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ACTION OBSERVATION AND SOCIAL ATTENTION: THE MODERATING ROLE OF SOCIAL VARIABLES

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Abstract

With the expression 'social attention' we refer to the ability to coordinate or to share attentional focus with social partners on an object, event, or a third person. Hand movements and actions in general are reliable signals about the interaction partners' intentions and goals. However, on one side, the vast majority of studies have mainly explored how the observation of other individuals' actions affects the observers' own motor program rather than their attention. On the other side, social attention literature primarily focused on the role of gaze rather than on the role of hand movements. The present thesis aims at filling this gap in literature exploring the role of human gestures, with emphasis on the reach-to-grasp movements, in driving social attention.

In Chapter 1, the literature on social attention and its relationship with action observation is reviewed. Then, a set of studies on the influence of reach-to-grasp movements on social attention is presented. Specifically, Chapter 2 aims to clarify whether human actions are likely to effectively shape social attention (Study 1) and if such effects are specific for biological stimuli (Study 2). Afterwards, the research program analyzes the impact of some social moderating variables.

Using different behavioral responses (e.g., reaction times and eye movements), Chapter 3 investigates the role of group membership (i.e., Italian vs. Iraqi; Study 1) and social threat elicited by objects (i.e., weapons; Study 2, Study 3 and Study 4) on social attention driven by actions.

Chapter 4 explores across three studies the interplay between social and physiological factors in shaping social attention during action observation. Specifically, we addressed the influence of hormonal shift during menstrual cycle on social attention (Study 1) with a particular focus on the role of products status (high status vs. low status) and social target's gender (Study 2 and Study 3). Next, Chapter 5 presents an experimental study on the effect of target's weight status (normal weight vs. overweight target) on the process.

Chapter 6 represents a change in perspective with respect to the previous chapters; in one experimental study we analyzed the potential outcomes of observing informative social cues -

namely, movements that help the participants in performing the task - provided by an outgroup member (i.e., Arab) on person perception and prejudice. Chapter 7 is focused on a complementary field of research and explores the impact of action observation of ingroup (i.e. Italian) and outgroup (i.e. Arab) members on motor resonance, measured by a mouse tracker. Finally, Chapter 8 presents an overview of findings, discusses the studies limitations, their implications and future directions.

Chapter 1

Humans are social creatures and spend most of their time interacting with other people. Through interactions humans try to understand the social environment and gather relevant information from the others' experiences (van Vugt, 2014). From others they can learn a great deal: What are they attending? What are they likely to do next? Which are their intentions? Is there a danger?

The typical interaction among humans that perhaps comes first to our mind is talking to each other; however, from an evolutionary point of view language is not the unique tool for communication. Indeed, humans innately communicate by pointing and pantomiming and find such gestures totally natural and clear (Tomasello, 2008). Consider pointing, for instance; we can easily imagine pre-linguistic infants trying to communicate to their parents which is the desired toy by simply pointing at it.

Such forms of gestural communication convey meaningful messages; for instance, from observing eye gaze, and head and body orientation, we readily detect other's focus of attention (e.g., Butterworth & Jarrett, 1991; Langton, Watt, & Bruce, 2000; Nummenmaa & Calder, 2009). Let's take an everyday example. Imagine we are out for a relaxing Sunday afternoon and we decide to go to the museum. While we are walking through the gallery I point to the 'Senecio' by Paul Klee and invite you to pay attention to it. Thus, following my suggestion, you are able to filter the vast array of oils, select that specific painting from many around us and have a look at it. We continue to look carefully the picture aiming at discovering the hidden meaning of the painting, while, at a certain point, a stealthy movement catches your attention. The hand of a guy is rapidly plunging into the pocket of my jacket. At once, you realize the guy's intentions: he is trying to steal my wallet. Thus, you decide to intervene intimidating him you'd called the police.

What has happened in the above scenario? First, I pointed at and you immediately saw what I meant, I drove your attention and shared with you what I was attending; second, while we

were selectively focusing our attention on the ‘Senecio’ painting, your attention was automatically captured by the action of the guy.

In this example as well as in other many examples, we could find some of the key features that characterize human attention in our everyday life: our attention is selective and relies mostly on vision to process the signals in our environment (Bundesen, 1990; Logan; 1996); as human beings we are able to share the focus of our attention with others (e.g., Friesen & Kingstone, 1998; Emery, 2000); and attention follows the actions of others, especially when they are salient and relevant for us (Allison, Puce, & McCarthy, 2000).

Throughout this thesis some of the aspects presented above will be taken under consideration. Specifically, the present work focuses on the role of actions in driving attentional processes; in particular the thesis centers on how action observation shapes social attention and on the social variables that are likely to influence the orienting of attention in response to human reach-to-grasp gestures towards objects.

Visual attention

Visual attention has been defined as a spotlight or a “fringe” (James, 1890) that selects parts of the visual world around us (Eriksen & Eriksen, 1974; Hoffman & Nelson, 1981; Posner, 1980; Posner, Snyder, & Davidson, 1980). Usually, we move our eyes towards an object in the context in order to pay attention to it. Although visual inputs in our environment are extremely numerous and various, our brain has a limited capacity to process visual information. Thus, to reduce the complexity of scene analysis and make sense of our world, we must be able to filter the vast amount of available signals and to pay attention selectively to particular chunks of the visual environment (Driver, 2001) before further processing (Tsotsos, Culhane, Wai, Lai, Davis, & Nuflo, 1995). Selective attention (e.g., Broadbent, 1958) allows us to "tune out" information that are not relevant at the moment and to focus on other things.

Furthermore, it is important to consider that visual attention is not always synonymous with looking; indeed, visual attention can be covertly or overtly directed to a spatial location. Attention can orient covertly, for instance, by attending to something in the periphery while not explicitly looking there. Thus, in these cases, attention can be seen as separate from eye-movements. On the other hand, attention can orient overtly when, for example, someone explicitly moves their eyes towards a source of interest (for a review see Posner, 2014).

But which stimuli are likely to capture our attention?

In some case, our attention is automatically caught by sufficiently salient stimuli (Saliency-Based Visual Attention Model; Itti, Koch & Niebur, 1998). When a feature in the environment automatically draws our attention because of its intrinsic properties relative to the background, such as a sudden change in luminance, texture, or motion (e.g., Oonk & Abrams, 1998; Yantis & Hillstrom, 1994), we are referring to *bottom-up* processes (e.g., Henderson, 2003).

However, in other cases, we are able to select intentionally to what stimulus paying attention basing on a specific goal. This example reflects *top-down* processes which allow the focus of attention to be manipulated by the demands of the task or situation (e.g., Yantis, 1993). In everyday life, visual attention is controlled by both bottom-up processes that refer sensory stimulation and cognitive top-down processes, such as memory-based knowledge, expectation and goals (Corbetta & Shulman, 2002; Yantis, 1993).

In addition, when considering how attention might be cued it is also important to consider the distinction between exogenous and endogenous cues (e.g. Theeuwes, 1991). An exogenous cue might be a peripheral stimulus, like a flashing light or a movement in the periphery, which catches the attention to it. On the other hand, an endogenous cue might be an arrow, a directional cue pointing to the left or to the right, or a social partner to whom you are attending that points out something for you to look at. In this regard, it has been illustrated that these types of cues reflect different control of attention; responses to exogenous cues are reflexive (bottom-up process), while

endogenous cues require processing, more effort and have a higher degree of control associated with them (top-down process) (Jonides, 1981).

When visual attention occurs in the social world this complexity may be amplified as a consequence of an intricate orchestra between interpersonal communication, the visual context, and the relationship between the people who share it (Richardson & Gobel, 2015). Indeed, in social context there are further top-down influences coming, for instance, from specific knowledge about personal characteristics of our social partners in the context, such as their intentions and mental states. As well, there are additional bottom-up factors due to the presence of another person as a stimulus, with his/her emotional expressions, facial features, gaze direction and body posture.

To sum up, the human visual attention is like a spotlight (e.g., Posner, 1980) directed by both bottom-up stimuli-driven and top-down goal-directed processes. In social context, visual attention not only allows humans to successfully navigate the environment but serves another important function by facilitating the communication among humans. Humans are social creatures that cooperate and communicate with others, with whom they have shared intentionality and a common conceptual ground (Tomasello, 2008). Thus, in this intricate complexity visual attention may represent a tool for successful communication in social contexts. Indeed, attention to the partners of the interaction is a fundamental characteristic of the human way of communicating. Think, for instance, to the advantages of being sensitive to where other individuals are looking at: it allows us to understand what others are doing and what they are likely to do next, to predict their intentions, or to coordinate actions with them (Emery, 2000; Frith & Frith, 2006; Wenke et al. 2011, Sebanz et al. 2006). Such ability is what psychologists and researchers in social cognition have defined *social attention* (e.g., Nummenmaa & Calder, 2009).

Social attention

With the expression 'social attention' we refer to the ability to coordinate or to share with social partners the attentional focus on an object or event. In other words, social attention is the

ability to orient attentional resources in response to social signals provided by other individuals in the context (e.g., Friesen & Kingstone, 1998; Langton & Bruce, 1999; Nummenmaa & Calder, 2009). For instance, when we see a person looking or pointing to a specific direction, we rapidly shift our attention to the same direction (e.g., Driver, Davis, Ricciardelli, Kidd, Maxwell, & Baron-Cohen, 1999; Ricciardelli, Bayliss, & Driver, 2000).

Social attention is a powerful tool for communication among humans (Richardson & Gobel, 2015); its importance for social development and throughout the life-span has been highlighted by several lines of research (e.g., Emery, 2000; for reviews see Langton, Watt, & Bruce, 2000; Frischen, Bayliss, & Tipper, 2007; Moore & Dunham, 1995; Scaife & Bruner, 1975).

First, it confers significant adaptive and social advantages (e.g., Frith, 2007); for instance, social attention allows to discover potential danger around us (e.g., Frischen, Bayliss, & Tipper, 2007). Furthermore, it is considered to be a precursor to more complex social skills, such as the ability to obtain an empathic contact with others (e.g., Baron-Cohen, 1995; Emery, 2000).

Social attention enables individuals to make sense of another individual's actions, to understand what others are likely to do next, to anticipate the outcome of their behaviors and to monitor the overall success of an interaction (Frith & Frith, 2006; Wenke, Atmaca, Holländer, Liepelt, Baess, & Prinz, 2011).

As shown, social attention is vital to social competence at all ages. Without such ability, success in many social contexts would be difficult to achieve. People who cannot initiate or follow a change in the attentional focus may be compromised in their social ability for relationships (Mundy & Newell, 2007). Impairments in social attention are associated with several neuropsychiatric disorders, as Autism, and this deprivation disrupts normal brain and further behavioral development (Mundy & Neal, 2001).

So far, it seems clear that as human beings we are very interested in where other people are directing their attention and this ability confers us several social advantages.

But which kind of social cues do we use to infer where, and to what, other individuals are attending? To answer this question, social psychologists have employed several Posner-like paradigms, namely some variations of the pioneering spatial cueing paradigm (Posner, 1980) originally developed to study how attention is deployed in space in response to non-social cues.

In a typical spatial cueing paradigm, participants are required to fixate a marker presented at the center of the screen. Then, the central marker is replaced by a central cue (i.e., an arrow) that elicits a shift of attention to either the left or right. After a certain period of time (Stimulus Onset Asynchrony, SOA), participants are asked to respond to the onset of a target stimulus, that can appear to the left or right of the central marker, by making a speeded response on the keyboard (see Figure 1.1).

Typically, such a paradigm shows faster responses with targets appearing in the previously cued location compared to targets appearing in the uncued location, as a signal of the attention shift to the indicated location.

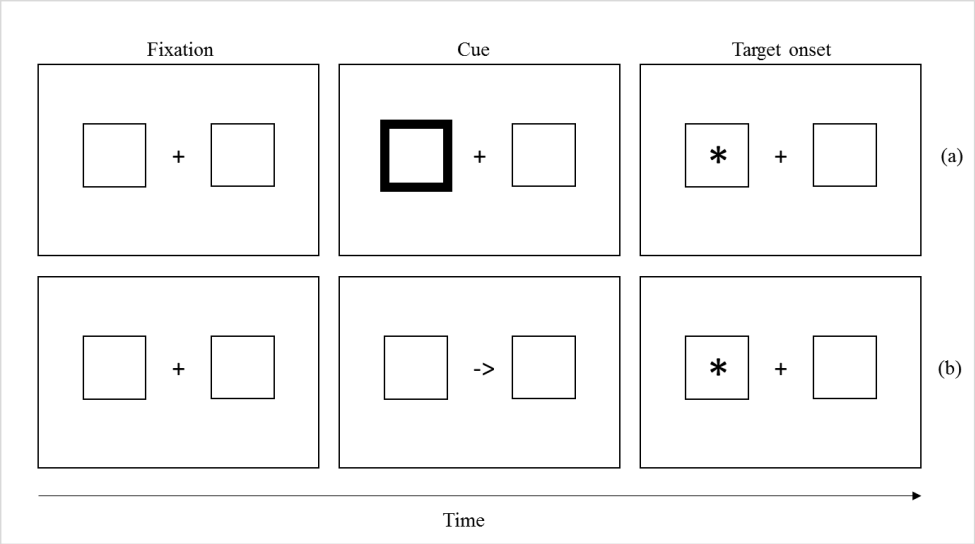

Figure 1.1.
An example of the basic spatial cueing task using an exogenous cue (peripheral cue; line a) or an endogenous (central arrow; line b). Line (a) depicts a congruent trial in which the target appears in the cued location whereas line (b) presents an incongruent trial where the target appears in the uncued location. Redrawn from Frischen, Bayliss, & Tipper, 2007)

By including social and symbolic cues researchers aim at exploring the role played by each cue (i.e., eye gaze, head and body posture) in modulating social attention.

For instance, several works on the role of eye-gaze in attentional orienting have adapted the typical spatial paradigm to the gaze cueing paradigm, whereby pictures depicting faces with averted gaze are used as cueing stimuli (Figure 1.2). What typically happens is that the onscreen face is centrally presented and displays averted gaze to the left or right. After a certain period of time (Stimulus Onset Asynchrony, SOA), a lateral target appears at the looked at or non- looked at location. Participants are required to categorize the target by making a speeded keypress response. A standard approach compares detection speed for visual targets and consistently shows faster responses when the target appears to the side of space that was prior cued by the eye-gaze, reflecting an attentional shift towards the cued location; gaze-cueing effect (Driver et al., 1999; Friesen & Kingstone, 1998; Frischen, Bayliss, & Tipper, 2007),

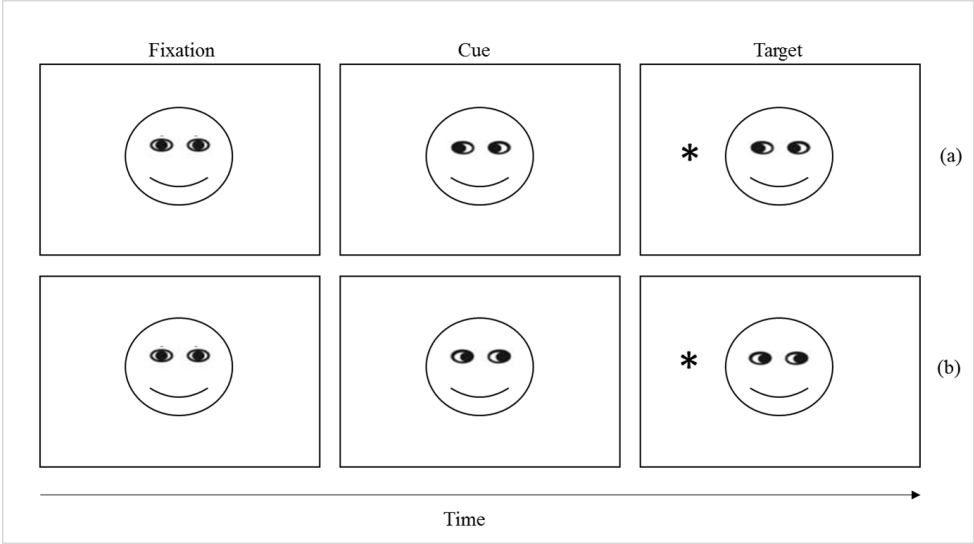

Figure 1.2.
An example of a gaze-cueing paradigm. The schematic face is firstly presented with gaze directed to the participants (Fixation). After that, the same face can look either to the left (a) or to the right (b) (Cue). The to-be detected target can either appear in a spatially congruent (a) or in a spatially incongruent (b) position with respect to gaze direction (Target). Adapted and redrawn from Frischen et al. (2006).

Posner-like paradigms have been also employed to study gaze-following behaviors (e.g., Ricciardelli, Bricolo, Aglioti & Chelazzi, 2002; Ciardo, Marino, Actis-Grosso, Rossetti, & Ricciardelli, 2014). In this paradigm observers are instructed to perform goal-directed saccades towards a peripheral stationary target while ignoring distracting gaze shifting towards or away from the instructed target. The number of mistaken saccades matching the direction of the distracting gaze stimulus when this was opposite to that indicated by the instruction cue has been taken as a proof of the gaze-following behaviors. Results typically reveal higher percentage of antisaccades in the incongruent than in the congruent condition, suggesting an automatic imitative response elicited by the perception of somebody else's direction of gaze.

Therefore, researchers have adopted other variations of the Posner paradigm to study the effect of other social cues on social attention; for instance, it has been studied the role of pointing gestures by replacing the eye gaze cue with a finger pointing either leftwards or rightwards (e.g., Dalmaso, Galfano, Tarqui, Forti, & Castelli, 2013).

As discussed above, social attention and interpretation of social signals provided by others is essential to how we communicate, learn about our social world, and establish empathy with others. One only has to think of our everyday life; we spent a great deal of time attending to faces, bodies, and actions throughout our lives. Such social signals have high priority and are likely to capture our attention; faces, bodies, and actions of others are naturally alerting because they can communicate interest or warnings by conspecifics (Tomasello, 2008). Besides folk knowledge, also laboratory experiments have shown the social attention is typically mediated by this kind of social cues such as gaze direction, head orientation and body orientation (e.g., Driver et al., 1999; Friesen and Kingstone, 1998).

Eye gaze is probably the most salient and commonly investigated cue used in social attention processes (Baron-Cohen, Campbell, Kamiloff-Smith, Grant, & Walker, 1995; Emery, 2000). Extensive research over the past decade reveals that the eyes convey a wealth of personal information and about their direction of attention to specific people, places, and objects

(Birmingham & Kingstone, 2009). The effectiveness of eyes in orienting attention has been mainly investigated through the gaze cueing paradigm (for a review see Frieschen et al., 2007). Generally, this task triggers rapid (e.g., Friesen & Kingstone, 1998; Brignani, Guzzon, Marzi, & Miniussi, 2009) and reflexive (e.g., Driver et al., 1999; Galfano et al., 2012; Kuhn & Kingstone, 2009) shifts of attention towards the spatial location indicated by eye gaze; indeed, as shown, responses times to targets appearing at the cued location are typically smaller than those to targets occurring at the an uncued location (i.e., incongruent trials).

It has been shown that the gaze-cueing effect emerges even when participants are explicit instructed that the gaze direction is counter-predictive of where the target appeared (e.g., Bayliss & Tipper, 2006; Bayliss, Bartlett, Naughtin, & Kritikos, 2011; Deaner & Platt, 2003; Friesen, Ristic, & Kingstone, 2004; Kuhn & Kingstone, 2009). Driver and colleagues (1999) for instance, presented pictures of a face whose eyes were looking leftwards or rightwards and asked participants to categorize a target letter that could appear either on the right or on the left side of the face. Interestingly, they found the typical gaze-cueing effect, even when participants were explicitly informed that the target was counter-predictive (i.e., more likely to appear at the uncued location; Experiment 3).

Furthermore, extensive research shows that such a gaze-cueing effect emerges rapidly even at short SOAs (e.g., Friesen & Kingstone, 1998; Langton & Bruce, 1999). On the other hand, in the case the duration of SOA is particularly long (i.e., 2400 ms), it is possible to observe an inhibitory aftereffect known as Inhibition of Return (IOR; e.g., Frischen & Tipper, 2004). IOR is an attentional mechanism that consists in the tendency to avoid orienting attention towards previously attended locations. The function of such inhibitory mechanism is to prevent individuals from repeated sampling of space that have already been searched (Klein, 1988) allowing to a more efficient exploration of the surrounding environment (e.g., Galfano, Betta, & Turatto, 2004; Klein, 2000; Lupiáñez et al., 2006). What typically occurs is that, in the case the duration of SOA is particularly long (i.e., more than 1200 ms), it is possible to observe such inhibitory aftereffect

which consists in observing smaller RTs on incongruent than on congruent trials (IOR; e.g., Frischen & Tipper, 2004).

Thus, gaze cueing is a very robust phenomenon that appears to be a reflexive and rapid shift of attention, triggered by the observed gaze direction (for a review, see Frischen, Bayliss and Tipper, 2007).

