neutral_Single, 2) Neutral_Group, 3) Happy_Single, 4) Happy_Group, 5) Angry_Single, and 6) Angry_Group. We didn't find any significant difference between conditions (see *Table A.1* for a *t-Test* summary).

		t	df	Sig. (2-tailed)
SINGLE	Neutral	-1.477	29	.151
	Happy	-.312	29	.758
	Angry	-1.343	29	.19
GROUP	Neutral	.788	29	.437
	Happy	.682	29	.501
	Angry	.361	29	.721

Table A.1: t-Tests for the approach/avoidance behaviour. No significant results.

From the plot in *Figure A.3*, we can just say that participants tended more to avoid than to approach to the stimuli (as in Heuer, Rinck & Becker, 2007), but we can't say that this is due to the stimuli we used or it's just a global tendency.

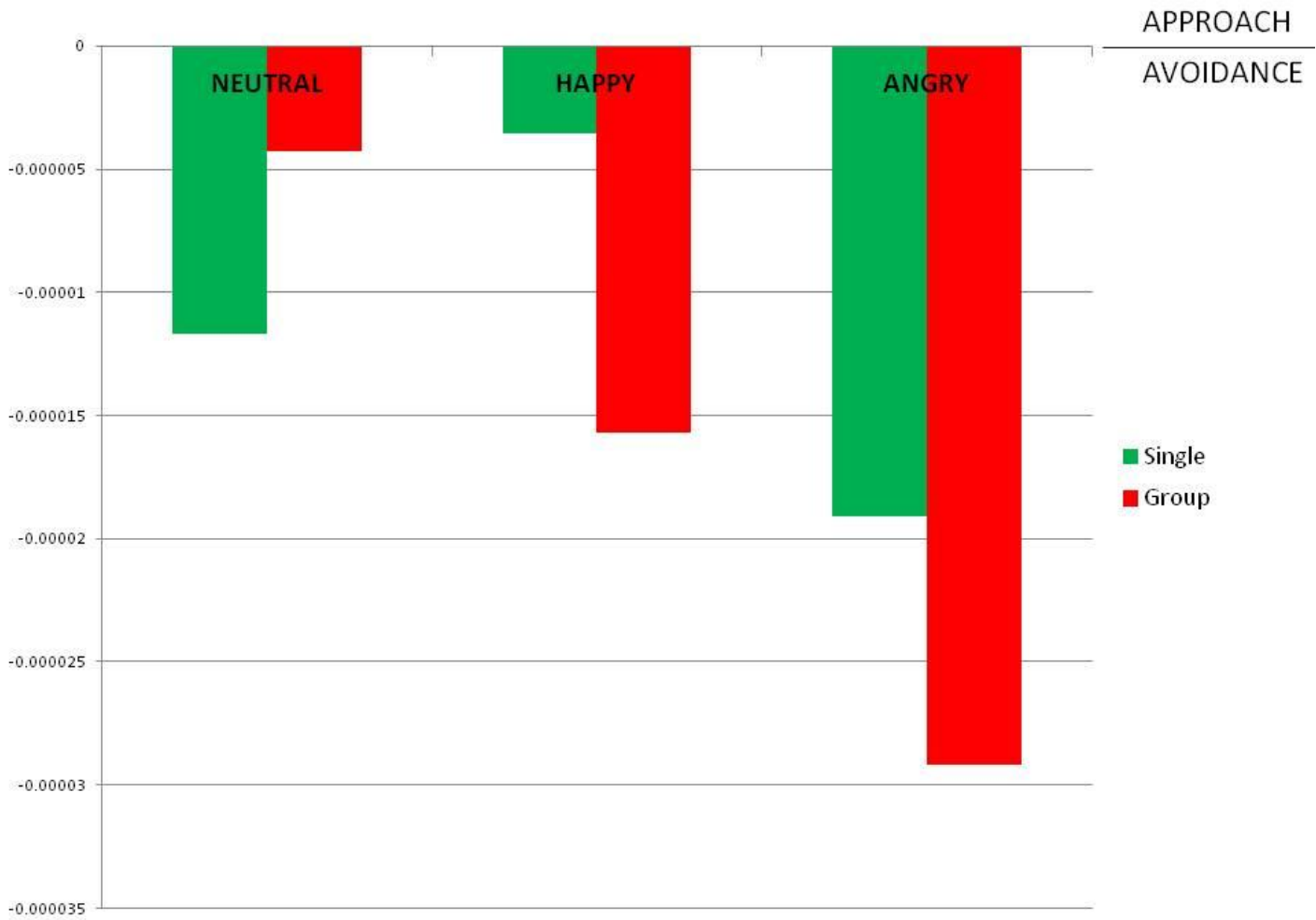


Figure A.3: Approach/Avoidance tendency in Study3 toward both Single and Group, for every emotion.