Although some researchers suggest that humans are highly sensitive to eye gaze because of the high contrast between a white sclera and a dark iris (e.g., Emery, 2000), we must not neglect other cues. Indeed, social attention may depend not only on the direction of eye gaze. In our daily life we don't have access only to the eyes of other people; moreover, their head and body are rarely still, and they move in their environment. All these kinds of information sources are potentially informative and make contributions to decisions about another individual's social attention (e.g., Cooney, Brady, & Ryan, 2017; Langton, 2000; Langton, Watt, & Bruce, 2000; Hietanen, 1999; Hietanen, 2002; Nuku & Bekkering, 2008; Nummenmaa & Calder, 2009; Perrett, Hietanen, Oram, & Benson, 1992).

However, research on the cueing effects of other social cues is less extensive than research on gaze cueing. In this current thesis we will focus on the cueing effects of actions and movements.

The role of actions

Actions can be defined as "sequences of movements that are controlled by the same internal control structure and that are not reflexes" (Neuman, 1987). Actions, rather than reflexes, have intended goals, can be planned and tailored, such as adjusting a reaching-to grasp movement towards a cup according to your intention, whether you want to drink or give the cup to me.

Actions and movements in general are foundational for communication among humans (e.g., Cazzato, Macaluso, Crostella, & Aglioti, 2012; Langton, O'Malley, & Bruce, 1996) because they provide a rich source of information about other people's goals and intentions (Chartrand &

Bargh, 1999; Decety & Grezes, 1999; Gallese, Keysers, & Rizzolatti, 2004; Sommerville & Decety, 2006; Tipper, 2010).

From the observation of others actions we can infer state of mind by others (e.g., Blakemore & Decety, 2001; Gallese, Rochat, Cossu, & Sinigaglia 2009; Wellman, Lopez-Duran, LaBounty & Hamilton, 2008); indeed, when we observe the movements of other people, we make implicit inferences about the intentions and goals associated with these movements (Wolpert, Doya, & Kawato, 2003). Moreover, our attention to observed actions automatically activates corresponding motor programs (Bertenthal & Longo, 2008; Kilner, Marchant, & Frith, 2006; Michael et al., 2014; Rizzolatti & Craighero, 2004).

Importantly with regard to the current thesis, it has been shown that humans spontaneously and automatically tend to follow the other agents' movements (e.g., Allison, Puce, & McCarthy, 2000; Tomasello, 2000).

Let's take the following example. We have all been sitting in the audience and fascinated by a magician in our lives. In such a situation, our attention is attracted by something that hides the trick. Imagine being sitting in front of a magician playing the Cups and Balls game. In this game, three cups are placed face-down on a surface and a small ball is placed beneath one of them so that it cannot be seen. The magician shuffles the cups and makes the ball pass through them, jump from cup to cup, disappear from the cup and appear in other places. You are invited to bet on which cup holds the ball. However, to guess where the ball is hold is such a hard task. Magician's actions immediately attract your attention so that it becomes hard for you to follow the ball. Magicians know that: people follow their magic wand movements, leaving them the possibility to trick the audience. Thus, you will be fooled and believe something magic has just happened.

Observing many such examples, it becomes clear that actions are likely to grab the social perceiver's attention.

Among gestures, pointing is a deictic gesture and represents a universal cross-cultural social cue, as also shown by several developmental studies on the importance of the pointing

movement in the mother-child relationship (e.g., Charman et al., 2000; Vaughan Van Hecke et al., 2007). Such a gesture can act the same way as a gaze cue (Boyer, & Bertenthal, 2012; Cazzato, Macaluso, Crostella, & Aglioti, 2012; Crostella, Carducci, and Aglioti, 2009) so that individuals are faster and more accurate in responding to a target-object when it is pointed by another person (Belopolsky, Olivers, & Theeuwes, 2007; Fischer & Szymkowiak, 2004; Langton, O'Malley, Bruce, 1996; Langton & Bruce, 2000). Moreover, it has been suggested that pointing gestures may provide a more salient and accurate cue than either eye or head orientation (e.g., Butterworth, 2003; Deák, Walden, Kaiser, & Lewis, 2008; Langton et al., 2000).

Similarly, grasping gestures can contribute to the computation of another's direction of attention. In the past decade researchers have investigated whether the observation of grasping actions also affects the attentional system of the observer, highlighting in some cases inconsistent findings. In particular, Fischer & Szymkowiak (2004), comparing the ability of observed pointing and grasping postures to induce joint attention, demonstrated that pointing postures facilitated encoding of target locations via attentional orienting whereas grasping postures did not modulate observer's attention. On the same vein, Mazzarella et al. (2012; Experiment 3) found a lack of significant influence on attention exerted by the actor's grasping. Conversely, several research successfully demonstrated joint attention for grasp cues, within 350 ms (Fischer, Prinz & Lotz 2008), with biological grasping actions (Lindemann, Nuku, Rueschemeyer, & Bekkering, 2011) and when cue was directed towards an object (Tschentscher & Fischer, 2008; Vainio, Tucker, & Ellis, 2007). For instance, Fischer, Prinz & Lotz (2008) in a simple detection task presented visual probes over small and large objects after the participations saw two kinds of grasping gestures (i.e., a precision or power grip posture). Their findings show an attentional shift to the aperture-congruent object. Indeed, although the grasping cues were uninformative, stimulus detection was faster when the target appeared over the object following observation of a congruent grasping posture (i.e., small object following a grip posture, large object following a power grip).

Vainio, Tucker, & Ellis (2007) suggested the importance of objects by presenting grasp actions that either were or were not directed towards an object. Keeping in line with these findings, Tschentscher & Fischer (2008) adopted a detection task to compare the role of grasp direction cueing and grasp aperture cueing on attention. In their Experiment 1, for instance, they showed a hand in its resting posture with the two objects, one small object requiring a precision grip and a big object requiring a power grip to be grasped, located on the right and on the left. In the aperture cueing condition, the hand in its resting posture was replaced by a hand showing either a precision grip or a power grip, facing in the direction of the observer. Conversely, in the direction cueing condition, the hand was replaced by the side view of the same hand in its resting posture, directed either to the left or the right, either to the small or the big object. Then, the to-be detected target appeared over the left or right object. Participants were required to press a key on the keyboard when they detected the target. In Experiment 2, they combined combining directional and aperture information into one cue. The authors demonstrated joint attention from grasp cueing; indeed, when the object was congruent with either the direction or the aperture of the grasp cue, participants could faster allocate their attention to that object. Moreover, such an effect emerged only when the cue was directed towards an object (Experiment 2).

More recently, Lindemann, Nuku, Rueschemeyer, & Bekkering (2011) used a similar detection task whereby participants were presented with both biological animate and non-biological inanimate cueing stimulus. Results showed that only biological grasping actions was able to modulate the observer's attention, suggesting that this mechanism may be driven by spontaneous mental simulation of the observed motor behavior.

As well as for pointing gesture, it has been suggested that also grasping may provide an accurate cue to the spatial location, especially when eye gaze is uninformative (Ambrosini, Pezzulo, & Costantini, 2015). Indeed, Ambrosini and colleagues (2015) found that during action observation participants disregarded gaze information as soon as information on the actor's hand preshape was available and relied increasingly more on arm movement source when actions develop in time.

Their results suggest that when informative motor cues such as a preshaped hand with a given grip are available and might help in selecting action targets, people tend to capitalize on such motor cues, thus turning out to be more accurate and fast in detecting the object to be manipulated by the social partner.

Although some contradictory results (Fischer & Szymkowiak, 2004; Mazzarella et al., 2012) overall these studies corroborate the idea that grasping represents a relevant social cue in social interactions. Yet, this body of work investigated such a gesture as a cue to shifting social attention with emphasis placed on the effect of different components (i.e., hand preshape, objects-grip aperture compatibility, object affordance, goal- and no goal-directed) of the grasping gesture or reducing the stimulus situations to disembodied hands reaching and grasping objects.

Nevertheless, in our everyday life we are likely to observe actions even more complex; we can attend not only the final step of an action, like the grasping, but also the backward step, like the reaching. Reaching involves moving the hand in the right direction and at the right distance, while the grasping phase begins during the reaching movement and the size of the grasp depends on the target object (Jeannerod, 1984). Extensive literature has covered the action observation topic; however, rather than on observer's attention it has focused narrowly on the link between the perception and execution of actions (see ideomotor theories; James, 1890; Greenwald, 1970), on the observer's motor performance (i.e., Brass, Bekkering, & Prinz, 2001; Craighero, Bello, Fadiga, & Rizzolatti, 2002; Craighero, Fadiga, Rizzolatti, & Umiltà, 1999; Girardi, Lindemann, & Bekkering, 2010; Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995; Kilner, Paulignan, & Blakemore, 2003), observer's eye motor program (i.e., Ambrosini, Costantini, & Sinigaglia, 2011; Costantini, Ambrosini, & Sinigaglia, 2012a, 2012b; Flanagan & Johansson, 2003; Falck-Ytter, & von Hofsten, 2006) and the observer's ability of actions' goal prediction (i.e., Pelphrey, Morris, & Mccarthy, 2004). Additional work is thus needed to shed light on the role of actions, particularly on reach-to-grasp movement, in social attentional mechanism.

Social attention and social moderating variables

The orientation of attention in response to spatial cues provided by others appears to be rapid (e.g., Friesen & Kingstone, 1998) and reflexive (e.g., Driver et al., 1999; Galfano et al., 2012).

Several gaze cueing studies showed that even when participants are instructed that the gaze direction is counter-predictive of where the target appeared, they continue to shift their attention according with the gaze direction (e.g., Bayliss & Tipper, 2006; Bayliss, Bartlett, Naughtin, & Kritikos, 2011; Deaner & Platt, 2003; Friesen, Ristic, & Kingstone, 2004; Kuhn & Kingstone, 2009). On the other hand, this seemingly robust and reflexive orienting response has also been shown to be sensitive to social modulators. A recent line of research suggests that the way in which it occurs can be related to the physical and social characteristics of the partner, to the message that are conveyed, or to individual differences, both in non-human primates (Shepherd, Deaner, & Platt, 2006; Micheletta and Waller, 2010) and humans (e.g., Dalmaso et al., 2012).

Social attention can be modulated by individual differences (Bayliss, di Pellegrino, & Tipper, 2005; Mathews, Calder, & Yiend, 2007; Wilkowski, Robinson, & Friesen, 2009), so that for example a greater gaze-cueing effect has been shown in people with higher need for belongingness (Wilkowski et al. 2009) and higher levels of anxiety (Fox et al. 2007). Moreover, perceived similarity (Hungr and Hunt 2012; Porciello et al. 2014, 2016) and familiarity between the self and the interaction partner (Deaner et al., 2007) are likely to modulate social attention, suggesting that people prefer to attend to similar and familiar individuals.

More recently, studies have addressed the influence of the social relationship between the observer and the on-screen face in modulating the cueing effect, by varying visual features of the observed face. Faces characterized by signals of physical dominance (Jones et al., 2010; Jones, Main, Little, & DeBruine, 2011; Ohlsen, van Zoest, & van Vugt, 2013) and masculinized if compared to feminized faces (Jones et al., 2010) are likely to enhance a greater cueing effect.

Social knowledge regarding the agent who are cueing attention can also influence the social attention. For example, faces of individuals belonging to one's own political group (Liuzza,

Cazzato, Vecchione, Crostella, Caprara, & Aglioti, 2011; see also Carraro, Dalmaso, Castelli, & Galfano, 2015; Dodd, Hibbing, & Smith, al. 2011; Dodd, Balzer, Jacobs, Gruszczynski, Smith, Hibbing, 2012) can elicit stronger gaze-cueing.

In a similar vein, individuals associated with high-social status, compared with low- social status, are likely to enhance a stronger gaze cueing (Dalmaso, Galfano, Coricelli, & Castelli, 2014, Dalmaso, Pavan, Castelli, & Galfano, 2012; Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010; Ratcliff, Hugenberg, Shriver, & Bernstein, 2011)

Furthermore, it has been illustrated the perceived trustworthiness (Sußenbach and Schonbrodt 2014) age (Ciardo et al., 2014), ingroup membership and ethnicity (Pavan, Dalmaso, Galfano, & Castelli, 2011; Dalmaso, Edwards, & Bayliss, 2016; Frischen & Tipper, 2006, Pavan et al., 2011; Dalmaso et al., 2011). Pavan and colleagues, for instance, comparing different racial group membership (i.e., White and Black people) found a significant cueing effect for White participants towards their ingroup (i.e., White people) but not towards the outgroup (i.e., Black people), whereas Black participants showed a significant cueing effect towards both White and Black individuals.

In addition, it has been recently demonstrated that the gaze cueing effect may be modulated by background social information and the nature of this effect can depend on culture (Cohen, Sasaki, German, & Kim, 2015).

Taken together, all these studies suggest that observer's social attention appears most influenced by highly relevant target for the perceiver (e.g., dominant looking faces, ingroup members) and target that portray important information about the environment.

As human beings we are particularly interested in negative information (Cacioppo, Gardner, Berntson, 1999). In order to survive, we need to be aware of danger in our environment and to avoid it because the consequences of a injurious event may be dramatic (e.g. Ekman, 1992; Öhman, 1992); thus, it appears we have an orienting response that involves diverting our attention

to targets providing such information. Recently, literature on social attention began to focus on this aspect.

Indeed, it has been shown that certain kinds of emotions such as fear may trigger attentional shift (e.g., Bayliss, Schuch, & Tipper, 2010; Graham, Friesen, Fichtenholtz, & LaBar, 2010; Kuhn & Tipples, 2011; Yiend, 2010); specifically, it has been found a greater gaze cueing effect in response to fearful rather than happy faces (e.g., Kuhn & Tipples, 2011; Tipples, 2006). Furthermore, a recent work demonstrated a stronger gaze-cueing effects for persons performing negative and norm-violating rather than positive behaviors (Carraro, Dalmaso, Castelli, Galfano, Bobbio, & Mantovani, 2017). Further, from an intergroup perspective Chen & Zhao (2015; see also Chen, Zhao, Song, Guan, & Wu, 2017) focused on the modulation of intergroup threat on gaze cueing effect and found that participants followed the gaze of threatening outgroup, but they did not follow the gaze of non-threatening outgroup faces.

To summarize, prior research showed that social attention driven by gaze is modulated by social variables and by social threat. However, little is known about the influence of social factors on social attention processes directed to actions.

As mentioned, actions, such as reach-to-grasp movements, are highly social in nature as well as eye gaze movements. Both are related to the present and future intentions to act on an object (Pierno et al. 2008; Wolpert, Doya, & Kawato, 2003), but at the same time it has been shown that advance information gained during the observation of the initial phase of an action sequence allows perceivers to discriminate across movements performed with different social intentions, such as the intention to cooperate with a partner or to compete against (Sartori, Becchio, & Castiello, 2011). Given the importance of human actions in social interactions, it is worth to explore how they affect attentional processes. Does the observation of people grasping either positive or negative objects affect social attention in the same manner? What happens when we observe actions performed by unfamiliar people? Or when they threaten our safety in any ways?

Before trying to answer to these questions, we need to take under consideration the role of the context (i.e., objects and contextual cues.) in attentional processes.

Objects and contextual cues

People do not behave in empty and aseptic contexts; in our everyday life, for instance, we often observe people interacting with objects in the environment around them.

Literature has broadly illustrated that objects *per se* (i.e., by merely being objects; Kimchi et al., 2007; Yeshurun, Kimchi, Sha'shoua, & Carmel, 2009) are likely to grab visual attention (see Chen, 2012 for review). Moreover, this seems to happen especially when they are graspable and affordable (e.g., Handy et al., 2003; Symes et al., 2008; for a review, see Humphreys et al. 2010).

Yet, observing certain target in a certain context interacting with certain objects may affect also social attention processes. In other words, objects and contextual cues may amplify or reduce the modulators effects of social targets on social attention.

We already mentioned the importance of objects in grasp cueing effect in social attention (Tschentscher & Fischer 2008; Vainio, Tucker, & Ellis, 2007). One reason for that may be due to the potential interactions that objects can afford (Gibson, 2013; Makris, Hadar & Yarrow, 2013). By jointly attending objects with other people we can predict future actions of social partners and infer their intentions and mental states regarding what they may think of the object to which they are attending and what they are likely to do next with the object (Baron-Cohen et al., 1995; Nummenmaa & Calder, 2009). The ability to jointly attend objects with others appears to be crucial to social learning (Corkum & Moore, 1995), as this can have positive outcomes on social development (Baldwin, 1995; Tomasello, 1995).

However, in social contexts objects are not merely objects. They are likely to convey meaningful messages and contribute to make sense of the environment in which they are, as they can have different valence and relevance.

Importantly to this thesis, negative valence of objects has been broadly taken into account (Brosch, Sander, Pourtois, & Scherer, 2008; Brosch & Van Bavel, 2012; Cunningham, Van Bavel, & Johnsen, 2008). Both behavioral (Pratto and John, 1991; Fiske, 1980) and physiological studies (Öhman et al., 1993) have illustrated that negative stimuli gain priority over neutral or positive stimuli in human attentional system; namely *negativity bias* (Cacioppo and Gardner, 1999; Mogg and Bradley, 1998; Mogg et al., 2000; Peeters and Czapinsky, 1990; Taylor, 1991). The explanation of such a privilege for negative stimuli could be found in the consequences of a negative event; indeed, they can be more dramatic than the consequences of ignoring neutral or even appetitive stimuli (e.g. Ekman, 1992).

Going beyond negativity, also evolutionary relevant threatening stimuli are likely to trigger and shape human attention (Öhman et al., 2001; Fox et al., 2002). Threatening stimuli preferentially catch attention because they have a greater affective and motivational significance for individuals in their current environment (Broeren & Lester, 2013; Purkis, Lester, & Field, 2011; Subra, Muller, Fourgassie, Chauvin, & Alexopoulos, 2017). For instance, dangerous objects are likely to capture human attention because they are relevant for survival (Anelli, Borghi, & Nicoletti, 2012; Anelli, Nicoletti, Kalkan, Sahin, & Borghi, 2012; Anelli, Ranzini, Nicoletti, & Borghi, 2013).

To sum up, it appears that objects and contextual cues play a crucial role in attentional processes. What has not been fully explored so far is how they interact and affect social attention during the observation of actions towards objects. In other words, what happen on our social attention ability when we observe people reaching-to grasp, for instance, threatening objects.

The present thesis

As shown, human actions and movements in general are important for communication among humans. In particular, hand movements are reliable signals to infer where the intentions of social partners are directed (Allison, Puce, & McCarthy, 2000; Tomasello, 2000). However, the vast majority of the studies has mainly explored how the observation of other individuals' actions affects

the observer's own motor program (e.g., Brass, Bekkering, & Prinz, 2001; Craighero, Bello, Fadiga, & Rizzolatti, 2002) rather than how it affects the observer's attention.

The present thesis aims at filling this gap exploring the role of human gestures in driving the attentional processes.

To investigate the role of action observation in social attention processes is theoretically relevant for several reasons. First, as reviewed above, human gestures, such as pointing and grasping an object, are important enough for the communication among humans that our brain has evolved to provide correct interpretations of others' actions (Perrett et al., 1989) and human language has evolved from gestural system to a spoken world (Corballis, 2003). Pointing and pantomiming, for instance, represent *a primordial form of uniquely human communication* (Tomasello, 2008, pag. 3). Every action is likely to be a potential communicative signal; a fundamental prerequisite for successful and cooperative communication among social partners is that they share attention, they pursue shared goals and they have shared intentionality (Searle 1995; Bratman 1992; Gilbert 1989; Tomasello, Carpenter, Call, Behne, and Moll 2005). Since social attention is defined as the ability to share attention with others (e.g., Nummenmaa & Calder, 2009), it becomes important to explore whether and how actions of other individuals may influence such ability.

Second, in our everyday social interactions we rely on multiple cues to understand another person's intention. It has been clearly established that from observing another person's gaze direction, we are able to infer what he might be interested in (Lee, Eskritt, Symons, & Muir, 1998) what he is likely to do next (Castiello, 2003; Pierno et al., 2006; Pierno, Mari, Glover, Georgiou, & Castiello, 2006) and which are his purposes and desires (Bayliss, Paul, Cannon, & Tipper, 2006; Pierno, Becchio, Turella, Tubali, & Castiello, 2008). Thus, the primary role of eye gaze in inferring others' intentions appears to be evident. However, eye gaze not always implies a current interaction with an object that one might have looked at. The common expression "Look, but do not touch" suggests exactly that one, for instance, could look at a desired object and decide to never interact

with it. Even though it has been shown that others' gaze direction can communicate either the future intentions and also the present intentions (Pierno, Becchio, Turella, Tubaldi, & Castiello, 2008), it appears clear that actions, such as grasping, are more effective in communicating the immediate intentions, because they depict an ongoing interaction (Mazzarella et al., 2012; Sartori, Becchio, & Castiello, 2011). For instance, from seeing the beginning of a movement, we are able to predict how it will end (Frith & Frith, 2006; Knoblich & Flach, 2001). In addition, it has been shown that advance information gained during the observation of the initial phase of an action sequence allows perceivers to discriminate across movements performed with different social intentions, such as the intention to cooperate with a partner or to compete against (Sartori, Becchio, & Castiello, 2011).

Given the importance of gestures in social interactions, it is worth to explore how they affect attentional process. Therefore, the first and primary aim of this thesis was to elucidate whether the observation of an action performed by another person is likely to shape social attention. In particular, we focused on the role of reach-to-grasp movements. The second aim of the present thesis was to investigate the potential role of some social factors in modulating social attention triggered by action observation.