Questionnaires

Analyzing the three questionnaires we administered to our participants at the beginning of the procedure, we found, as reported in *Table A.2*, a significant correlation between the *EC* subscale of the *IRI* and the contagiousness by anger measured with three questions from the *Emotional Contagion* scale ($r=.442, p<.05$). This correlation has a positive coefficient, so the higher is the empathic concern level, the higher is the proneness to be contaminated by anger.

		Happiness	Anger	EC
Happiness	Pearson Correlation	1	-.046	.135
	Sig. (2-tailed)		.809	.477
	N	30	30	30
Anger	Pearson Correlation	-.046	1	.422
	Sig. (2-tailed)	.809		.02
	N	30	30	30
EC	Pearson Correlation	.135	.422	1
	Sig. (2-tailed)	.477	.02	
	N	30	30	30

Table A.2: Correlations between EC, Happiness and Anger. In red the only significant correlation, between Anger and EC. In red the significant correlations ($p < .05$).

Ratings

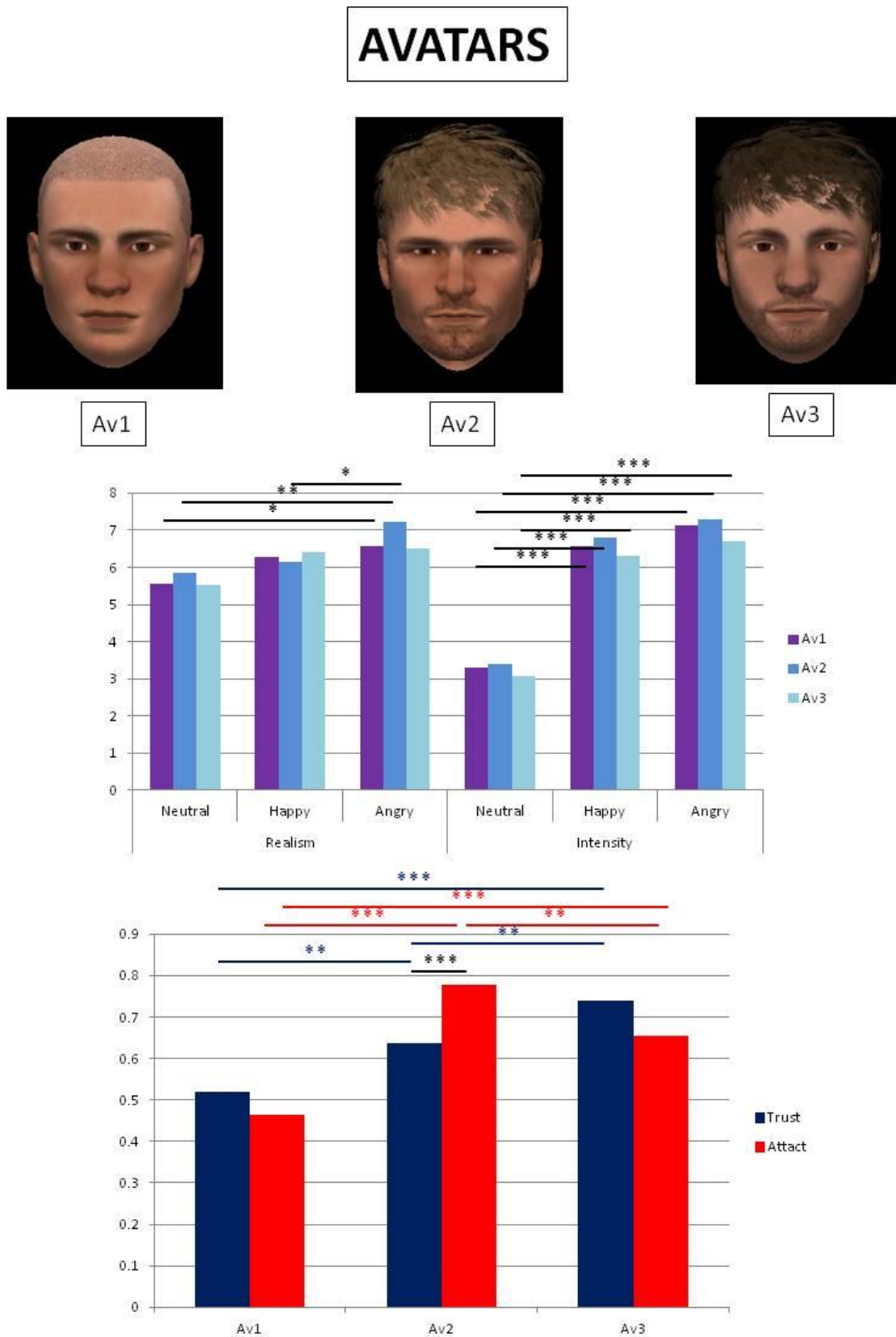
Considering *Realism* per each emotion for each avatar, we found that for the 1st avatar (Av1) the Neutral expression has been considered less realistic than the Angry one ($t=28.14$, $p < .05$), and the same for the 2nd (Av2) ($t=27.69$, $p < .01$). For the 3rd avatar (Av3) we found that the Happy expression has been rated as less realistic than the Angry one ($t=26.21$, $p < .05$).

About *Intensity* of the emotions for every avatar, Av2 and Av3's expressions were considered all significantly more intense than Av1's ones ($p < .001$ for all the expressions), even the Neutral expression.

Trustworthiness and *Attractiveness* has been rated as different between the avatars. Av3 has been considered the most trustworthy in respect to both Av1 ($t=28.28$, $p < .001$) and Av2 ($t=22.62$, $p < .01$). Av1 was judged as the less trustworthy, also compared to Av2 ($t=17.11$, $p < .01$). The most attractive avatar was Av2 in respect to both Av1 ($t=33.49$, $p < .001$) and Av3 ($t=19.37$, $p < .01$). Av1 was rated as the less attractive, also compared to Av3 ($t=12.4$, $p < .001$).

We found also a difference between trustworthiness and attractiveness in Av2, rated as more attractive than trustworthy ($p < .001$).

For a graphical representation of ratings' results, see *Figure A.4*.



*Figure A.4: Ratings of Intensity and Realism for all the emotions, and Trustworthiness and Attractiveness for Av1, Av2 and Av3. On the Y-axis there are the points of the Likert scales. *= $p < .05$, **= $p < .01$, ***= $p < .001$.*

For every avatar, the emotions we created has been mostly perceived with the expected *Valence*:

- Av1: Happy (86.7% Positive), Angry (96.7% Negative), No expression (96.7% Neutral).
- Av2: Happy (86.7% Positive), Angry (96.7% Negative), No expression (90% Neutral).
- Av3: Happy (83.3% Positive), Angry (86.7% Negative), No expression (100% Neutral).

These percentages are graphically shown in *Figure A.5*.