Thus, the current thesis presents 12 experiments whereby we adopted an action observation task, namely a variation of the spatial cueing paradigm (e.g., Posner, 1980), that consists, generally, of presenting centrally-placed an actor while performing a reach-to grasp movement rightwards or leftwards toward an object.

In the first set of studies of this thesis (Chapter 2) we have shown that observing a reach-to-grasp movement in direction of an object is likely to grab social attention. Afterwards, in different laboratory studies we have analyzed in detail the impact of some social (e.g., group membership, social threat, status, weight) and physiological (e.g., hormonal fluctuations during menstrual cycle) factors on attentional orienting in response to human reach-to-grasp movements towards objects. Specifically, we have explored whether some characteristics of the on-screen actor and the social context are likely to attract our attention; we have investigated the role of group

membership and social threat (Chapter 3), the role of gender, products status and hormonal shift during menstrual cycle (Chapter 4), and the role of weight status (Chapter 5).

Then, Chapter 6 we have analyzed the potential outcomes of observing informative cues provided by a social target on person perception and prejudice.

In Chapter 7 we have investigated a different process that can also be influenced by action observation: more explicitly, we have explored the relationship between action observation and motor resonance (e.g., Brass, Bekkering, & Prinz, 2001; Craighero, Fadiga, Rizzolatti, & Umiltà, 1999) with emphasis on the impact of group membership and social threat on such a process.

Finally, Chapter 8 presents an overview of the findings and discusses their limitations, their implications and future directions.

Chapter 2

Is social attention affected by human action observation?

Hand movements, such as grasping an object, are reliable indicators of another's attentional focus of interest (Allison, Puce, & McCarthy, 2000; Tomasello, 2000). Surprisingly, as reviewed in Chapter 1, although the observation of other individuals' actions is a relevant attentional cue, a huge body of research in this domain mainly explores how action observation affects the observer's own motor system (e.g., Brass, Bekkering, & Prinz, 2001; Craighero, Bello, Fadiga, & Rizzolatti, 2002) rather than how it affects the observer's attention. The available studies on attentional processes driven by actions corroborate the idea that hand gestures are relevant social cues in social interactions. However, especially with regard to grasping gesture, they primarily focus on the congruence of the configuration of the grasping hand and the grasped object rather than on attentional shift (e.g., Fischer, Prinz & Lotz 2008; Vainio, Tucker, & Ellis, 2007; Tschentscher & Fischer, 2008); moreover, the few experiments that investigate attentional shift report some mixed evidence (Fischer & Szymkowiak, 2004; Mazzarella et al., 2012; Tschentscher & Fischer, 2008).

In sum, it remains unclear so far whether social attention may be affected by action observation; further work is needed to address this issue. This observation raises a first research question: is a reach-to-grasp movement likely to lead our social attention in the same way as the eye gaze?

The aforementioned lack of empirical interest regarding action observation effects on social attention can be also found in the literature comparing the role of human and non-human actions on this process. Yet again, this issue has been addressed extensively in studies on action-observational modulation of motor responses (Castiello, Lusher, Mari, Edwards, & Humphreys, 2002; Kilner, Paulignan, & Blakemore, 2003; Heyes, Bird, Johnson, and Haggard, 2005; Liepelt &

Brass, 2010; Longo & Bertenthal, 2009; Tai, Scherfler, Brooks, Sawamoto, & Castiello, 2004). On social attention, the vast majority of the studies compare eye gaze and other non-biological and non-social cues that convey direction, such as arrows.

While a few behavioural studies illustrate a processing advantage for gaze cues relative to arrows (Friesen et al., 2004; Ristic, Wright, & Kingstone, 2007), wider evidence suggests that eye gaze is not unique in eliciting a strongly automatic orienting of attention (e.g., Brignani, Guzzon, Marzi, & Miniussi, 2009; Dodd, Stigchel, Leghari, Fung, & Kingstone, 2008; Hommel, Pratt, Colzato, & Godijn, 2001; Kuhn & Kingstone, 2009; Galfano , Dalmaso , Marzoli , Pavan , Coricelli & Castelli, 2012; Quadflieg, Mason & Macrae, 2004; Tipples, 2002, 2008).

Indeed, similar to gaze, arrow cues have been shown to elicit reflexive shifts of attention. In a Posner-like paradigm conducted by Tipples (2002), two arrow cues were presented to the left and right of a fixation asterisk. After an interval of time, a to-be detected target appeared either on the left or on the right of the screen. As for gaze-cueing effect, response times were faster when the arrows pointed toward, rather than away from, the location of the target, suggesting that even arrows can automatically trigger the orienting of attention.

Crucially, regarding the current work, biological and non-biological movements have been ignored in studies looking at action-cueing of attention. To the best of our knowledge, only one study has addressed this issue: comparing the effects of animate biological (i.e., human hand) and inanimate non-biological (i.e., U-shaped geometrical shapes) prehensile cues on the observer's attention, Lindemann, Nuku, Rueschemeyer, & Bekkering (2011) show that biological grasping actions modulate the observer's attention whereas the observation of inanimate stimuli does not produce an analogous grasp cueing effect. Thus, this study demonstrates that perceived animacy modulates the presence of action-cueing effects; however, it focuses on the cueing effect of an aperture-congruent configuration of the grasping hand and an object rather than on the direction of the movement.

Indeed, prior studies on social attention left this important aspect unexplored. Hence, research on this topic is called to answer a second important question: are action cues provided by conspecifics more likely to tune individuals' attention than non-human and mechanical movements?

In other words, we should investigate whether attentional shifts are specifically promoted by human being movements rather than an asymmetry in our perceptual field.

The studies presented in this chapter aim at answering these questions.

Specifically, the goal of this initial set of studies was twofold. First, the current work was interested in testing the hypothesis that human actions -with emphasis on reach-to-grasp movements- are socially important in shaping social attention (Frischen et al., 2007). Second, it aims at comparing the effects of human and non-human movements on social attention.

We expected reach-to-grasp movements to act as a social cue in social attention processes. Thus, consistently with the existing literature on gaze, pointing, and grasping gestures (Fischer, Prinz & Lotz 2008; Frischen, Bayliss, & Tipper, 2007; Langton & Bruce, 2000; Tschentscher & Fischer, 2008), we predicted a task facilitation when the reach-to-grasp movement was towards the target and a delay in response when the reach-to-grasp movement was in the opposite direction with respect to the target, namely an action-cueing effect on social attention (*Hypothesis 1*).

Second, if people tend to pay more attention to action cues provided by their conspecifics than by other agents, we predicted a larger cueing effect for human actions than for non-human actions (*Hypothesis 2*). Social and non-social attention are different because they serve different communicative functions. As mentioned in the previous chapter, social signals, such as eye gaze, facial expression and body movements, take priority over other information (e.g., Birmingham & Kingstone, 2009) and affect attention because they provide information regarding warnings and rewards (Tomasello, 2008). Thus, given the biological importance of conspecifics, it is possible that reflexive attentional orienting may be most emphasized when triggered by other people.

To test our hypotheses, we carried out two experimental studies using a Posner-like paradigm, namely an adapted version of the classical spatial cueing paradigm (Posner, 1980). In a

simple action observation task, participants responded to the colour of a target appearing on the screen either on the left or on the right. Before the target onset, we presented a cueing stimulus while reaching-to-grasp one object located either on the left or on the right. In Study 1 we presented a human actor as the cueing stimulus while reaching-to grasp a neutral object; in Study 2 the cueing stimuli could be either a human actor, a human-like object or a non-human-like object.

The procedure of this set of studies were approved by the Ethical Committee of the University of Milano-Bicocca, Milan, Italy, and were in accordance with the ethical standards of the 1964 Declaration of Helsinki and with the ethical standards procedures recommended by the Italian Association of Psychology (AIP).

Study 1

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (d=.25) is N= 31 for paired t-test. We advertised the study and we enrolled all the individuals who answered the call and volunteered to participate even if the final number of participants exceeded the number suggested by the G-Power analysis. Thus, forty-seven Italian citizens (M_{age} =29.53, SD_{age} =11.22, range = 18-57 years, 21 females), naive to the purpose of the study, took part in the study.

All participants provided written informed consent to participate.

Apparatus and stimuli

The stimuli were presented on a 17-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh rate: 59 Hz) placed at an approximate viewing distance of 60 cm in front of the participants. Stimuli presentation and response registration were controlled by the E-Prime v2.0 software. The initial stimulus consisted of cross fixation presented at the center of the

screen. The following stimulus consisted of a picture (640 pixels × 480 pixels) depicting an actor sat in front of a table. The cueing stimulus consisted of a picture of the actor grasping an object (i.e., juices) located either on his left or on his right. The to-be categorized target consisted of a square that could be either yellow or blue and could appear either on the left or on the right of the screen.

Procedure

After the informed consent, participants were given detailed task instructions and asked socio-demographic information (gender, age, nationality). Before the actual experiment, participants performed 4 randomly chosen training trials. Next, experimental session started.

Each trial started with the presentation of a central fixation cross which remained visible for 900 ms. Then, a picture depicting an actor sat in front of a table appeared on the screen. After 900 ms, the picture was replaced by the cueing stimulus, showing the actor grasping either an object placed on the left or an object placed on the right. After 200 ms, a square appeared either on the left or on the right of the screen, namely in a spatially congruent or spatially incongruent position with respect to the cue's grasping direction (Figure 2.1). The target remained visible until a response was made. Participants were instructed to ignore the actor's movement, (even they could freely move their eyes around the screen while the frames were displayed) and to detect the color of the square. They were asked to respond as quickly and accurately as possible with a button press on the keyboard, specifically "Y" (for yellow stimulus) and "B" (for blue stimulus). Because the ''Y'' key is directly above the "B", this up/down response was orthogonal to the left/right location of the target. Participants were instructed to press them using their thumb and forefingers of one hand. Responses were allowed after the square appearance and reaction times (RTs) were recorded. The experimental session was composed of all combinations of the variables (e.g., movement toward right, yellow target on the right; movement toward left, blue target on the right). Each trial was presented 4 times resulting in a total amount of 32 experimental trials. The order of trials within each block was randomized. At the end of the experiment, participants were fully debriefed.

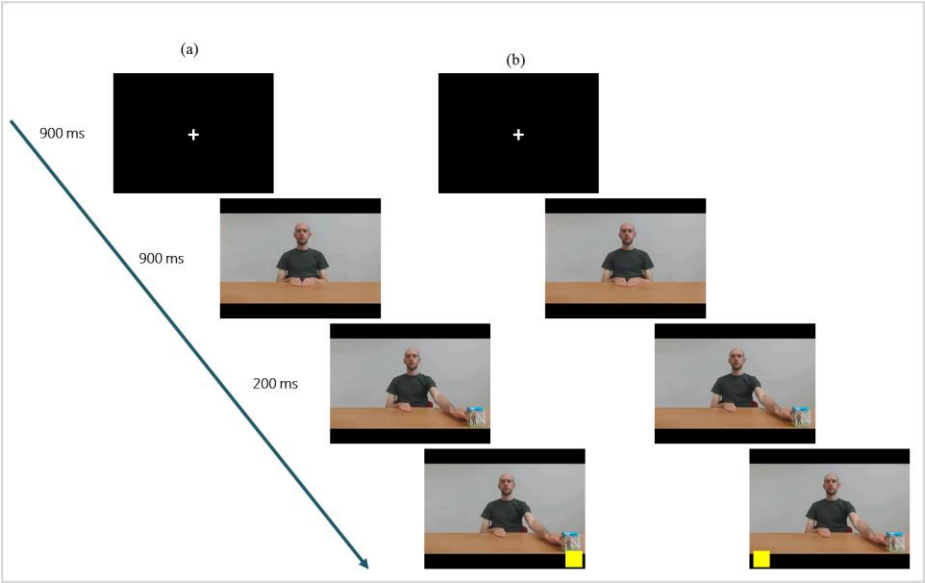

Figure 2.1
Stimuli, trial sequence and timing of the action observation task (Study 1). An example of a congruent trial (a) an incongruent trial (b).

Results

Preliminary Analysis

We excluded from the analysis training trials (11.1% of trials) and errors (e.g., pressing the 'B' key when the square was yellow; 2.33% of trials). Trials with correct RTs 2.5 SD above or below the participant's mean (2.99% of trials) were removed before the calculation of means for each condition.

Reaction times

A paired *t*-test on the average RTs in incongruent and congruent trials was then computed. As displayed in Figure 2.2, paired comparison between RTs revealed that the participants were quicker in detecting the target (i.e., the color of the square) when it appeared in a congruent location with respect to the direction of the reach-to-grasp movement (M = 481.66, SD = 80.40) than when it appeared in a incongruent position (M = 504.86, SD = 81.92), $t(46) = 5.11$, $p < .001$, $d = .75$, 95% CI [.42, 1.07]. This finding, in line with the hypothesis and with the literature on social attention, suggested an action-cueing effect.

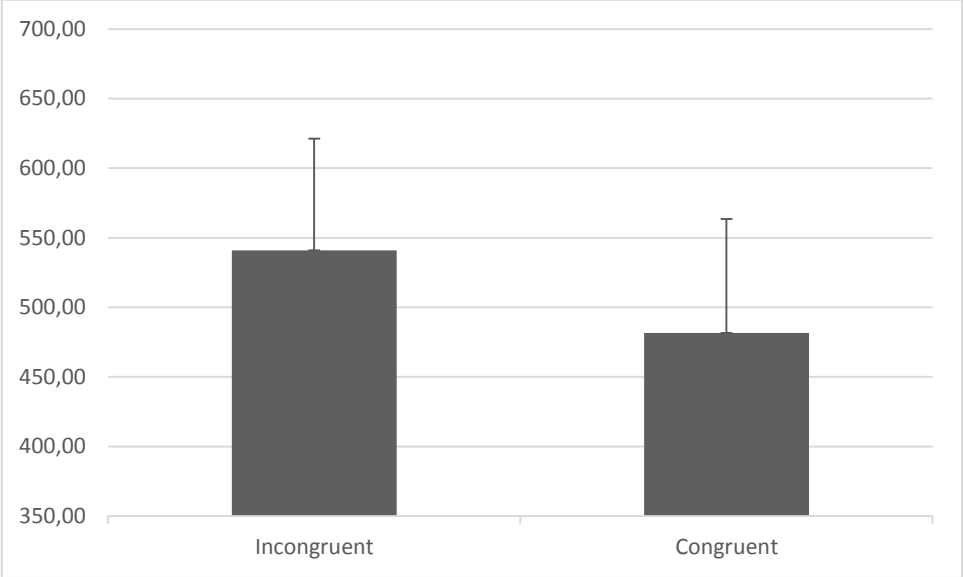

Figure 2.2
Mean (in ms) comparison between incongruent and congruent trials in Study 1. Error bars represent standard errors.

Discussion

Our data showed that responses were faster to cued targets than to the uncued targets. Consistently with our hypothesis, our findings suggest that reach-to-grasp is likely to shift individual's attention; thus, it seems to act as the gaze in social attentional processes (e.g., Frischen et al., 2007). Study 2 aimed to test whether the reported action-cueing effect is specific for human actions or whether it is generalized to non-human movements. To this purpose, in a similar action observation task we presented a cueing stimulus consisting of either a human actor, a human-like object or a non-human-like object reaching-to-grasp one of two objects.

Study 2

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (*f*=.25) is N= 21 for a within-subject ANOVA (1 group,

6 measurements). We advertised the study and we enrolled all the individuals who answered the call and volunteered to participate. Thus, forty Italian students from the University of Milano – Bicocca (M_{age} = 23.15, SD_{age} =3.29, 18-36 range years, 30 females), naive to the purpose of the study, took part in the study in exchange for credit points.

Apparatus and stimuli

The stimuli were presented on a 22-in LCD computer monitor (Asus® VW226; Resolution: 1920 pixels × 1080 pixels; Refresh rate: 59 Hz) placed at an approximate viewing distance of approximately 60 cm in front of the participants. Stimuli presentation and response registration were controlled by the E-Prime v2.0 software. The initial stimulus consisted of cross fixation presented at the center of the screen. The following stimulus consisted of a picture (624 pixels × 467 pixels) depicting either a human actor, or a human-like object (i.e., a mannequin) or a non-human-like object (i.e., a backhoe toy) in front of two objects (i.e., glasses) located on a table respectively on their left and on their right. Both objects were identical and were distributed symmetrically about the vertical midline. The cueing stimulus consisted of a picture of each cue reaching-to-grasp one of two objects. Note that reaches using the right arm were always executed towards objects presented in right space, and reaches using the left hand to objects in left space. The to-be categorized target consisted of a square that could be either yellow or blue and could appear either on the left or on the right of the screen.

Procedure

The experimental procedure was analogous to that used in the previous study. Thus, after the informed consent, participants were given thorough task instructions and asked socio-demographic information (gender, age, nationality). Before the actual experiment, participants performed 6 randomly chosen training trials. Next, experimental session started.

Each trial started with the presentation of a central fixation cross for 900 ms. Then, a random picture of one of the three cues (i.e., human actor, human-like object, non-human-like object) appeared on the screen. After 900 ms, the picture was replaced by the cueing stimulus,

showing the cue grasping either the object on the left or the object on the right. After 200 ms, a square appeared either on the left or on the right of the screen, namely in a spatially congruent or spatially incongruent position with respect to the cue's grasping direction, and lasted visible until a response was made. Participants were instructed to ignore the action direction, (even they could freely move their eyes around the screen while the frames were displayed) and to detect the color of the square. As for Study 1, they were asked to categorize the color of the square and to respond as quickly and accurately as possible with a button press on the keyboard, specifically "Y" for the yellow square and "B" for the blue square; participants were instructed to press them using their thumb and forefingers of one hand (Figure 2.3). Responses were allowed after the square appearance and reaction times (RTs) were recorded. The experimental session was composed of all combinations of the variables. Each trial was presented 6 times resulting in a total amount of 144 experimental trials split evenly into two blocks. The order of trials within each block was randomized. Hence, a 3 (cue type: human vs. human-like object vs. non-human-like object) x 2 (cue-target spatial congruency: congruent vs. incongruent) within-subjects design was adopted.

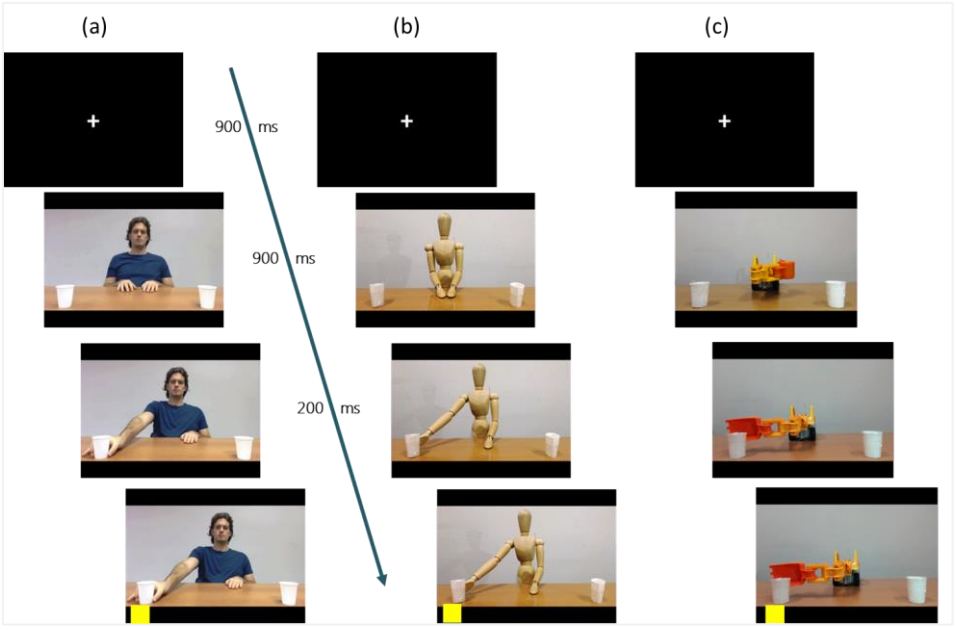

Figure 2.3
Stimuli, trial sequence and timing of the action observation task (Study 2). An example of congruent trial with human actor (a), human-like object (b), and non-human-like object (c) as cueing stimuli.

Results

Preliminary Analysis

Training trials (4% of trials) and errors (e.g., pressing the 'B' key when the square was yellow; 2.5% of trials) were discarded from the analysis. Trials with correct RTs 2.5 SD above or below the participant's mean (1.48% of trials) were removed before the calculation of means for each condition. Finally, we excluded one outlier data point with standardized values greater than ±3 from the RTs averages. Thus, final analysis was conducted on a sample of 39 subjects. Mean and RTs are reported in millisecond (ms).