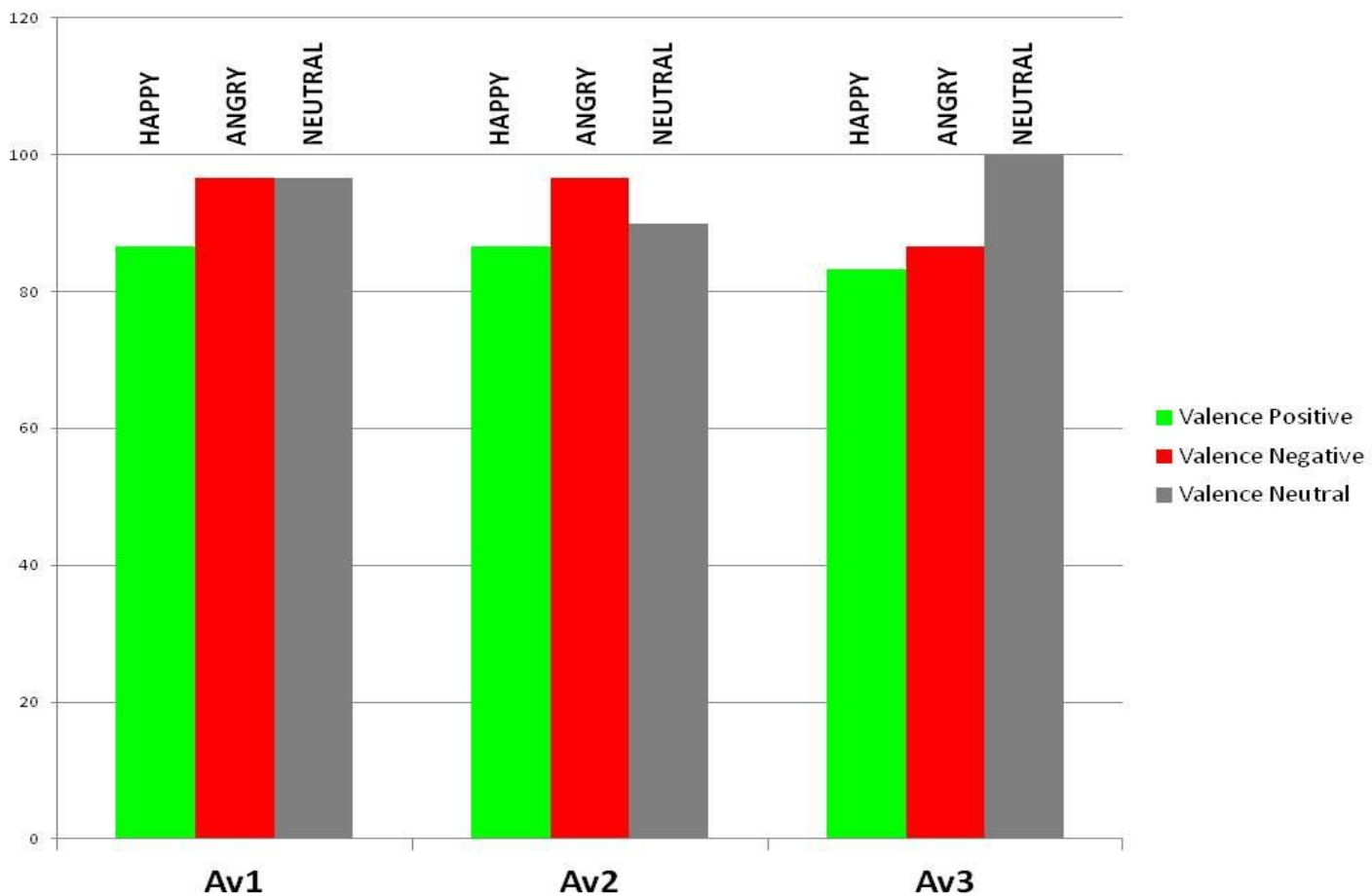


Figure A.5: Plot of the Positive/Negative/Neutral Valence level per each emotion. On the Y-axis there is the percentage.

Discussion

The absence of significant behavioural results could be explained considering the structure of the experiment we used. In Heuer and colleagues (2007), the approach and avoidance conditions were the opposite as in our study: pushing the joystick forward was considered withdrawal while pulling it back was considered approach. Considering the movement of the avatars on the z-axis, it seems to be not possible that participants misunderstood that pushing the joystick made the avatars come near and pulling it made them go further. Another possible issue about this procedure could be linked to the entire timing of the experiment. Maybe the blocks' duration (around 18 minutes each) was too long to maintain participants' attention focused and sustained, influencing their RTs at the task. Also, probably the chosen intra-trials and inter-trials time-windows were not appropriate for this new task. To solve this problem, it could be useful to perform a pilot study measuring arousal level of participants (eg., Skin Conductance Response, Heart Rate frequency and variability), to check, if some indices are present, when they occur, and so how to change the general timing intra- and inter-trial. For the whole duration of the procedure, we should reduce the number of presentations and increase the sample size, to ensure an appropriate number of observations. The paradigm here proposed is something totally new, aimed to compare the difference between emotional contagion driven by a single individual (avatar) and driven by a group of three individuals avatars. The future direction to take is to fix all the possible technical and structural problems of the task, to understand if it's really appropriate to study a complex phenomenon like emotional contagion, and, if it is, to validate the final procedure and adapt it to different possible studies of intergroup interactions (eg. modifying the aspect of the avatars, using cover stories on their identity).

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