Reaction times

A 3 (cue type: human vs. human-like object vs. non-human-like object) x 2 (cue-target spatial congruency: congruent vs. incongruent) within participants repeated-measures ANOVA was computed on the RTs. The analysis showed that the main effect of cue-target spatial congruency was significant, $F(1,38)=30.83$, $p<.001$, $\eta_p^2 =.45$. In line with the previous study and with the action-cueing effect, RTs for congruent trials were faster (M = 517.80, SD = 12.87) than for incongruent trials (M = 540.43, SD = 14.21). Also the main effect of cue type was significant, $F(2,37)=9.70$, $p<.001$, $\eta_p^2 =.34$, showing smaller RTs for human cue (M = 523.35, SD = 13.37) than for both human-like object (M = 526.24, SD = 13.41) and non-human-like object (M = 537.75, SD = 13.88). Importantly, the interaction between cue type and cue-target spatial congruency was significant, $F(2,37)=3.67$, $p=.035$, $\eta_p^2 =.17$. As displayed in Figure 2.4, the *post hoc* analyses revealed significant differences between RTs in congruent and incongruent trials for human cue ($M_{incongruent}$ = 540.58, $SD_{incongruent}$ = 14.26; $M_{congruent}$ = 506.11, $SD_{congruent}$ = 13.16), $p<.001$, human-like cue ($M_{incongruent}$ = 534.22, $SD_{incongruent}$ = 14.45; $M_{congruent}$ = 518.27, $SD_{congruent}$ = 13.04), $p=.014$, and non-human-like cue ($M_{incongruent}$ = 546.49, $SD_{incongruent}$ = 14.79; $M_{congruent}$ = 529.01, $SD_{congruent}$ = 13.39), $p<.001$ (see Table 2.1 for means and standard deviations). Moreover, for incongruent trials, there were no differences between RTs in human and human-like condition, $p=.224$, and human and non-human-like condition, $p=.224$. A significant difference was found between RTs on human-like

and non-human-like cues, p=.026. For congruent trials, RTs were significantly different either between human and human-like condition, p<.020, human and non-human-like condition, p<.001 and human-like and non-human-like condition, p<.051.

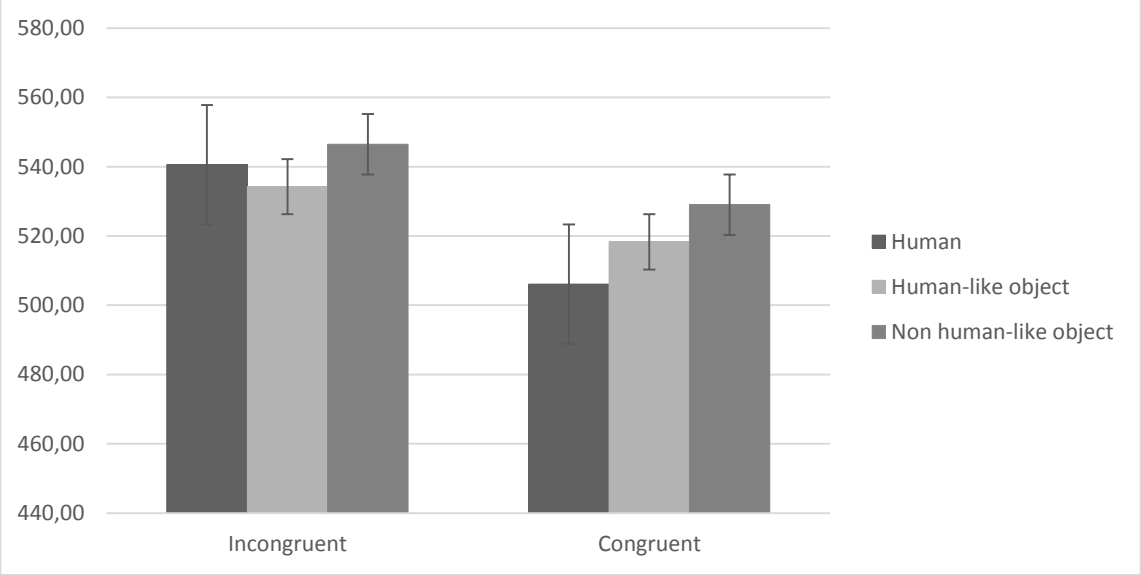

Figure 2.4
Two-way interaction between Cue Type and Cue-Target Spatial Congruency in Study 2. Error bars represent standard errors.

	Cue-Target Spatial Congruency		
	Incongruent	Congruent	Action-cueing magnitude
Cue type	*M (SD)*	*M (SD)*	*M (SD)*
Human	540.58 (14.26)	506.11 (13.16)	34.47 (38.49)
Human-like object	534.22 (14.45)	518.27 (13.04)	15.95 (38.80)
Non-human-like object	546.49 (14.79)	529.01 (13.39)	17.48 (31.45)

Table 2.1
Means and Standard Deviations (in parentheses) for RTs (ms) in Study 2. The action-cueing magnitude has been calculated as the difference between RTs in incongruent trials and RTs in congruent trials for each cue type.

Then, the difference between RTs in incongruent trials and RTs in congruent trials was calculated for each cue type as an index of action monitoring and action-cueing; thus, the higher the index, the larger the delay of the response to incongruent stimuli when compared to congruent

stimuli. The three-level (cue type: human vs. human-like object vs. non-human-like object) one-way ANOVA computed on this index, $F(2,37)=3.67$, $p=.035$, $\eta_p^2 = .17$, confirmed a greater action-cueing effect for human cue than for both human-like cue, $t(38) = 2.44$, $p = .019$, $d = .39$, 95% CI [.06, .71], and non-human-like cue, $t(38) = 2.39$, $p = .022$, $d = .38$, 95% CI [.06, .71]; no difference was found on the action-cueing magnitude between human-like and non-human-like object, $t(38) = -.22$, $p = .83$, $d = .04$, 95% CI [-.28, .35] (see Table 2.1 for means and standard deviations).

Discussion

Study 2 replicated the findings emerged in the previous study; observing an action results in faster detections of targets appearing in a congruent location with respect to the action direction in contrast to targets appearing in an incongruent location with respect to the action direction. Moreover, Study 2 aimed to clarify whether the action-cueing effect is specific for actions performed by human agents or generalized to non-human agents. In line with our hypothesis, our data showed a greater action-cueing effect when observing human agents than when observing inanimate agents. These findings suggest that, although individuals' attention is likely to be caught by asymmetries in the perceptual field and by every kind of movements, conspecifics' actions play a primary role in driving human attention. Therefore, these preliminary data provide a first crucial support to our theoretical assumption.

General discussion

The purpose of the present work was twofold. First, it aimed to clarify whether, beyond eye gaze, human actions are likely to effectively shape social attention (Frischen et al., 2007) with emphasis on reach-to-grasp movements. In this regard, the available studies have reported mixed evidence; additionally, among hand movements, such line of research focused on pointing gestures and grasping, but considering the latter in terms of congruence between grip aperture and object size rather than on shift in the direction of a movement. Second, once it was established that people

tend to ‘follow’ the others' actions, it aimed at investigating whether this response was specialized for biological stimuli, comparing the influence of human and non-human agents on social attention.

With the purpose to reconcile inconsistent findings on grasping and social attention (Fischer & Szymkowiak, 2004; Mazzarella et al., 2012; Fischer, Prinz & Lotz, 2008; Lindemann, Nuku, Rueschemeyer, & Bekkering, 2011; Tschentscher & Fischer, 2008), we simplified the paradigm by presenting reach-to-grasp actions always directed towards an object (i.e., goal-directed actions) and hand grip apertures always congruent with the objects size.

The present set of experiments yielded a robust effect of action on individual's attention: hence, consistently with our hypothesis, we found an action-cueing effect showing faster responses to cued targets (i.e., when targets appeared in a congruent position with respect to the direction of the actor’s movements) than to uncued targets (i.e., when targets appeared in an incongruent position with respect to the direction of the actor’s movements).

Moreover, our data support the hypothesis that perceived humanness modulates the action-cueing effect; indeed, we found a larger cueing effect for human actions than for non-human actions. Thus, it appears that the attentional orienting is emphasized when triggered by other people's movements rather than by non-biological cues.

It is worth noting that the action performed by the cueing stimuli (i.e., the human actor in Study 1 and in Study 2; the mannequin and the backhoe toy in Study 2) acts as a peripheral cue as in Posner-like paradigms with exogenous peripheral cues. Our results showed faster responses for congruent rather than incongruent trials for all cues, both human, human-like and non-human-like, suggesting that responses might be affected also by low-level processes triggered by the sudden appearance of a peripheral cue. However, the smaller action-cueing effect for non-human agents, either human-like and non-human-like (Study 2), is in contrast with the possibility that the reported effect was simply triggered by a visual asymmetry in the stimulus. The observation of a meaningful action performed by the human actor led to stronger cueing effects for the human actor as compared to the other two cueing stimuli.

On the other hand, the greater action-cueing effect could be ascribed to a rapid and spontaneous mental simulation of the observed motor action, that can occur easily when observing human agents rather than non-human agents. Indeed, humans possess more social agency in nature and movements performed by humans are more familiar than those performed by inanimate agents so that it can be easier to guess the goals of such actions (Bandura, 1989). However, further work is needed to address this crucial aspect. For instance, since the importance of the eyes as social cue (Baron-Cohen, Campbell, Karmiloff-Smith, Grant, & Walker, 1995), it could be interesting to explore whether adding schematic eyes on the face of a human-like cues may affect the attentional orienting (e.g., Quadflieg, Mason & Macrae, 2004).

Finally, it is worth noting that the paradigm adopted in the present work was much simpler than situations we face in everyday life. Indeed, here our participants just saw the beginning and the end of the performed actions. In the next chapters we will present several set of studies in which we used more ecological paradigms, showing videos of actions unfolded in time.

Chapter 3

Can social variables modulate social attention?

In Chapter 2 we illustrated that individuals spontaneously tend to follow the direction of observed actions. Watching a movement can drive our attention resulting in faster detection of targets appearing at the reached-to location. Moreover, we showed that perceived humanness modulates the presence of action-cueing effects. Indeed, such an effect is even stronger when actions are triggered by other people, rather than by inanimate agents.

Thus, humans seem to particularly attend to their conspecifics. These preliminary findings arise further research questions: more specifically we are interested in investigating whether specific social characteristics make conspecifics' movements more or less likely to grab our attention. In which situations do we follow others' actions? Can higher order variables, such as social factors, modulate the action-cueing effect? Specifically, the present work aims at exploring the effect of social variables, such as agent's group membership and perceived social threat, on attentional orienting in response to human reach-to-grasp movements towards objects.

As mentioned in Chapter 1, the orientation of attention in response to spatial cues provided by others is a robust phenomenon (see Frischen et al., 2007 for review). Recently, a great bulk of research has started to investigate whether this process is moderated by social information (e.g., Carraro, Dalmaso, Castelli, Galfano, Bobbio, & Mantovani, 2017; Dalmaso, Pavan, Castelli, & Galfano, 2012; Deaner, Shepherd, & Platt, 2007; Kuhn & Tipples, 2011; Mathews, Fox, Yiend, & Calder, 2003; Pavan, Dalmaso, Galfano, & Castelli, 2011). Most of the studies on this topic focus on the role of eye gaze, showing that social knowledge regarding the agents who are cueing attention can modulate the magnitude of the attentional shift

For instance, faces similar to one's own appear to enhance a greater cueing effect than dissimilar faces (Hungr and Hunt 2012; Porciello et al. 2014, 2016). Also, it has been demonstrated that social information associated to racial group membership can influence attentional orienting,

especially when two groups are not associated to equal social status. Pavan, Dalmaso, Galfano, & Castelli (2011) found a significant cueing effect for White participants towards their ingroup (i.e., White people) but not towards an outgroup (i.e., Black people), whereas Black participants showed a significant cueing effect towards both White and Black individuals.

Taken together, all these studies seem to suggest that observer's social attention is most influenced by faces and individuals that we perceived as more similar and familiar for us, such as our ingroup members.

However, we are not always and not in every condition more attracted by those kinds of social partners. In such situations, the role of perceived threat seems to be crucial.

Literature on social attention has provided evidence in this direction. Indeed, a stronger gaze cueing effect has been found in response to fearful rather than happy faces (e.g., Kuhn & Tipples, 2011; Tipples, 2006) and for persons performing negative and norm-violating rather than positive behaviors (Carraro, Dalmaso, Castelli, Galfano, Bobbio, & Mantovani, 2017). Furthermore, it has been established that people follow the gaze of threatening faces rather than of non-threatening faces, when feeling intergroup threat from an outgroup (Chen & Zhao, 2015; Chen, Zhao, Song, Guan, & Wu, 2017).

Overall, this line of research suggests that observer's social attention is most influenced by highly relevant target for the perceiver; on the one hand, relevant because similar to us (e.g., ingroup members), on the other hand, relevant because they may be, in some ways, threatening to the observer (e.g., angry faces, threatening faces). As reviewed in Chapter 1, threat has attention grabbing power. Thus, it is plausible that it is likely to play a role even in social attention.

Social Threat as a Modulator of Attention

A wealth of research suggests that emotional and biological relevant stimuli rapidly capture attention (e.g., Bradley, Mogg, & Lee, 1997; Öhman, Flykt, & Esteves, 2001; Vuilleumier & Brosch, 2009). Among these kinds of clues, threatening stimuli play a dominant role (Brosch,

Sander, Pourtois, & Scherer, 2008; Brosch & Van Bavel, 2012; Cunningham, Van Bavel, & Johnsen, 2008; March, Gaertner, & Olson, 2017). Hence, threat perception is likely to trigger and shape human attention: threatening stimuli preferentially catch attention because they have a greater affective and motivational significance for individuals in their current environment (Broeren & Lester, 2013; Purkis, Lester, & Field, 2011; Subra, Muller, Fourgassie, Chauvin, & Alexopoulos, 2017). Moreover, from an evolutionary viewpoint, stimuli such as harmful animals (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Öhman, Flykt, & Esteves, 2001; Öhman & Mineka, 2001), dangerous objects (Anelli, Borghi, & Nicoletti, 2012; Anelli, Nicoletti, Kalkan, Sahin, & Borghi, 2012; Anelli, Ranzini, Nicoletti, & Borghi, 2013) are likely to capture human attention because they are relevant for survival and can inflict immediate physical harm.

Menace plays a central role not only in the physical environment but also in our social life. Research on impression formation posits that when evaluating others, we are primarily interested in defining whether others could represent a benefit or a threat (Cuddy, Fiske, & Glick, 2008; Fiske, Cuddy, & Glick, 2007; Wojciszke, 2005; Wojciszke, Bazinska, & Jaworski, 1998). In fact, being able to intercept hostile individuals at early stages of information processing, is highly functional for adaptation (LeDoux, 2012). From an intergroup perspective, the perception of threat represents an important predictor of global group attitude (Stephan et al., 1999; Stephan and Stephan, 2000; Riek et al., 2006; Pettigrew, 2008; Pettigrew and Tropp, 2008). Indeed, specific social categories (e.g., Blacks, Latinos and more recently Arabians) that are stereotypically associated with aggression and threat (e.g., Payne, 2001; Mange et al., 2012) are more likely to elicit aggressive responses in a social perceiver.

According to this perspective, social threat at an interpersonal and intergroup level proved to be pivotal in social perception. Thus, for instance, individuals are very rapid to distinguish angry faces (e.g. Fox, Lester, Russo, Bowles, Pichler, & Dutton, 2000; Fox, Russo, & Dutton, 2002;

Hansen & Hansen, 1988) or in detecting trustworthiness even when the faces are presented below the threshold of awareness (e.g., Todorov, Pakrashi, & Oosterhof, 2009).

During social interactions, the perception of social threat can act in conjunction with social categorization and stereotyping. Indeed, social categories and stereotypes provide essential information regarding where to allocate cognitive resources and what to prioritize, particularly when cognitive resources are limited (Ackerman et al., 2006; Kenrick, Delton, Robertson, Becker, & Neuberg, 2007). A negative stereotype related to a specific outgroup, for instance, would lead people to perceive its members as a threat and, as a consequence, to allocate cognitive resources to monitor these jeopardizing individuals. In addition, given that contexts systematically influence social categorization (Freeman et al., 2013), contextual cues may influence the impression of a social target and may work jointly with the relevant stereotypes to signal potential threat targets to perceivers (e.g., Trawalter et al., 2008). Thus, threatening contextual cues, for instance, can weaken or strengthen race-based stereotypes of aggressiveness and menace: a threatening context is likely to activate negative stereotypes associated with specific social categories. The interaction between threat-related stereotypes and contextual cues eliciting social threat has been recently shown to affect several cognitive processes, such as motor resonance (Capellini, Sacchi, Ricciardelli, & Actis-Grosso, 2016).

What has not been fully explored so far is how social threat can influence the attention mechanism when observing other individuals moving in a context. Given the importance of actions in social interactions, it is worth to explore how they affect attentional processes in particular when they have a negative valence (i.e. reaching to and grasping threatening objects).

Building on the body of work presented above, this research aimed at exploring how and if social attention during action observation can be influenced by social variables (e.g. group membership and contextual cues eliciting social threat).

Our hypotheses were as follows. First, we expected to replicate the action-cueing effect reported in the previous chapter (Study 1, Study 2). More specifically, we expected to find a

facilitation the cued target and delay in responses with reaching-to-grasp towards uncued target (*Hypothesis 1*).

Our second aim was focused on the role of social variables. It has been clearly established that higher social variables are likely to modulate social attention triggered by eye gaze movement (e.g., Dalmaso et al., 2012). Here, we expected to find a similar role of social modulators during action observation. In particular, in the light of existing literature showing a greater gaze-cueing effect in response to fearful rather than happy faces (e.g., Kuhn & Tipples, 2011; Tipples, 2006) and to faces associated with antisocial norm-violating behaviors rather than faces associated with positive behaviors (Carraro et al., 2017) and in keeping with recent works on the role of intergroup threat (Chen & Zhao, 2015; Chen et al., 2017), we expected social threat to influence social attention. In particular, borrowing Chen & Zhao (2015) that showed that a greater gaze-cueing effect only emerged when participants felt intergroup threat from an outgroup, we predicted to find no interaction between membership and congruency when the social context is neutral. On the other hand, in a menacing context people may follow the actions of threatening individuals rather than of non-threatening ones; thus, we hypothesized to find greater discrepancy between RTs in cued and uncued targets when observing an outgroup member in a threatening social context (*Hypothesis 2*).

Third, at the light of existing literature on attentional bias and social threat perception (e.g., Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Öhman & Mineka, 2001) we hypothesized to find more rapid target detection when observing an outgroup member stereotypically perceived as menacing grasping threat-related objects *(Hypothesis 3).* This effect may be due to the threat-related stereotype activation; threatening contextual cues are likely to activate negative stereotypes associated with specific social categories (Trawalter et al., 2008) which, in turn, are likely to draw human attention.

Given that not every outgroup is stereotypically associated with threat and aggression, we tested whether our effects are specific for outgroups stereotypically perceived as threatening. Mange and colleagues (2015) show that only the priming of the threatening outgroup (i.e., Arabs)

generated aggressive responses in the shooter paradigm. Based on this work, we predicted not to find similar effects when facing individual belonging to non-threatening outgroup *(Hypothesis 4).*

To test our hypotheses, we carried out four experimental studies adopting a modified version of the paradigm used in the previous chapter. Indeed, here we decided to use a more ecological paradigm, showing videos of actions unfolded in time rather than just the pictures of the beginning and the end of a movement.

In a first study, participants were presented with movie-clips depicting an actor reaching-to grasp one of two objects located respectively on the left and on the right. Subsequently, a square appeared either in a congruent or incongruent position with respect to the direction of the movement. Participants were asked to make a speeded keypress response upon the detection of the color of the square and reaction times were recorded. Starting from the literature on the Islamic prejudice that revealed a stereotypical association of Arab people with threat and aggression (Mange et al., 2012; Mange et al., 2016), we manipulated the on-screen actors' membership by presenting Italian and Iraqi actors grasping neutral objects (i.e., boxes of juice). In a second action observation experiment, we followed a similar procedure of the previous study; in addition, to elicit social threat, we manipulated both the actors' membership and the social valence of the objects by presenting Italian and Iraqi actors grasping either neutral objects (i.e., boxes of juice) and threatening objects (i.e., guns). In the third action observation experiment, we introduced a non-threatening outgroup as a control group by presenting a Japanese actor. In all of the studies, we measured the identification with the national group and the explicit and implicit prejudice (IAT: Greenwald, McGhee & Schwartz, 1998; Study 2 and Study 3).

Study 4 aimed at investigating the role of perceived threat on social attention with a different manipulation. We recorded eye fixations during the observation videos of ingroup and outgroup actors while reaching-to grasp neutral objects. We manipulated the intergroup threat by presenting either a positive or a threatening newspaper article about the relation between the ingroup (i.e., British) and the outgroup (i.e., Arabs).

The studies reported in this work have been approved by the local Ethics committees, and informed consent was obtained from all participants. The experiments were conducted in accordance with the guidelines laid down in the Declaration of Helsinki. The procedures of Study 1, 2 and 3 were approved by the Ethical Committee of the University of Milano-Bicocca, Milan, Italy. Study 4 was conducted at the University of East Anglia; thus, ethical approval for Study 4 was granted by the University of East Anglia, School of Psychology's Ethics panel.

Study 1

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (*f*=.25) is N= 38 for a within-subject ANOVA (2 groups, 2 measurements). We advertised the study and we enrolled all the individuals who answered the call and volunteered to participate even if the final number of participants exceeded the number suggested by the G-Power analysis. Sixty-three students *(M_{age}* = 24, SD_{age} = 4.73, range 19 – 56 years, 37 female) from the University of Milano – Bicocca volunteered to participate in the experiment. All participants were Italian citizens except for one Peruvian with native knowledge of the Italian language[1].

Apparatus and stimuli

Participants were comfortably seated in a chair positioned approximately 60 cm away from a 22-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh

[1] Data analyses conducted on the Italian sample (N=62) excluding the Peruvian citizens revealed the same pattern presented in the result section.

rate: 59 Hz). Stimuli presentation and response registration were controlled by the E-Prime v2.0 software.

Stimuli were videos (WMV format; 25 frames/s; 640 pixels × 480 pixels; 1.296 kbps; Duration = 1.388 ms) depicting members of different ethnic groups performing an action (see Capellini, Sacchi, Ricciardelli & Actis-Grosso, 2016). Specifically, each video presented the front view of an actor executing an arm movement toward one out of two identical objects located on a table respectively one on his left and one on his right, at a distance of 55 cm from his torso and 67.5 cm apart from each other. In all videos, the actor was displaying a neutral face, was looking straight ahead in the direction of the observer and was instructed to make fluent but precise reach-to grasp actions and not to move any body parts other than his arm. Note that reaches using the right arm were always executed towards objects presented in right space, and reaches using the left hand to objects in left space. The final frame of each video was the contact with the object. Then, a square appeared in one of two possible locations: spatially congruent or incongruent with movement direction, as shown in Figure 3.1.

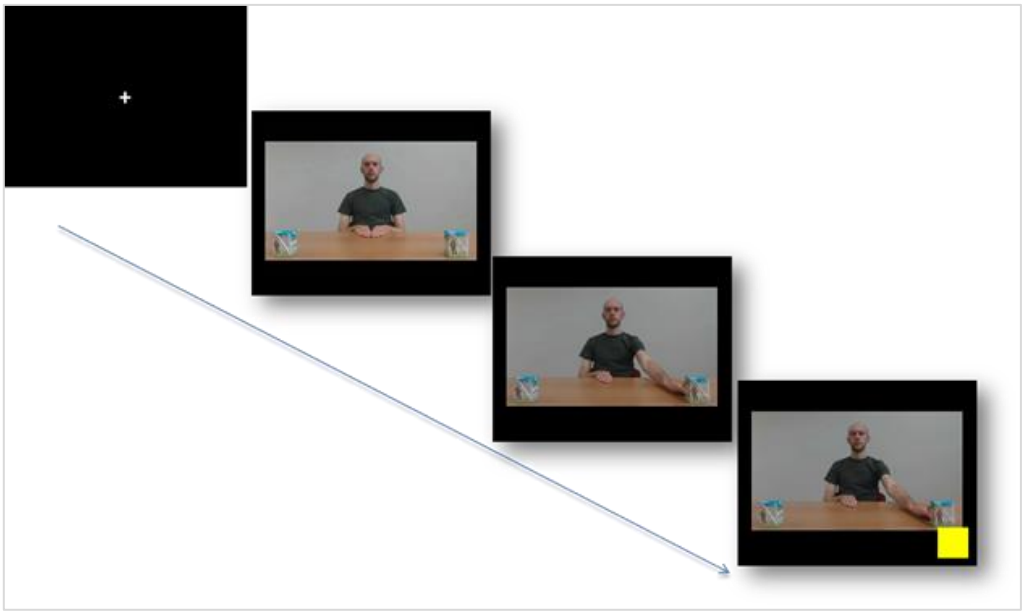

Figure 3.1.
An example of the experimental procedure in Study 1: the illustration shows the ingroup member (i.e., Italian) in a congruent trial.

Materials and procedure

The experimental procedure comprised three parts: a first session in which participants were asked to answer a questionnaire, a second session in which they were required to perform an action observation task, and a third session that consisted of a further questionnaire. Participants entered a dimly lit room and signed the consent form. Then, they were required to complete a first questionnaire. On the cover page, their demographic data were collected. Participants were then asked to answer to a 7-items national identification scale (e.g., "I identify with Italians"; Centrality Factor; Cameron, 2004) on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

The second part consisted of an action observation task. On the monitor participants were provided with the instructions and were introduced with a photo and a brief description of each actor they were going to watch during the experiment (name, age, and nationality). Next, the experiment started.

Each trial began with the presentation of a white cross at the center of the screen on which participants were required to fixate it. After 900ms, a random stimulus video showing the actor's movement was presented at the center of the screen. Participants were required to ignore the direction of the actor's arm movement and to categorize the color of the square appearing on the screen, by pressing on the keyboard the key "Y" whether the square was yellow or "B" whether it was blue. Response keys ("Y" and "B") were located on the keyboard on a vertical line (up – down); participants were instructed to press them using their thumb and forefingers of one hand. They were asked to do this as quickly and accurately as possible. Responses were allowed only after the square appeared and reaction times (RTs) were recorded.

We manipulated within participants the group membership of the on-screen actor (ingroup vs. outgroup) by presenting an Italian male as the ingroup member and an Arab male as the outgroup member. This outgroup was selected since recent research (Oswald, 2005; Mange et al., 2012; Mange et al., 2016) suggested that the Arab group is stereotypically related to aggression or

threat. A pretest on the Italian and Arab actors was conducted, in order to control participants' perception of both targets[2].

Objects to which movements were directed were neutral: we presented either two identical bottles of water or two identical boxes of juice. We chose two different types of objects to eliminate possible effects of the object specificity.

Hence, a total of 96 trials resulting from the combination of the variables were presented. In addition, 8 trials have been presented at the beginning of the session as training trials, producing a total of 104 trials. The experimental session was split in two blocks.

In the third session, participants were asked to answer to a 9-item Modern Prejudice Scale Toward Islamic people (e.g., "For Italians it's normal to have a relationship with an Islamic person"; McConahay, 1986), and a 10-item Motivation to Respond Without Prejudice Scale (e.g., "Being non-prejudiced toward Islamic people is important to my self-concept"; Plant and Devine, 1998) on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). At the end of the experiment, participants were thanked and fully debriefed.

Hence, the experimental design consisted of a 2 (membership: ingroup vs. outgroup) x 2 (cue-target spatial congruency: congruent vs. incongruent) within participants design.

Results

Preliminary Analysis

We excluded from the analysis training trials (7.7% of trials) and errors (e.g., pressing the 'B' key when the square was yellow; 2.84% of trials). Then, we removed trials in which RTs were

[2] In a pretest, 57 Italian participants (26 males; age range: 18–65; M_{age} = 33.20, SD_{age} = 10.75) were presented with a picture of the Italian and the Arab males, and they were asked to evaluate how much they perceived the targets (the order was properly balanced) as threatening ("*[…] is a threatening person*") and frightening ("*[…] is a frightening person*") on a 5-point scale (ranging from 1 = *not at all* to 5 = *extremely;*α = 0.76). In line with prior studies (Mange et al., 2012), the results showed that participants perceived the Arabian outgroup member to be more menacing (*M* = 2.26, *SD* = 1.02) than the Italian ingroup member (*M* = 1.96, *SD* = 0.87), *t*(56) = 2.12, *p* = 0.04.

greater or lower than ±2.5 SD (2.04% of trials). Finally, we excluded three outlier participants with standardized values on the action-cueing scores greater than ±2.5 SD

Regarding the three explicit scales analysis, after reversing the items negatively phrased in the questionnaire and testing the scales reliability (national identification: Cronbach's α = 0.80; prejudice: Cronbach's α = 0.67; motivation to avoid prejudice: Cronbach's α = 0.62), we computed the average scores for each measure.

Reaction times

After the aforementioned preliminary analyses, a 2 (group membership: ingroup vs. outgroup) x 2 (cue-target spatial congruency: congruent vs. incongruent) within participants repeated-measures ANOVA was computed on the answers RTs.

In line with our hypothesis, the ANOVA yielded a main effect of cue-target spatial congruency, $F(1,59)=21.82$, $p<.001$, $\eta_p^2 =.27$; showing an overall action-cueing effect. Indeed, RTs were faster when the target appeared in a location congruent with the movement direction (M = 476.60, SD = 64.88) than when it appeared in an incongruent location (M = 493.39, SD = 69.42). Moreover, the analysis yielded a main effect of group membership, $F(1,59)=12.71$, $p=.001$, $\eta_p^2 =.18$, revealing that participants were faster when observing an action performed by a threatening outgroup member (M=478.99, SD=68.14) than by an ingroup member (M=491.01, SD=65.62). No interaction effects were found, $F(1,59)=.086$, $p=.67$, $\eta_p^2=.003$.

Moderation analyses

Finally, in order to investigate whether individual differences on identification and prejudice were likely to moderate the effects, moderated moderation models were explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with cue-target spatial congruency (0= incongruent; 1= congruent) as an independent variable, group membership (0 = ingroup; 1 = outgroup) as a moderator, the individual variables as second moderator, and RTs as dependent variables. The explicit measures to assess individual variables were: identification with the ingroup (M = 4.15, SD = 1.11), explicit prejudice toward Islamic people (M = 3.51, SD = 0.77), and

motivation to avoid prejudice (M = 4.08, SD = .75). None of these models revealed significant interaction, p_s > .76. Thus, these measures of identification and prejudice did not moderate our effects on social attention revealed by previous analyses.

Discussion

Result of Study 1 replicated findings reported in the previous chapter showing an action-cueing effect on social attention, even using a more ecological paradigm (videos rather than pictures). Therefore, we found faster RTs for congruent trials than for incongruent trials. Aiming at reconciling inconsistent findings on grasping and social attention (Fischer & Szymkowiak, 2004; Mazzarella et al., 2012; Fischer, Prinz & Lotz, 2008; Lindemann, Nuku, Rueschemeyer, & Bekkering, 2011; Tschentscher & Fischer, 2008) we tried to avoid possible confounding effect by showing two identical objects grasped one at a time by the actor. Thus, participants always observed object-directed gestures and hand apertures congruent with the objects size. Consistently with our hypothesis, our findings suggest that not only gaze but also reach-to-grasp actions are likely to grab social attention (e.g., Frischen et al., 2007).

Moreover, no interaction effects were found. In our experiment, the mere exposure to different group membership in a neutral context seems not to influence social attention; we only found overall faster RTs observing the Arab member, that could represent an activation due to the presence of an outgroup. Indeed, the observation of an outgroup member seems to speed up our participants' responses.

Study 2 aimed to verify whether the presence of threatening contextual cues may amplify the perception of social threat, thus affecting social attention process. To this purpose, in Study 2, we manipulated the group membership as in Study 1; in addition, we introduced threatening contextual cues by presenting both neutral (i.e., boxes of juices) and threatening objects (i.e., guns) grasped by ingroup (vs. outgroup) members. The interaction between group membership and contextual cues eliciting social threat may influence such a process due to the stereotype activation.

As shown, literature on attentional capture and threat shows that the attentional allocation is biased toward threat-related stimuli (e.g., Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Öhman & Mineka, 2001). Moreover, observing a member of a menacing outgroup (i.e., Arabs) interacting with threatening object could activate the relative stereotype and lead to faster RTs and to a hyper-monitor of the outgroup member. Threatening contextual cues, for instance, can weaken or strengthen race-based stereotypes of aggressiveness and menace (Trawalter et al., 2008). Hence, at the light of existing literature showing larger gaze-cueing effects in response to fearful compared to than happy faces (e.g., Kuhn & Tipples, 2011; Tipples, 2006) and to faces associated with antisocial norm-violating behaviors rather than faces associated with positive behaviors (Carraro et al., 2017) and in keeping with recent works on the role of intergroup threat (Chen & Zhao, 2015; Chen et al., 2017) showing a larger cueing effect for threatening people compared to non- threatening, we expected to find a greater discrepancy between RTs in cued and uncued targets (i.e., larger action cueing effect) when observing an outgroup member in a threatening social context.

Study 2

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (f=.25) is N= 40 for a within-subject ANOVA (4 groups, 2 measurements). We advertised the study and we enrolled all the individuals who answered the call. Seventy-eight participants (M_{age} = 24.29, SD_{age} = 6.50, range 18 – 51 years, 54 female) volunteered to take part in the experiment. All participants were Italian citizens. All of them were naive to the experiment and provided written informed consent to participate.

Apparatus and stimuli

In addition to the experimental stimuli presented in Study 1, we recorded video of reaching-to grasp movements towards threatening objects (i.e., guns).

Materials and procedure

The experimental procedure was similar to that used in the previous study. Participants came to the lab and, after signed the informed consent, they answered to the 7-item national identification scale (Cameron, 2004). Then, they performed the action observation task. On the monitor participants were provided with the instructions and were introduced with a photo and a brief description of each actor they were going to watch during the experiment (name, age, and nationality). Next, the experiment started.

Each trial began with the presentation of a fixation cross in the center of the screen for 900ms. Then, participants were shown a random video depicting a reach-to-grasp movement performed by an actor. The task was identical as in Study 1: participants were required to ignore the direction of the actor's arm movement and to categorize the color of the square appeared on the screen, by pressing with one of their hands on the keyboard the key "Y" whether the square was yellow or "B" whether it was blue. They were asked to answer as quickly and accurately as possible. Responses were allowed only after the square appeared and RTs were recorded.

As in Study 1, we manipulated within participants the group membership (ingroup vs. outgroup) by presenting an Italian and an Arab target. In order to elicit social threat we manipulated the social valence of the objects (neutral vs. threatening) by presenting either two identical boxes of juices or two identical guns. Objects were pretested in order to measure participants' perception[3] (Figure 3.2).

[3] 14 Italian participants (six males; age range: 21–32; M_{age} = 26.07, SD_{age} = 3.95) were presented with a picture of a gun and a picture of a box of juice and they were asked to evaluate how much they perceived the object (the order was properly balanced) as threatening ("*[…] is a threatening object*") and frightening ("*[…] is a frightening object*"), α = 0.86, and graspable ("*[…] is a graspable object*") on a 5-point scale (ranging from 1 = *not at all* to 5

Hence, there were 8 different videos as a result of the combinations of these variables (actors' group membership, movement direction, objects valence). Since the square could appeared either in a congruent or incongruent location with respect to the movement direction, and they could be either yellow or blue, the result was 32 combinations. Each combination was presented randomly three times throughout the experiment, resulting in a total of 96 trials with eight additional trials presented at the beginning of the session as training trials, producing a total of 104 trials. The experimental session was split in two blocks.

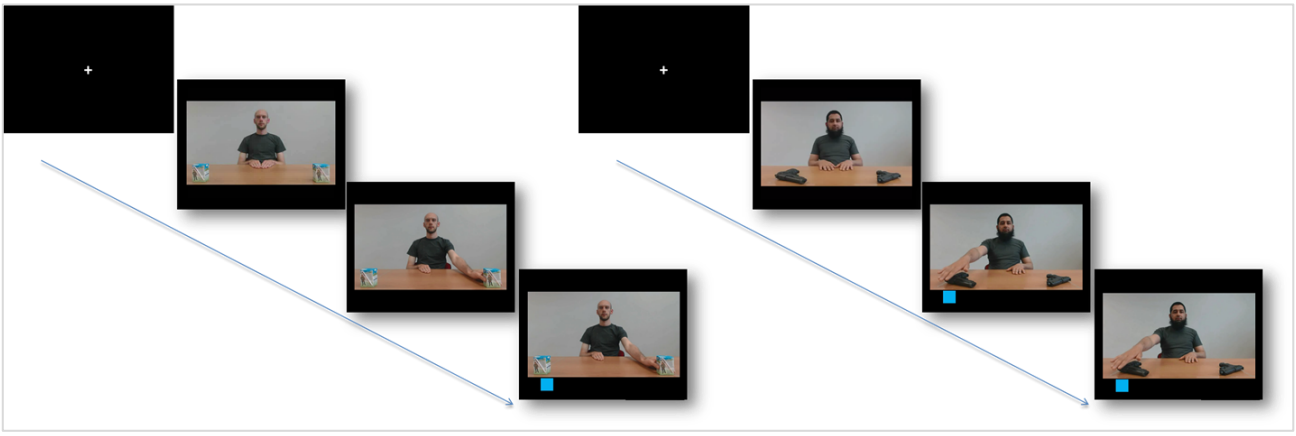

Figure 3.2
An example of the experimental procedure in Study 2: the illustration shows the on the left the ingroup member (i.e., Italian) while reaching-to-grasp a neutral object (i.e., juice) in an incongruent trial. On the right the outgroup member (i.e., Iraqi) while reaching-to-grasp a threatening object in a congruent trial.

= *extremely*). Then, they were asked to rate their overall impression on a 7-point scale range (ranging from -3 = *extremely negative* to +3 = *extremely positive*). The results showed that participants perceived the gun to be more menacing (M = 4.50, SD = 0.71) than the box of juice (M = 1.14, SD = 0.36), $t(13) = 18.17$, $p < 0.000$, and more negative (M = 2.50, SD = 1.7) than juices (M = 4.93, SD = 1.21), $t(13) = 4.57$, $p < 0.000$. Moreover, guns were perceived to be as graspable as the boxes of juice, $p = 0.90$.

Next, participants were asked to answer to the 9-item Modern Prejudice Scale Toward Islamic people (McConahay, 1986), and the 10-item Motivation to Respond Without Prejudice Scale (Plant and Devine, 1998), on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). Then, differently from Study 1, participants were asked to perform an Implicit Association Test (IAT: Greenwald, McGhee, & Schwartz, 1998), to measure their implict level of prejudice towards Arab people. At the end of the experiment, participants were asked personal information (age, gender, nationality), thanked and fully debriefed.

Hence, the experimental design consisted of a 2 (group membership: ingroup vs. outgroup) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (object valence: neutral vs. threatening) within subjects design.

Results

Preliminary Analysis

Following the same procedure used in Study 1, we excluded from the analysis training trials (7.7% of trials) and errors (e.g., pressing the 'B' key when the square was yellow; 3.52% of trials). Then, we removed trials in which RTs were greater or lower than ±2.5 SD (2.01% of trials). Finally, we excluded five outlier participants with standardized values on the action-cueing score greater than ±2.5 SD and two participants that made more than 15% of errors.

About the explicit scales scores, after reversing the items negatively phrased in the questionnaire and testing the scales reliability (national identification: Cronbach's $\alpha = 0.77$; prejudice: Cronbach's $\alpha = 0.74$; motivation to avoid prejudice: Cronbach's $\alpha = 0.70$), we computed the average scores for each measure.

Reaction Times

After the preliminary analyses described above, a 2 (membership: ingroup vs. outgroup) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (object valence: neutral vs. threatening) within participants ANOVA on the RTs was computed. In line with the first study, the analysis revealed a main effect of cue-target spatial congruency, $F(1, 70)= 7.83$, $p=.007$, $\eta_p^2 =.10$.

Indeed, RTs were faster when the target appeared in a location congruent with the movement direction (*M* = 493.90, *SD* = 73.24) than when it appeared in an incongruent location (*M* = 503.55, *SD* = 80.75).

Moreover, the ANOVA yielded a main effect of membership, $F(1, 70)=17.66$, $p<.001$, $\eta_p^2 =.20$: indeed, RTs were lower when observing an outgroup member (M=490.57, SD=77.43) than when observing an ingroup members (*M*=50.88, *SD*=77.47).

Importantly, in line with the hypothesis, the analysis yielded a two-way interaction between membership and cue-target spatial congruency, $F(1, 70) = 4.17$, $p=.045$, $\eta_p^2=.06$ (Figure 3.3). Interestingly, as showed by post hoc analyses, a greater action-cueing effect was found for the outgroup member; indeed, during the observation of actions performed by the outgroup member, participants were faster in congruent trials (*M* = 484.34, *SD* = 73.74) than in incongruent trials (*M* = 497.80, *SD* = 85.39), $p =.002$. No differences were found between RTs on congruent (*M* = 509.30, *SD* = 80.87) and incongruent (*M* = 504.46, *SD* = 77.23) trials for the ingroup member, $p=.20$.

Moreover, RTs were higher when observing the ingroup member than outgroup member both in congruent, $p<.001$, and incongruent trails, $p=.017$.

Then, the difference between RTs for incongruent trials and RTs for congruent trials was calculated for each cue type as an index of action monitoring and action-cueing; thus, the higher the index, the larger the delay of the response to incongruent stimuli when compared to congruent stimuli. Paired comparison between the magnitude of action-cueing for ingroup and outgroup confirmed a greater action-cueing effect for the outgroup member, $t(70) = -2.04$, $p = .045$, $d = .24$, 95% CI [.01, .48].

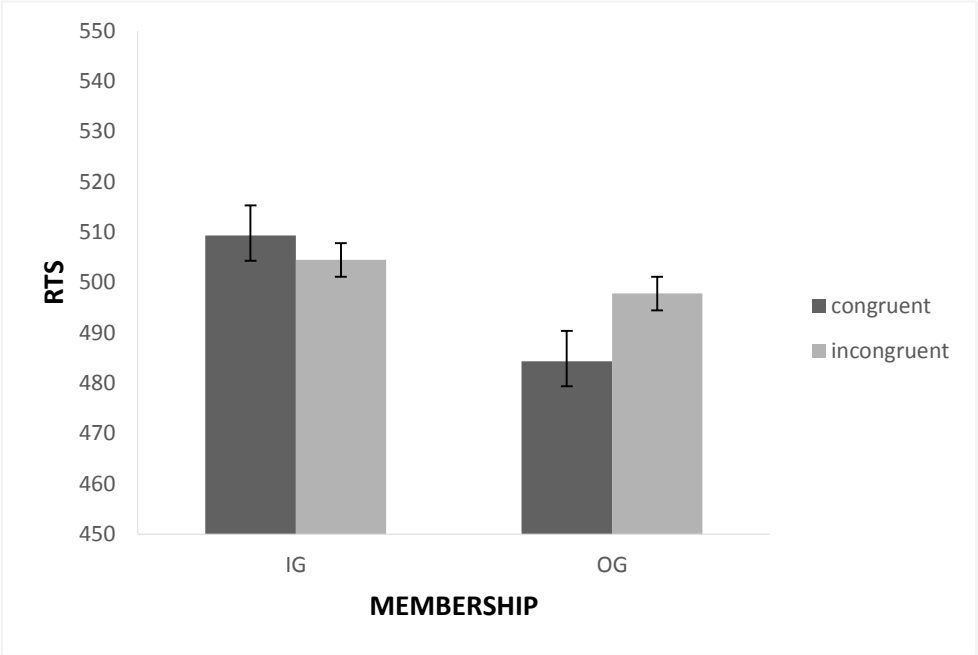

Figure 3.3.
The two-way interaction between membership and cue-target spatial congruency (Study 2). IG is for Italian ingroup whereas OG for the Arab outgroup

Furthermore, in line with our third hypothesis, the analysis yielded a two-way interaction between membership and object valence, $F(1, 70) = 22.17$, $p<.001$, $\eta_p^2=.24$. Interestingly, as showed by post hoc analyses, participants were faster when observing an outgroup member grasping a threatening object ($M = 482.21$, $SD = 77.07$) than when observing an ingroup member grasping the same threatening object ($M = 511.86$, $SD = 80.97$), $p <.001$. Furthermore, participants were faster when observing an outgroup member interacting with a threatening object than when it was interacting with a neutral one ($M = 498.93$, $SD = 82.66$), $p =.001$. A reverse pattern was found for the ingroup member; indeed, observing an ingroup member grasping a threatening object slowed down the participants' response times compared to observing an ingroup member grasping an object with a neutral valence ($M =501.90$, $SD = 78.04$), $p= .02$. No differences were found between ingroup and outgroup when moving towards neutral objects, $p=.54$.

No other effects were found, $F_S<.95$, $p_s > .13$.

Moderation models

Finally, in order to investigate whether participants' level of identification with the national group (i.e., Italians), level of explicit and implicit prejudice and level of motivation to avoid prejudice were likely to moderate the effects, moderated moderation models were explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with cue-target spatial congruency (0 = incongruent; 1 = congruent) as an independent variable, membership (0 = ingroup; 1 = outgroup) as a moderator, the explicit and implicit measures as moderators of the moderator, and RTs as dependent variable. The measures used were: identification with the ingroup (M = 4.52, SD = 1.11), explicit prejudice toward Islamic people (M = 3.33, SD = 0.77), motivation to avoid prejudice (M = 4.09, SD = .80), and implicit prejudice toward Islamic people (M = 0.58, SD = .34). None of these models revealed significant interaction, $p_s > 0.55$. Thus, these measures of identification and prejudice did not moderate our effects on social attention revealed by previous analyses.

Discussion

Consistently with Study 1 we found an action-cueing effect on social attention; thus, grasping seems to represent a social cue for social attentional processes. More interestingly, Study 2 shows that social variables as group membership and social threat are likely to modulate this mechanism. As expected, our findings suggest a stronger action-cueing effect for the threatening outgroup, when the social threat is elicited by the presence of threatening objects.

Moreover, results revealed an interaction between group membership and object valence: we found lower RTs (i.e., participants were faster) when observing the outgroup stereotypically perceived as menacing while grasping threatening objects and even higher RTs (i.e., participants were slower) when observing the ingroup member while grasping threatening objects. Thus, contextual cues eliciting social threat could have activated the stereotype related to Arab and, as a consequence, could have drawn the attention. In addition, we did not find any moderation effect of

the individual level of prejudice, both implicit and explicit and of the identification with the ingroup, that suggests that our effect could have been due to the stereotype activation. This result is in line with the literature on the distinction between stereotype and prejudice (Devine, 1989; Devine and Elliot, 1995) showing that automatic stereotype activation may be equally strong for both high- and low-prejudice individuals.

Study 3 aimed to exclude alternative explanations by introducing a control outgroup: whether our effect is due to the stereotype activation, we expected it to be specific for outgroup stereotypically perceived as threatening rather than for a generic and non-threatening outgroup. To this purpose in Study 3 participants were presented with Italian (i.e., ingroup), Arab (i.e., threatening outgroup) and Japanese (i.e., control outgroup) male grasping both neutral and threatening objects.

Study 3

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (*f*=.25) is N= 42 for a within-subject ANOVA (6 groups, 2 measurements). Forty-Two Italian citizens *(M_{age}* = 22.10, SD_{age} = 2.39, range 18 – 28 years, 33 female) participated in the experiment. All of them were naive to the purpose of the experiment and provided written informed consent to participate.

Apparatus and stimuli

Stimuli were identical to those presented in detail in the section above. In order to introduce the control outgroup, we recorded new videos depicting a Japanese male while reaching-to-grasp objects.

Materials and procedure

The experimental procedure was similar to that used in the previous study. Participants came to the lab and signed the informed consent. Then, they received the instructions on a desktop screen. First, they were asked to answer to the 7-items national identification scale. Next, they were introduced with a photo and a brief description of the actors they were going to watch during the experiment (name, age, and nationality). Then, the action observation task started.

The task was analogous to those described in Study 1 and Study 2: each trial began with a fixation cross in the centre of the screen for 900ms. Then, a random video depicting a reach-to-grasp movement was shown. Participants were required to ignore the direction of the actor's arm movement and to categorize the color of the square appeared on the screen, by pressing as quickly and accurately as possible the key "Y" whether the square was yellow or "B" whether it was blue. Responses were allowed only after the square appeared and RTs were recorded.

We manipulated within participants the group membership of the on-screen actor's (ingroup vs. outgroup) by presenting the same Italian and Arab males used in the previous studies and a Japanese male as the control outgroup member. A pretest on the Japanese actor was conducted, in order to control the perception of Japanese outgroup as non-menacing[4].

As in Study 2, in order to elicit social threat we manipulated the social valence of the objects (neutral vs. threatening) by presenting either two identical boxes of juices or two identical guns.

Hence, a total of 144 trials in addition to 9 training trials presented at the beginning of the session was presented. The experimental sessions were split in two blocks.

Next, participants were asked to perform two Implicit Association Test (IAT: Greenwald, McGhee, & Schwartz, 1998), to measure their implict level of prejudice towards Arab people and towards Japanese people. The order of the two IATs was counterbalanced.

[4] 57 Italian participants (26 males; M_{age} = 33.20, SD_{age} = 10.75) were asked to evaluate how much they perceived the Arab and the Japanese actors as threatening ("[…] is a threatening person") on a 5-point scale (ranging from 1 = not at all to 5 = extremely).The *paired t-test* show that the Japanese actor was perceived as less menacing (M = 1.16 , SD = .64) than the Arab actor (M = 2.26, SD = .96), $t(56) = 4.73$, $p < .001$, $d = 1.26$, 95% CI [.36, .89].

Hence, the experimental design consisted of a 3 (group membership: ingroup vs. outgroup vs. control outgroup) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (object valence: neutral vs. threatening) within participants design.

Results

Preliminary Analysis

Following the same procedure used in the previous studies, we excluded from the analysis training trials (5.9% of trials) and errors (e.g., pressing the 'B' key when the square was yellow; 2.2% of trials). Then, we removed trials in which RTs were greater or lower than ±2.5 SD (2.25% of trials). We excluded from the following analysis two outlier participants with standardized values on the action-cueing scores greater than ±2.5 SD and one data point that made more than 15% of errors.

For the explicit scales, after reversing the items negatively phrased in the questionnaire and testing the scales reliability (national identification: Cronbach's α = 0.75; prejudice: Cronbach's α = 0.73; motivation to avoid prejudice: Cronbach's α = 0.70), we computed the average scores for each measure.

Reaction Times

A 3 (membership: ingroup, Arab outgroup, Japanese outgroup) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (object valence: neutral vs. threatening) within participants repeated-measures ANOVA on the RTs was computed.

The ANOVA yielded a main effect of cue-target spatial congruency, $F(1, 39)= 7.06$, $p=.01$, $\eta_p^2 =.15$, corroborating the overall action-cueing effect found in the previous studies. Indeed, RTs were faster in congruent trials (M = 514.03, SD = 111.52) than in incongruent trials (M = 524.87, SD = 119.266). Moreover, the analysis revealed a main effect of membership, $F(2, 38)=36.48$, $p<.001$, $\eta_p^2 =.66$; participants were faster when observing the Arab male (M=507.03, SD=114.91) than respectively when observing the Japanese (M=511.42, SD=111.67) and the Italian male (M=539.90, SD=120.39).

As expected, a two-way interaction between membership and object valence was found, $F(2, 38) = 12.04$, $p<.001$, $\eta_p^2=.39$. The *post hoc* analyses revealed that participants were faster when observing a threatening outgroup member (i.e., Arab) grasping a threatening object (M = 498.54, SD = 111.62) than when observing both an ingroup member (M = 554.57, SD = 128.21), p <.001 and a non- threatening outgroup member (i.e., Japanese; M = 509.90, SD = 113.70), p =.04 grasping the same threatening object.

Furthermore, participants were faster when observing the threatening outgroup member interacting with a threatening object than when he was interacting with a neutral one (M = 515.53, SD = 120.36), p =.002. A reverse pattern was found for the ingroup member; indeed, observing an ingroup member grasping a threatening object slowed down the participants' response times compared to observing an ingroup member grasping an object with a neutral valence (M =525.24, SD = 116.58), p <.001. No differences were found between RTs on threatening and neutral objects (M =512.95, SD = 113.19), when observing a non-threatening outgroup member p=.63.

The two-way interaction between membership and cue-target spatial congruency was not significant, $F(2, 38) = 1.08$, p=.35, η_p^2=.05. Although the interaction term did not reach significance, we did find a descriptively stronger action-cueing effect for the threatening outgroup member than for the ingroup and the non-threatening outgroup. Indeed, during the observation of actions performed by the Arab member, participants were faster in congruent trials (M = 499.17, SD = 112.85) than in incongruent trials (M = 514.90, SD = 119.00), p =.003. Marginal differences were found between RTs on congruent (M = 533.99, SD = 116.90) and incongruent (M = 545.81, SD = 127.21) trials for the ingroup member, p=.08. No differences were found between RTs on congruent (M = 508.94, SD = 109.69) and incongruent (M = 513.91, SD = 116.83) trials for the Japanese member, p=.42 (Figure 3.4).

Moreover, RTs were higher when observing the ingroup member compared to the Arab outgroup both for congruent, p<.001, and incongruent trails, p<.001; the same pattern was found comparing the ingroup to the Japanese actor on congruent, p<.001, and incongruent trails, p<.001.

Moreover, RTs were higher on congruent trails for the Japanese compared to the Arab, p=.04. No differences were found between Arab and Japanese in incongruent trails, p=.86.

No other significant effects were found, F_s<.72, p_s > .40.

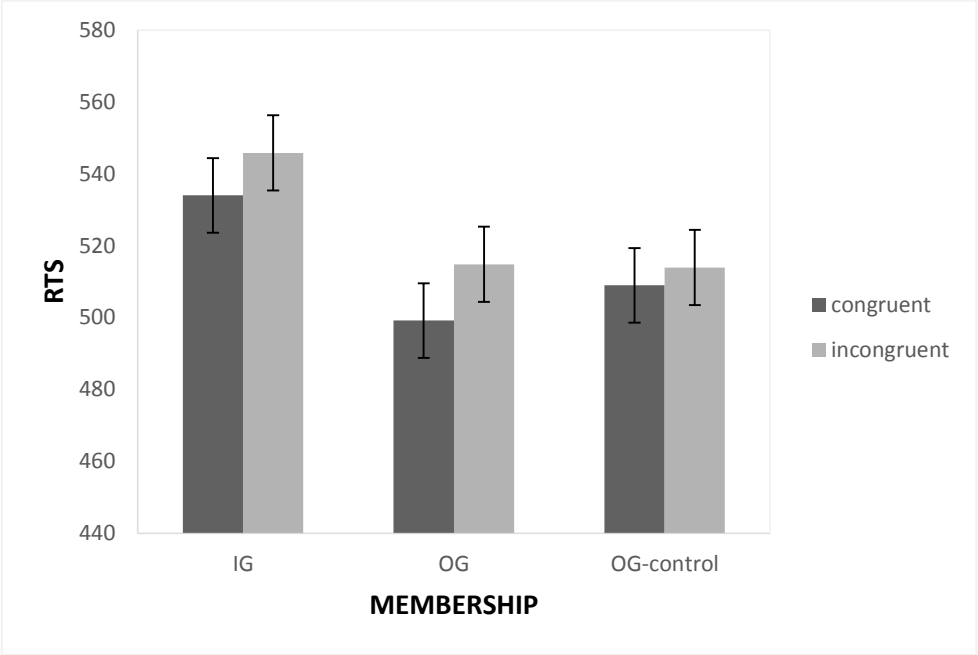

Figure 3.4.
The two-way interaction between membership and cue-target spatial congruency (Study 3). IG is for Italian ingroup, OG for the Arab outgroup and OG-control for the Japanese outgroup

Moderation models

Finally, as in the previous studies a set of moderated moderation models were explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with cue-target spatial congruency (0 = incongruent; 1 = congruent) as an independent variable, membership (0 = ingroup; 1 = Arab outgroup; 2 = Japanese outgroup) as a moderator, the explicit and implicit measures as moderators of the moderator, and RTs as dependent variable. The measures used were: identification with the ingroup (M = 4.08, SD = 1.14), implicit prejudice toward Islamic people (M = .61, SD = .33) and implicit prejudice toward Japanese people (M = .48, SD = .32). None of these models revealed significant interaction, p_s > 0.50. Thus, these measures of identification and prejudice did not moderate our effects on social attention revealed by previous analyses.

Discussion

Study 3 replicates findings of previous studies by showing an action-cueing effect on social attention. Moreover, in line with the recent literature on the role of intergroup threat and gaze-cueing (e.g., Chen and Zhao, 2015) and findings of Study 2, we expected to find results in the direction of a hyper-monitoring of the threatening outgroup member (i.e., the Arab) and no effect on the non-threatening outgroup (i.e., the Japanese). Although this interaction between cue-target spatial congruency and membership did not reach statistical significance, we show a descriptive a greater action-cueing effect for the menacing outgroup.

Moreover, contextual cues eliciting social threat are likely to modulate this mechanism. Our findings revealed lower RTs (i.e., participants were faster) when observing the outgroup stereotypically perceived as menacing while grasping threatening objects and even higher RTs (i.e., participants were slower) when observing the ingroup member while grasping threatening objects. No differences were found when observing the non-threatening outgroup member. The mere exposure to an outgroup seems to not influence such a process. Indeed, this result could be interpreted as the threat-related stereotype activation due to the presence of the Arab in interaction with threating objects which could have drawn the attention of our participants.

However, since the interaction effect between action-cueing and membership did not always reach the significance level in our data, we computed a small-scale meta-analysis.

Meta-analysis

The small-scale meta-analysis recommended by Cumming (2012) is a technique that allows to combine the results obtained from different studies to increase the precision of the parameter estimates. Therefore, to provide important indications related to the effect size of the action-cueing effects in all the studies, we meta-analytically combined the results reported in Studies 1–3 (N = 171) following a standard meta-analysis procedure. Specifically, we meta-

analyzed the magnitude of the action-cueing effect for the ingroup (i.e., Italian) and for the outgroup (i.e., Arab) in Study 1 and in Study 2 and, to be even more conservative, we included the magnitude of the action-cueing effect for the non-threatening outgroup (i.e., Japanese) and for the outgroup (i.e., Arab). The random effects meta-analysis (ESCI procedure; Cumming, 2012) produced the overall ES =7.65, 95% CI [0.06, 15.24]. Moreover, we tested the heterogeneity between the different studies: as reveled the three studies proved to be homogeneous, $Q(2) = 0.80$; $p = .67$.

Thus, the meta-analysis corroborates the hypothesis of a higher level of attentional monitoring towards the menacing outgroup.

Study 4 aimed at exploring the role of perceived social threat by adopting a different manipulation and a different measure (i.e., eye fixations). In particular, it was intended to test whether social attention may be influenced by action observation when threat is not involved in the ongoing interaction, as in Study 2 and Study 3 (i.e., actions were directed to guns) but when it lies in previous knowledge on the relation between social groups.

Study 4

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an $\alpha = .05$ and power = .85, the projected sample size needed to detect a medium effect size ($f = .25$) is N= 26 for a within-between subject ANOVA (2 groups, 4 measurements).

Forty-five students (M_{age} = 19.53, SD_{age} = 1.46, range 18 – 27 years, 7 male) from the University of East-Anglia volunteered to participate in the experiment in exchange of course credits. The sample comprised 36 British, 1 Irish, 1 Lithuanian, 2 Chinese, 1 Italian, 1 Bulgarian, 1 Spanish and 2 Polish participants.

Apparatus and stimuli

Participants placed their head on a chinrest in front of a 19-inch monitor (1024 × 768 pixels, 75 Hz) at a distance of 60 cm. A video-based (infrared) eye tracker (Eyelink 1000, SR Research, Ontario, Canada) recorded left eye position. A PC running E-Prime v2.0 software handled timing and stimulus presentation.

Experimental stimuli were videos (WMV format; 30 frames/s; 854 pixels × 480 pixels; 1137 kbps; Duration: M = 1099.19 ms) presenting the front view of an actor executing a reaching-to-grasp movement toward one out of two identical objects located on a table respectively one on his left and one on his right, at a distance of 55 cm from his torso and 67.5 cm apart from each other. Each video ended with the frame in which the actor grasps one of the object.

Each actor was instructed to make fluent but precise reach-to grasp actions and not to move any body parts other than his arm. Note that reaches using the right arm were always executed towards objects presented in right space, and reaches using the left hand to objects in left space. In all the videos, actors were displaying a neutral face; in order to control for possible effect of the eye gaze direction, all actors were wearing sunglasses and their eyes were not visible to the participants. Moreover, they were wearing the same T-shirt, but the Arab actor was also wearing the traditional Middle Eastern scarf (i.e. Kefiah) so as to make readily salient their ethnicity.

We controlled for the effects of specificity of the objects toward which the action was directed by presenting different objects (i.e., bottle of water, box of juice, smartphone); moreover, in order to control for visual quality and fluency of movement, we recorded three examples of each reach-to-grasp action for each condition (i.e., three examples for the British actor while reaching-to-grasp the bottle of water on the left).

Finally, in order to control for eventual visual asymmetry effects, each stimulus was flipped about the vertical axis (i.e., left- right) so as to produce an additional set of mirrored stimuli.

Since participants were eye-tracked, we decided to introduce a grey frame surrounding the videos, in order to create a whole visual context comprising the area in which the videos were shown and the area in which the target could appear.

Materials and procedure

The experiment procedure was split in two parts: the first part was run online and the second one in lab, at least one day after participant completed the first one. The online session was handled via the Inquisit Web Platform. In the first screen participants first provided their consent to participate and their personal information (i.e., age, gender, nationality). Then, they were asked to fulfil a questionnaire followed by an online version of the IAT (Greenwald, McGhee, & Schwartz, 1998).

The scales presented in the questionnaire consist of 7-item identification with their ingroup scale (i.e., British; Cameron, 2004), the inclusion of ingroup in the Self measure (IIS; Tropp, & Wright, 2001); 16-item Social dominance orientation (SDO; Pratto, Sidanius, Stallworth, 1994; feeling-thermometer toward the Arab; 15-item Islamophobia Scale (Lee et al., 2009); BIS/BAS Scales (Carver and White, 1994).

At least one day after they completed the online part, the lab session took place. Upon arriving to the lab, participants were presented on the screen with an article they were told was taken from "The Times" describing the relationship between British people and Middle-Eastern people as positive or threatening. Each article was created ad-hoc and pretested in a preliminary study[5] (see Appendix for materials).

[5] 53 British participants (7 males; M_{age} = 23.43, SD_{age} = 7.75; range: 19-49) were asked to read four articles and relative pictures they were told they were taken from the newspaper "The Times" and to evaluate their feelings after reading each one. They were presented with two articles depicting the intergroup relation between British people and Middle-Eastern people as positive; the other two articles presented a threatening intergroup relation between British people and Middle-Eastern people. Articles were presented in a random order. Then, for each article they were asked how much they felt threaten, anxious and pleased after reading the article and watching the relative picture on a 7-point

Further, as a manipulation check, we asked participants to indicate on a 7-point scale (1 = not at all, 7 = at all) the extent to which they felt threatened, anxious, pleased after reading the article and to provide an overall evaluation of the article on a on 7-point scale (ranging from 1 = extremely negative to 7 = extremely positive).

Next, participants were provided with photos and brief descriptions (i.e., name, age, nationality) of the four actors they were going to see in the following task. In addition, as a manipulation check to measure whether participants perceived the British actor as belonging to their ingroup and the Arab as belonging to their outgroup, we asked the following question: 'At what extent do you think [name] shares the same British values as you?" and asked them to answer on a 7-point scale ranging from 1=not at all to 7=at all.

Following the manipulation check, the action observation task started.

Each trial began with a central white fixation cross lasted 1000 ms; then, a frame of the front view of the actor was shown; after 1000 ms this frame was replaced by a random video of the

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scale (ranging from 1 = not at all to 7 = extremely) and an overall evaluation of what they had just read on 7-point scale (ranging from 1 = extremely negative to 7 = extremely positive). Then, we computed a 4 (article: positive1 vs. positive2 vs. threatening1 vs. threatening2) X 4 (rating: threat vs. anxiety vs. pleasantness vs. overall evaluation) ANOVA on the mean ratings on each dimension for each article. The analysis yielded an interaction between the two variables $F(9,44)=44.34$, $p<.001$, $\eta_p^2 =.90$, allowing us to select the two most effective articles, one positive and one negative. Indeed, our data showed that participants when reading the selected positive article they felt less anxiety (M = 1.98, SD = .17) that when reading the other not selected article (M = 2.74, SD = .18), p=.001. No differences between ratings on the other dimensions for the two positive articles were found, p_s >.20. On the other hand, when reading the selected threatening article they felt more threat (M = 4.68, SD = .15), and anxiety (M = 4.30, SD = .15) and less pleasantness (M = 2.25, SD = .13), than when reading the other threatening article (threat: M = 4.08, SD = .18, p= <.001; anxiety: M = 2.55, SD = .13, p=.03; pleasantness: M = 3.96, SD = .19, p=.05). No differences between ratings on the overall evaluation for the two threatening articles were found, p_s >.76. Crucially the selected article differed from each other on all the dimensions, p_s <.001.

reaching-to-grasp action. Each video was played on the screen for its effective duration. The video's final frame lasted on the screen for 500 ms.

Eye movements, in terms of the number of fixations, were recorded.

The group membership (ingroup vs. outgroup) was manipulated within-subjects by presenting actors belonging to different ethnic groups, namely two British and two Arab actors. The valence of social context (neutral vs. threatening) was manipulated between-subjects by presenting different scenarios. Hence, a total of 288 trials resulting from the combination of the variables were presented. The action observation task was split in 6 blocks of 48 trails each one. A 9-point calibration was conducted at the beginning of the practice block.

Four training trials have been presented before starting the first experimental block. Moreover, after the third block, participants were provided again with photos and brief descriptions of the four actors.

At the end, participants were thanked and fully debriefed about the purpose of the study.

Hence, the experimental design consisted of a 2 (membership: ingroup vs. outgroup) x 2 (intergroup context: positive vs. threatening) with the first factor manipulated within subjects and the latter between subjects.

Results

Preliminary Analysis

Data from the first two participants were lost due to technical problems. Non-British participants were excluded from the following analysis (N=9). Thus, the final sample comprised thirty-four participants.

Regarding the three explicit scales analysis, after reversing the items negatively phrased in the questionnaire and testing the scales reliability (identification with their ingroup scale: Cronbach's α = .83; social dominance orientation: Cronbach's α = .88; islamophobia scale: Cronbach's α =.97; BIS/BAS Scales: Cronbach's α = .79), we computed the average scores for each measure.

Manipulation check

Article. The manipulation check confirmed that the level of threat, anxiety and pleasantness that participants felt and the overall evaluation of the article differed across conditions, $F(3, 30) = 5.91$, $p = .003$, $\eta_p^2 = .37$. Results revealed that participants in the threatening condition (i.e., after reading the negative article) were more likely to report feeling threat ($M = 3.82$, $SD = 1.55$), anxiety ($M = 3.94$, $SD = 1.48$) and less pleasantness ($M = 2.71$, $SD = .77$) than participants in the positive condition (threat: $M = 1.53$, $SD = .94$; anxiety: $M = 1.47$, $SD = .80$; pleasantness; $M = 5.59$, $SD = .71$), $p<.001$. Moreover, the overall evaluation of the threatening article was more negative ($M = 2.24$, $SD = 1.03$) that the evaluation of the positive article ($M = 6.00$, $SD = .71$), $p<.001$.

Ingroup and outgroup. The manipulation check confirmed that participants were more likely to perceive the British actors that the Arab actors as belonging to their ingroup, $t(33)=6.51$, $p<.001$, $d = .19$, 95% CI [-.04, .42].

Eye Fixations

As explained, in the current study we decided to record participants' fixations during action observation in order to explore which were the mostly fixate areas on the screen. For each trial, we individuated a main area of interest for which we calculated the number of fixations, namely the grasping hand. We used this area in order to investigate the level of monitoring of the actors' gestures. The number of fixations represents how many times the participants' eye gaze has looked to the actors' hand.

Then, a 2 (membership: ingroup vs. outgroup) x 2 (intergroup context: positive vs. threatening) repeated-measures mixed ANOVA was computed on the number of fixations.

The analysis yielded a two-way interaction between membership, intergroup context on the number of fixations, $F(1, 32) = 6.58$, $p=.015$, $\eta_p^2=.17$. *Post hoc* analyses revealed differences in the number of fixations on the grasping hand between the positive and threatening condition for the outgroup member. In particular, the grasping hand was tendentially fixated more in the positive ($M = 2.32$, $SD = 1.07$) than in the threatening condition ($M = 1.60$, $SD = 1.04$), $p=.057$. Furthermore, it

was fixated more that the hand of the ingroup in the positive condition, p=.012. No differences were found for the ingroup between the positive (M = 2.17, SD = 1.05) and the threatening condition (M = 1.65, SD = 1.03), p=.16. Moreover, no differences were found between ingroup and outgroup in the threatening condition, p=.34.

The analysis did not reveal neither a main effect neither of the membership, $F(1, 32) = 1.40$, p=.25, η_p^2=.04, nor of the intergroup context, $F(1, 32) = 2.99$, p=.09, η_p^2=.09.

Thus, in the positive condition, participants appeared to pay more attention to the gestures of the outgroup than for the ingroup. On the negative condition, no differences were found between ingroup and outgroup.

Moderation models

Finally, in order to investigate the role of the individual differences (e.g., the level of prejudice toward Islamic people), moderated moderation models were explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with group membership (0 = ingroup; 1 = outgroup) as an independent variable, intergroup context as a moderator (0 = positive; 1 = threatening) as a moderator, the individual variables as second moderator, number of fixation on hand area as dependent variable. The explicit measures to assess individual variables were: identification with their ingroup scale (M = 3.39, SD = 1.00), social dominance orientation (M = 2.23, SD = .74), islamophobia scale (M = 1.36, SD = .70), BIS/BAS Scales (M = 3.05, SD = .33), prejudice toward Arabs (M = 3.68, SD = 1.31), IIS measure (M = 3.68, SD = 1.31), and the IAT (M = .50, SD = .35). None of these models revealed significant interaction, $p_s > .33$.

Discussion

Study 4 aimed to verify whether the perception of social threat based on previous knowledge may influence social attention during action observation. Our statistical data did not support this hypothesis. We exploratory analysed patterns in the numbers of eye fixations during action observation as indicators of whether participants monitored the actors' gestures. Our findings

showed that participants looked more at the outgroup gestures only in the positive condition. This surprising result is not in line with our hypothesis and at odds with the findings arose in previous studies. In fact, we expected a greater number of fixations on outgroup target's hands than on ingroup's hand in threatening condition.

General Discussion

During social interactions human movements represent relevant social cues able to draw the observer's attention. For instance, people constantly use their hands and their arms to point at visual targets or reaching and grasping objects in the environment. The current research explored whether specific social aspects, namely group membership and social threat, would influence social attention processes during action observation. We focused on these variables on the basis of previous work suggesting that several basic cognitive processes, such as, for instance, impression formation, memory, and attention (i.e., Elfenbein & Ambady, 2002a, 2002b; Dalmaso, Galfano, & Castelli, 2015; Fiske et al., 2007; Todorov et al., 2009; Xu, Zuo, Wang, and Han, 2009) are highly sensitive to these social factors.

This set of experiments showed a robust effect of action on individual's attention: hence, consistently with our hypothesis, we found an action-cueing effect indicating faster responses to stimuli in valid trials (i.e., when stimuli appeared in a congruent position with respect to the direction of the actor's movements) than in invalid trails (i.e., when stimuli appeared in an incongruent position with respect to the direction of the actor's movements). Reconciling inconsistent findings on grasping and social attention, our findings suggest that grasping is likely to represent an important social cue in social attention processes.

More interestingly, we expected to find a stronger action-cueing effect for the threatening outgroup, especially in menacing context. Our statistical findings corroborated this hypothesis.

In Study 1 we did not find any interaction between group membership and congruency. We only found overall faster RTs observing the Arab member. In line with the literature on the gaze-cueing effect (i.e., Pavan et al., 2011), we could have expected an interaction between these variables as a result of a higher or lower monitoring of the ingroup or outgroup members. However, our result suggests that the mere exposure to an outgroup member is not likely to influence social attention during action observation; overall faster RTs when observing the outgroup member could represent a response activation due to the presence of an outgroup.

However, in Study 1 the context was neutral; participants did not have any motivations to hyper-monitor the actions of the outgroup member or to follow their ingroup member's actions. In Study 2 and Study 3 our manipulation aimed at activating the perception of social threat to test the idea that social threat is likely to shape social attention during action observation.

Results of Study 2 revealed an interaction between membership and congruency when the social context elicited social threat due to the presence of weapons: we found that, in a menacing context, when observing an outgroup member, responses to stimuli in congruent position with the actor's action were faster than responses to incongruent stimuli. No differences were found when observing an ingroup member. Even though the same interaction did not reach the standard level of significance in Study 3, descriptive results are in line with this direction, suggesting a greater action-cueing effect only for the threatening outgroup. Moreover, the meta-analysis conducted on the data of this set of experiments supports our hypothesis.

In keeping with recent works (e.g., Chen and Zhao, 2015; Chen, Zhao, Song, Guan, & Wu, 2017) showing that people, when feeling intergroup threat from an outgroup, follow the gaze of threatening faces rather than of non-threatening faces, (Chen & Zhao, 2015; Chen, Zhao, Song, Guan, & Wu, 2017) our results could be interpreted, from an evolutionary perspective, as a hyper-monitoring of the threatening outgroup member in a threatening context that allows to rapidly detect a threat in the environment.

Study 4 showed surprisingly results in the direction of a monitoring of the outgroup's hand in the positive condition. As explained, here, we adopted a different manipulation (i.e., scenarios) and a different measure (i.e., eye fixation) from the previous studies; moreover, the actions were always directed to objects with a neutral valence. In Study 2 we did find a hyper-monitoring of the threatening outgroup that may be due to the fact the action was directed to guns. Hence, the action itself could have been perceived as menacing and in interaction with the activation of the outgroup's stereotypes could have driven our results. In Study 4 social threat was not involved in the ongoing interaction; thus, this crucial aspect may explain our findings. Thus, future research with eye movements is needed and should explore eye fixations' patterns during action observation comparing differences between social threat elicited by contextual cues in the actual environment (i.e., guns) and social threat elicited by previous knowledge about the relation between social groups.

According to our third hypothesis we also found more rapid target detection when observing the outgroup member stereotypically perceived as menacing grasping threat-related objects. This scenario is in line with existing literature on attentional bias and threat showing that threatening stimuli preferentially catch attention because they are relevant for the perceiver (Broeren & Lester, 2013; Purkis, Lester, & Field, 2011; Öhman, Flykt, & Esteves, 2001; Öhman & Mineka, 2001; Subra et al., 2017). People may be vigilant for threatening stimuli and this tendency could have an impact in several ways. Indeed, previous evidence demonstrating that several basic cognitive processes, such as impression formation and person perception (Wojciszke et al., 1998; Wojciszke, 2005; Fiske et al., 2007; Cuddy et al., 2008) and cognitive processes, such as joint attention (Chen & Zhao, 2015; Chen et al., 2017) and motor resonance (Capellini et al., 2016) are highly sensitive to social threat.

In Study 2 and in Study 3 contextual cues eliciting social threat could have activated the group membership categorization and, as a consequence, could have activated the threat-related stereotype. Previous research suggest that an outgroup must be stereotypically associated with

threat for its priming to increase aggressive responses (Mange et al., 2015). Our findings are in line with this body of work; threatening contextual cues could have strengthen negative stereotypes associated with the specific social categories (Trawalter et al., 2008) and led to hyper-monitoring of the menacing outgroup in the menacing context and no effects with the non-threatening outgroup.

Intergroup threat occurs when one group's actions, beliefs, or characteristics cause to another group harm (Stephan, Ybarra, Rios Morrison, 2009) and results in negative outgroup attitudes (Sherif & Sherif, 1969). Being able to detect a threat at early stages of information processing is a highly functional self-defence mechanism (LeDoux, 2012) that may alter an individual's and a group's survival. A recent work on the gaze-cueing effect (Chen et al., 2017) suggest that humans may have more difficulty disengaging from threatening stimuli than from nonthreatening stimuli (i.e., involuntary holding of attention) rather than they may be vigilant for threatening stimuli (i.e., more vigilance or facilitated attention to detect threat). Future studies should address this issue exploring the effect of action observation in drawing or holding attention.

Furthermore, our findings are not affected by levels of prejudice. From a social psychology perspective, our results are compatible with an automatic stereotype activation rather than with a consequence of the individual level of prejudice. Indeed, previous research has broadly demonstrated that stereotypes become automatically active in the presence of a relevant behavior or stereotyped-group features (Brewer, 1988; Fiske & Neuberg, 1990; Rodin, 1987) and automatic stereotype activation is equally strong and leads to prejudice-like behavioral responses for both those high and low in prejudice (Devine, 1989; Devine and Elliot, 1995).

The present study has some limitations. First, in our paradigm two identical objects were always present in the context and were grasped by the actor one at a time. The presence of the two weapons could have made more salient the threat perception and could have catch participants' attention. Such result is in line with recent literature showing that people orient their initial gaze more frequently toward threatening than nonthreatening-negative, positive, or neutral images (March et al., 2017). Aiming to disentangle between the effect of the objects in the context and the

role of the actor movement, future research could adopt a modified version of the paradigm in which actors, for instance, show a neutral or a threatening object.

Furthermore, in our paradigm, while moving his arm towards an object, the actor was always looking straight ahead in the direction of the observer. During real social interactions, it could be unusual to observe someone acting with an object without looking at it and/or without moving the head. This aspect could have influenced the attentional process, given the crucial role of the eye-gaze (e.g., Frischen et al., 2007). Future studies could deepen this issue by means of eye-tracker in order to explore where the observer's attention is directed and/or by exploring the integration with other social cues (i.e., eye-gaze, head orientation, body posture).

In conclusion, our work extends literature on social attention showing that actions, such as reaching-to-grasp, are likely to represent as a relevant social cue in social interactions. Second, it suggests that the perception of social threat can biased attention in a similar vein to more evolutionarily significant threatening stimuli.

Chapter 4[6]

The interplay between social and physiological factors in shaping social attention

As reviewed in the first chapter, the orientation of attention in the direction of social cues provided by other individuals proved to be a robust phenomenon (see Frischen et al., 2007 for review). The findings presented in the current thesis so far suggest that actions are likely to automatically orient individual's attention, as gaze and pointing gestures do (Frischen et al., 2007; Langton & Bruce, 2000). Moreover, it has been shown that some social variables play a role in modulating this ability (see Chapter 3).

The current chapter is mainly focused on the interplay between social and physiological factors in shaping social attention during action observation. Specifically, it aims to bridge two lines of research, namely the social psychology literature on social attention and the evolutionary psychological studies on the effects of women's hormonal shifts on behaviors. Thus, we will analyze the interaction between variables such as social status, gender and hormonal shifts during the menstrual cycle on social attention toward reach-to-grasp movements.

It is well known that social status strongly influences human social interactions. Social hierarchy is one of the most central features of social life and refers to a rank order of groups or individuals within a group (Magee & Galinsky, 2008) so that one individual or group is subordinate to one other individual or group (Blau & Scott, 1962). Hierarchical organization not only establishes order and facilitates coordination in a social group, but also influences a wide range of motivational and cognitive processes (e.g., Fiske, 2010; Magee & Galinsky, 2008). Social status represents one of the most foundational bases of social hierarchy (Blau, 1964; Mannix & Sauer, 2006; Thye, 2000).

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Indeed, differences in social status can result in asymmetry among people, in dominance and power over other individuals (Fiske, 1993), and, at the same time, may impact more basic cognitive processes. For instance, perceived relative status allows people to discriminate between individuals who are worthy of attention and individuals who are not (Fiske, 2005). Given that, literature has broadly demonstrated the role of social status on several human cognitive processes (e.g., DeWall & Maner, 2008; Fiske, 1993; Guinote & Vescio, 2010; Maner et al., 2008; Neuberg & Fiske, 1987). It has been established, for instance, that people tend to allocate more cognitive resources on individuals of higher subjective relevance (e.g., Fiske, 2004). Moreover, there is evidence for an attentional bias toward high-status targets (Maner, DeWall, & Gailliot, 2008; Ratcliff, Hugenberg, Shriver, & Bernstein, 2011). In addition, it has been demonstrated that high-status faces are privileged in memory, better coded and more holistically processed than low-status faces (Ratcliff, et al, 2011).

Importantly with regard to this thesis, social status is likely to deeply shape social attention. For instance, it has been found a greater gaze-cueing effect for masculinized, perceived as more dominant (e.g., Perrett et al. 1998), than for feminized faces (Jones, Main, Little, DeBruine, 2011; Ohlsen, van Zoest, van Vugt, 2013). Moreover, it has been demonstrated that people spent more time looking at high-status individuals than at low-status individuals (Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010) and tended to selectively attend to spatial locations gazed by high-status rather than low-status individuals, independently from the identity of the face and when the time to extract social status information is particularly brief (Dalmaso, Galfano, Coricelli, & Castelli, 2014; Dalmaso, Pavan, Castelli, & Galfano, 2011).

Taken together, all these studies cast evidence for a general preference for high-status rather than low-status targets; focusing on the social attention domain, they show a stronger cueing effect for high-status rather than low-status individuals, corroborating the hypothesis that social attention is likely to be influenced by perceived social status.

The second central factor in the current work is the hormonal shift during the menstrual cycle. The menstrual cycle refers to the time interval between the first day of menstruation and the last day before the next menses. Literature has established that the menstrual cycle is related to a specific pattern of hormonal shifts resulting in dramatic changes in female fertility. Consequently, the likelihood of conception (LoC) is not constant across the menstrual cycle but oscillates throughout the cycle. The LoC is high during ovulation, a window of fertility that occurs 14 days prior to the next menses (Jöchle, 1973) and that is characterized by a spike in estrogen and luteinizing hormone (LH) (Lipson & Ellison, 1996; Eichner & Timpe 2004; Wilcox, Dunson, Weinberg, Trussell, & Baird, 2001). This hormonal shift is typical in normally ovulating women (NOW); on the other hand, the usage of hormonal contraceptives, such as pill usage, suppresses the regular flow of hormones and eliminates cycle effects (Fleischman, Navarrete, & Fessler, 2010).

Empirical evidence suggests an association between hormonal fluctuation during the menstrual cycle and changes in women's inter-sex and intra-sex attitudes and behaviors (e.g., Alvergne & Lummaa, 2009; Garver-Apgar, Gangestad, & Thornhill, 2008; Macrae, Alnwick, Milne, & Schloerscheidt, 2002). Specifically, previous studies demonstrated that women's self-presentation (Durante, Li, & Haselton, 2008; Grammer et al., 2004), women's level of dehumanization of other women (Piccoli, Foroni, Carnaghi, 2013; Piccoli, Fantoni, Foroni, Bianchi and Carnaghi, 2017), women's sexuality (Bullivant et al., 2004), women's mate preferences (Gangestad & Thornhill, 1998; Thornhill & Gangestad, 1999), as well as women's attention toward mating-relevant stimuli (Johnston, Arden, Macrae, & Grace, 2003; Macrae, Alnwick, Milne, & Schloescheidt, 2002) are moderated by the likelihood of conception.

Furthermore, as suggested by Penton-Voak & Perrett (2000), when fertile, women prefer testosterone related facial characteristics. In addition, during the high-conception risk phase, women display explicit preference for more attractive, masculine, taller and dominant men (Anderson, Perea, Becker, Ackerman, Shapiro, Neuberg, & Kenrick, 2010; Gangestad, Thornhill, & Garver-Apgar, 2005; Lukaszewski &Roney, 2009), for male-status stereotypical traits (Gangestad,

Simpson, Cousins, Garver-Apgar, & Christensen, 2004) as well as high-status male-related cues (Lens, Driesmans, Pandelaere & Janssens, 2012).

Thus, it appears that fertility changes do not only affect women's attention toward potential partners and their status related features (Johnston et al., 2003; Macrae et al., 2002; Rule et al., 2011), but it is possible that it might also orient women's attention towards signals of status. Interestingly, the work of Lens and colleagues (2012) represents one of the first attempts to link together attentional processes, status of products, and hormonal shifts in women. They tested the idea that women's attention toward high-status products was higher during their fertile phase than their low fertility phase. Using a visual attention task, they presented on the screen pictures of six products and asked participants to recall the products they had seen. Each display contained one high status product (e.g., Maserati, Mont Blanc pen, etc.); the other five products were functional products (e.g., towel, bicycle, etc.). Then, they asked participants to provide information about when their last menstruation had started and whether they used hormonal contraceptives or not. The authors show that ovulating women display an increased attention and a memory improvement for high-status male products (e.g., Maserati) but not for functional items (e.g., bicycle). Indeed, normally ovulating women (NOW) listed more high status products and listed them earlier in the high-conception risk phase than in other phases of their menstrual cycle. Moreover, the aforesaid pattern of results was found only in the sample of. NOW and not in pill users.

Keeping in line with this body of work, we aimed to link the line of research on social attention and social status to the line of research on hormonal shifts in women and products status.

Specifically, the goal of the present research was twofold. First, it intended to study whether there is a relation between hormonal fluctuation and social attention processes. Second, it aimed at investigating whether this relation may be affected by the products status.

Concretely, we first tested whether higher levels of LoC are associated with stronger action-cueing effects (*Hypothesis 1*). As already mentioned, high social status individuals and high-status products have been shown to enhance a stronger cueing effect for females in the ovulating

phase (Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004; Lens et al., 2012); starting from this line of research, one could expect women around ovulation to be spontaneously attracted by signals that may identify as high-status. Consequently, we expected to find a greater cueing effect for female participants' in their high-conception risk phase as opposed to those in their low-conception risk phase when observing actions directed to high-status objects rather than to low-status objects (*Hypothesis 2*).

Third, such predicted effects are supposed to be driven by hormonal fluctuation during the menstrual cycle (e.g., Garver-Apgar, Gangestad, & Thornhill, 2008; Lukaszewski & Roney, 2009). Given that pill usage flattens the normal flow of hormones (Fleischman, Navarrete, & Fessler, 2010) and eliminates cycle effects on attitudes and behaviours (Alvergne & Lummaa, 2009; Miller, 2010), we hypothesized to find such expected effects of cycle on social attention only in normally cycling women (NOW) and not in pill users (women that use hormonal contraceptives: HCW) (*Hypothesis 3*).

Thus, we carried out three experimental studies whereby we used an action observation paradigm. We presented videos of people performing actions directed toward both low- and high-status products. Female participants were asked to do a speeded detection of a target appearing on the screen either in cued or in the uncued position. Moreover, participants were asked information about their menses to infer their levels of LoC. As detailed in the next session, following a counting forward method, we were able to infer the hormonal fluctuation and the level of LoC for each participant (Haselton & Gangestad, 2006; for a similar procedure see Piccoli, Fantoni, Foroni, Bianchi, & Carnaghi, 2017). To test our third hypothesis, a sample of pill users (HCW) was included in each study as a control group (see Johnston, Arden, Macrae, & Grace, 2003; Lucas et al., 2007; Miller, Tybur, & Jordan, 2007). All participants provided written informed consent to participate. The procedures were approved by the Ethical Committee of the University of Milano-Bicocca, Milan, Italy, and were in accordance with the ethical standards of the 1964 Declaration of

Helsinki and with the ethical standards procedures recommended by the Italian Association of Psychology (AIP).

Study 1

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85 a medium effect size =.25, for regression with 3 predictors (i.e., congruency, LoC, pill use) suggests N = 54. Eighty-five female participants (M_{age} = 22.73, SD_{age} = 4.24; range: 18-51 years) from the University of Milano-Bicocca participated in the study. 96.5% of the sample were native Italians. Fifty-nine women were normally ovulating and twenty-six were using hormonal contraceptives.

Apparatus and stimuli

Experimental stimuli were presented on a 22-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh rate: 59 Hz) equipped with E-Prime v2.0 software. Participants were comfortably seated in a chair positioned approximately 60 cm away from the monitor.

Stimuli were videos (WMV format; 25 frames/s; 640 pixels × 480 pixels; 1.296 kbps) depicting an actor while performing a reach-to-grasp movement toward an object. Specifically, each video presented the front view of an actor executing an arm movement toward one out of two identical objects located on a table respectively on his left and on his right, at a distance of 55 cm from his torso and 67.5 cm apart from each other. The actor was instructed to make fluent but precise reach-to grasp actions while looking straight ahead in the direction of the participant and showing a neutral face and not to move any body parts other than his arm. Actions performed with the right arm were always executed towards objects presented in right space, and actions using the left hand to objects in left space. Each video ended with the frame displaying the grasping.

The to-be categorized target was a yellow or blue square that could appear in one of two possible locations: spatially congruent or incongruent with the movement direction.

Procedure

A female experimenter welcomed participants in the lab and asked them to sign the consent form. The first part of the experimental procedure consisted of the action observation task. First, participants were provided with the instructions and were introduced with pictures of the people they were going to watch in the following videos. Next, the experiment began.

Each trial started with a cross fixation presented at the center of the screen. After 900ms, a random stimulus video showing the actor's movement was presented at the center of the screen for 1000 ms. Participants were required to ignore the direction of the actor's arm movement and to categorize the color of the square appeared on the screen, by pressing on the keyboard the key "Y" whether the square was yellow or "B" whether it was blue with their thumb and forefinger. Because the ''Y'' key is directly above the "B", this up/down response was orthogonal to the left/right location of the square. They were asked to do this as quickly and accurately as possible. Responses were allowed only after the square appeared and reaction times (RTs) were recorded.

We controlled for eventual effects of the actors' specificity by presenting four actors, two females and two males. The objects were two identical bottles of water. After 4 practice trials, the experiment comprised a total of 128 trials over two blocks. Hence, the experimental design consisted of a 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (contraceptive: NOW vs. HCW) with the first factor manipulated within subjects and the latter between subjects. The LoC level was the third independent continuous variable. At the end of the social attention task, participants were asked to provide personal information (age, gender, nationality), to indicated whether they used a contraceptive pill or other hormone based medicine and to self-report on a calendar the first and last day of the previous menses and to indicate the beginning of the following menses. Next, they were thanked and fully debriefed.

Results

Preliminary analysis on social attention task

Training trials (3.03 % of trials), errors (2.17 % of trials) and outliers, defined as trials in which RTs were 2.5 SD above or below participant's mean (2.03 % of trials), were excluded before the means for each condition were calculated.

Determination of LoC

As explained, we asked participants to indicate on a calendar the first and last day of the previous menses and to indicate the beginning of the following menses. Then, we followed the counting forward method (McDonald, Asher, Kerr, & Navarrete, 2011) to define the day within the participant's menstrual cycle in which the experiment took place (Haselton & Gangestad, 2006; for a similar procedure see Piccoli, Fantoni, Foroni, Bianchi, & Carnaghi, 2017). This method relies on the first day of the previous date of bleeding to identify on which day of the menstrual cycle a given participant takes part in an experiment (e.g., Penton-Voak, Perrett, & Castles, 1999; Pillsworth, Haselton, & Buss, 2004; Wilcox, Duncan, Weinberg, Trussell, & Baird, 2001). For example, if a woman participates in the experiment eight days after the first day of bleeding, it is possible to calculate in which phase of the menstrual cycle the woman is, considering the first day of the last bleeding as the starting point of the forward counting. Hence, on the basis of the information regarding the menstrual cycle, we assigned to each participant a value of LoC according to Wilcox et al. (2001), with higher values meaning higher conception risk (see, Piccoli et al., 2013). Participants who reported an unusually long cycle or who reported not to menstruate were excluded from the sample and from the following the analysis (N=4; 4.7% of the sample).

Values of LoC ranged from .000 to .094 (M = 0.03, SD = 0.03).

Reaction Times

First, we calculated the magnitude of the action-cueing effect for each participant as the difference between RTs in incongruent trials and RTs in congruent trials. Then, we tested whether higher levels of LoC are associated with stronger action-cueing effects (Hypothesis 1)

First, we tested the interaction between LoC and the actors' gender on action-cueing effect with a moderation model using PROCESS macro (Hayes, 2013; model 1, 5000 bootstrap resampling) with the levels of LoC as an independent variable, the gender as a moderator and the RTs (i.e., action-cueing magnitude) as dependent variable either in the normally ovulating sample and in the pill users sample. Results show that the actors' gender did not interact with our crucial variable, neither in the normally ovulating, p=.67, nor in the pill users, p=.42.

Therefore, multiple regression analysis was conducted where each score was regressed on the conception risk (the continuous variable was centered) on the normally ovulating sample. Statistical results were in line with our hypotheses.

Indeed, for the normally ovulating participants, the effect of LoC on action-cueing effect was significant, β = 10.77, SE = 4.50, t = 2.39, p =.02, 95% CI [1.81, 19.73]. Then, multiple regression analysis was conducted where each score was regressed on the conception risk (the continuous variable was centered) on the pill users sample. As expected, for the pill user participants, the overall model was not significant, β = 1.95, SE = 5.28, t = 0.37, p =.71, 95% CI [-8.58,12.47].

In sum, as expected, the action-cueing magnitude is positively associated with LoC and such effect was found only in normally ovulating women.

Discussion

Our hypotheses were tested across a first preliminary study; results suggest a positive relation between hormonal fluctuation during menstrual cycle and social attention so that, in normally ovulating women, higher levels of LoC are associated with stronger action-cueing effects. No effects were found in participants that used hormonal contraceptive. This pattern of result allows us to test our hypotheses in two experimental studies whereby we adopted a similar action observation task and manipulated the status of the products toward which the actions were directed and the gender of the actors.

Study 2

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85 a medium effect size *f*==.25, for regression with 5 predictors (i.e., congruency, LoC, pill use, status, gender) suggests N=58. Forty-nine female participants (M_{age} = 20.58, SD_{age} = 4.32; range: 19-48 years) participated in the study. 93.95% of the sample were native Italians. Thirty-four women were normally ovulating and fifteen were pill users.

Apparatus and stimuli

Participants were comfortably seated in a chair positioned approximately 60 cm away from a 22-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh rate: 59 Hz) equipped with E-Prime v2.0 software. Stimuli were videos (WMV format; 25 frames/s; 640 pixels × 480 pixels; 1.296 kbps; Mean Duration = 1.388 ms) depicting an actor while performing a reach-to-grasp movement toward an object. Videos were similar to those used in Study 1, with the exception that here we presented actors (two females and two males) reaching-to-grasp 6 types of products, 3 low- and 3 high- status products.

Figure 4.1
Illustration of the 6 types of stimuli presented in Study 2. Line (a) presents low-status products and Line (b) presents high-status products.

Procedure

A female experimenter welcomed participants in the lab. The first part involved a categorization task in which participants were first presented with pictures of both high- and low-status products, same to those used in the following action observation task. High-status products category includes pictures of an I-pad, a Mont Blanc pen and a modern smartphone; as low-status products we showed a notebook, a ballpoint pen and an older mobile phone (Figure 4.1). Each object picture was provided with the name of the product and the price. Next, each picture was individually presented in a random order in the middle of the screen. Participants were asked to classify pictures using "E" and "I" keys on the keyboard. The target categories were high-status products (I) and low-status products (E). A red X appeared in the middle of the screen if the participant did not answer correctly. Such categorization task allows us, on one hand, to make salient the two categories of high- and low-status products and, second, to test whether our manipulation was successful.

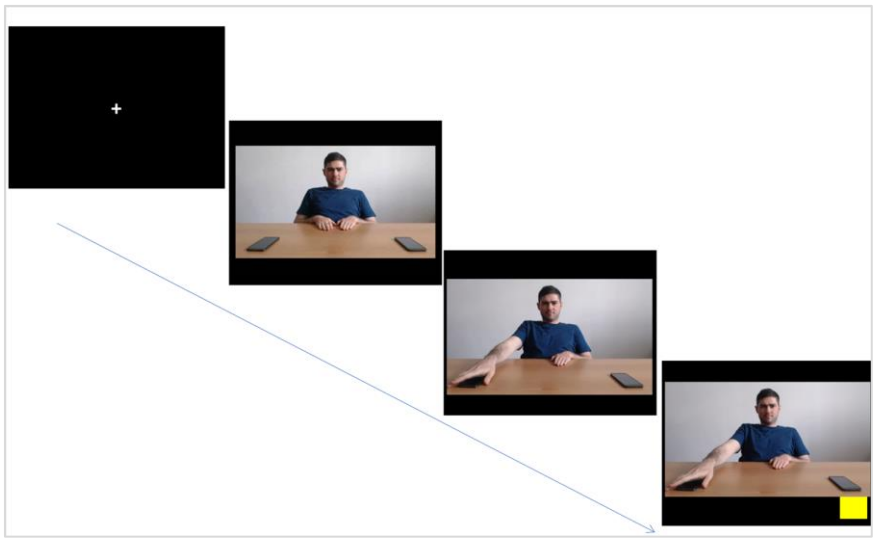

Figure 4.2
Stimuli and trial sequence of the action observation task (Study 2). An example of an incongruent trial towards a high-status product (i.e., a modern smartphone).

The second part of the experimental procedure consisted of the action observation task. First, participants received the instructions. Next, the experiment began. As in Study 1, each trial

started with a cross fixation lasted 900ms; then, a random stimulus video showing the actor's movement was presented at the center of the screen for 1000 ms. Participants were required to categorize the color of the square appeared on the screen at the end of each movie clips. Reaction times (RTs) were recorded.

We manipulated the gender of the actors by showing two females and two males. Moreover, we manipulated the status of the products by presenting both high-status (e.g., I-pad) and low-status (e.g., notebook) products. Hence, videos depicted either a female or a male actor while reaching-to grasp one of two identical objects, either two identical high-status (e.g., two I-pads) or two identical low-status objects (e.g., two notebooks) located on a table on his/her left and on his/her right.

After 4 practice trials, the experiment comprised a total of 192 trials over two blocks. In one block only videos depicting actions directed to high-status products were presented; in the other block only videos depicting actions directed to low-status products were shown. The order of the blocks was randomized.

At the end of the social attention task, participants were asked to provide personal information (age, gender, nationality), indicated whether they used a contraceptive pill or other hormone-based medicine and indicated on a calendar when their last menses had started (day 1 of their last cycle). Then, they were thanked and fully debriefed.

Hence, the experimental design consisted of a 2 (product status: high-status vs. low-status) x 2 (actor gender: male vs. female) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (contraceptive: NOW vs. HCW) with the first factors manipulated within subjects and the latter between subjects. Moreover, we used the LoC level as continuous variable.

Results

Manipulation check

The categorization task was used to test whether our manipulation succeeded. Thus, a chi-square test of independence was performed to examine the relation between the status of the products and the status perceived by participants. The proportion of high-status products that were

correctly categorized into the high-status category was 0.91 whereas the proportion of low-status products that were correctly categorized into the low-status category was 0.93. The difference in proportions is significant, N = 588, $\chi^2(1) = 411.85$, $p<.001$. In sum, our manipulation of the status of the products appeared to be successful.

Determination of LoC

On the bases of the calendar data and information regarding the menstrual cycle, the forward-counting method (McDonald et al., 2011; Navarrete et al., 2009) was applied to the day within the participant's menstrual cycle in which the experiment took place. Hence, to each participant was assigned a value of conception-risk likelihood (LoC), according to the actuarial data from Wilcox and colleagues (2001), with higher values denoting higher conception risk (see, Piccoli et al., 2013). Two participants did not report information about their menstrual cycle and were excluded from the sample (*N*=2; 4.1% of the sample). In our sample, the assigned values of LoC ranged from .000 to .094 (M = 0.03, SD = 0.03).

Preliminary analysis on social attention task

We excluded from the analysis training trials (2.04 % of trials), errors (2.17 % of trials) and outliers, namely trials in which RTs were 2.5 SD above or below participant's mean (2.14 % of trials).

Reaction Times

To simplify the experimental design and to test our hypotheses, we first calculated the magnitude of the action-cueing effect by subtracting RTs in congruent trails from RTs in incongruent trials for each condition. First, we controlled that the blocks order did not interact with our crucial variables, $p=.73$.

Then, a first moderation model was explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with levels of LoC as an independent variable, status as a moderator, gender as a moderator of the moderator and RTs (i.e., action-cueing magnitude) as dependent variable for either the normal ovulating sample and for pill users sample.

Results showed that gender did not interact with our crucial variables, p=.86. The same result was revealed by the analogous moderation model for pill users sample, p=.40.

Therefore, a second moderation model was explored using PROCESS macro (Hayes, 2013; model 1, 5000 bootstrap resampling) with levels of LoC as an independent variable, status as a moderator, and RTs (i.e., action-cueing magnitude) as dependent variable on the NOW and HCW samples. As for the normally ovulating women, the model revealed a significant interaction between level of LoC and products status, β = -20.24, SE = .14, t = -2.22, p =.028, 95% CI [-38.33, -2.16]. When our participants observed a reaching-to grasp actions towards a low-status product, no differences arose on the action-cueing effect across the levels of LoC, β = 9.60, SE = 6.46, t = -1.49, p = .14, 95% CI [-22.38, 3.19]. Interestingly, when participants observed reaching-to-grasp actions directed to high-status products, the action-cueing effect was stronger for women in the high-conception risk phase rather than for those in the low-conception risk phase, β = -29.84, SE = 6.46, t = -4.42, p < .001, 95% CI [-42.63, -17.06]. As expected, for women that use hormonal contraceptives (HCW), no interaction between LoC and status was found, p =.42.

Discussion

This study analyzed the relationship between women's conception risk and social attention for reaching-to-grasp movements toward high- and low-status products performed by both male and female targets. First, the target' gender did not interact with status and level of LoC. Notably, in line with the existing literature (Lens et al., 2012) we found that the higher the level of conception risk the greater the action-cueing effect when observing a target reaching-to-grasp high-status products.

Importantly, hormonal-contraceptive users do not show any change in the action-cueing effects as a function of the level of conception risk. Thus, increased levels of conception risk are selectively associated with stronger action-cueing effects for high-status products. As expected, such effect was found only in normally ovulating women.

As shown, in our statistical analysis we used the magnitude score of the action-cueing effect. We calculated that as the difference between RTs in incongruent trails and RTs in congruent

trials. Thus, a negative score means that RTs were smaller in incongruent trials than in congruent trials. A positive score is the result of smaller RTs in congruent trials than in incongruent trials. Study 2 showed a greater but negative action-cueing effect for high-status products in normally ovulating women during the high-risk conception phase. This effect could be ascribed to an Inhibition of Return (IOR; e.g., Frischen & Tipper, 2004). As reviewed in Chapter 1, IOR is an attentional mechanism that consists in the tendency to avoid orienting attention towards previously attended locations and typically occurs at a long SOAs.

Our videos lasted for around 1000 ms; thus, faster RTs on incongruent trails than in congruent trails could be due to the long duration of the video before the target onsent. An alternative explanation could lie in the paradigm adopted. As detailed, we presented two identical objects placed on the left and right side on a table and an actor at the center. When the actor grasped on of the two objects, he was, in fact, hiding with his hand the object itself. Hence, as a consequence, since participants were attracted by the high-status object, once understood the direction of the actions, they could have shifted their attention to the other object on the table, namely the object that was not hidden by the actor' hand, resulting in faster responses to incongruent trials compare to congruent trials. In order to better understand this mechanism and to disentangle between the two possible explanations, in Study 3 we decided to slightly modify our paradigm by presenting a different action performed by the actors; specifically, rather than a reaching-to-grasp we presented a showing off action. If we replicated Study 2, we could discard the second explanation in favor to the IOR effect.

Study 3

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85 a medium effect size

f==.25, for regression with 5 predictors (i.e., congruency, LoC, pill use, status, gender) suggests N = 58. Sixty-two female participants (M_{age} = 24.40, SD_{age} = 3.90; range: 18-39 years) participated in the study. 93.4% of the sample were native Italians. Forty-three women were normally ovulating and nineteen were pill users.

Apparatus and stimuli

Stimuli was presented on a 22-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh rate: 59 Hz) equipped with E-Prime v2.0 software. Participants were comfortably seated in a chair positioned approximately 60 cm away from the monitor.

Experimental stimuli were videos (WMV format; 25 frames/s; 640 pixels × 480 pixels; 1.296 kbps; Mean Duration = 1.660 ms) depicting an actor while showing a given object to the observer positioned in front of the screen. As mentioned, we slightly changed the paradigm with respect to the previous study in order to avoid the possible confounding of the grasping hand "hiding" the object. Specifically, each video started presenting the front view of an actor sitting at a table with his hands positioned under the table and not visible to the participants. The second frame of each video depicted the beginning of the arm movement performed by the actor while keeping in his hand a given object; each movement began from the center and was directed toward the left or the right of the screen, and ended with the actor showing off the object in his hand.

The actor was instructed to make fluent but precise arm movements while looking straight ahead in the direction of the participant and showing a neutral face and not to move any body parts other than his arm. Actions performed with the right arm were always executed towards objects presented in right space, and actions using the left hand to objects in left space. As in the previous studies, the to-be categorized target was a yellow or blue square that could appear in one of two possible locations: spatially congruent or incongruent with movement direction.

Procedure

The procedure was identical to that used in Study 2. A female experimenter welcomed participants and asked them to sign the consent form.

The first part involved a categorization task in which participants were required to categorize high- and low-status products. Here, we presented the same products of Study 2 adding two types of products (e.g., a low-status watch and a high- status watch; Figure 4.3).

Figure 4.3
Illustration of the 8 types of stimuli presented in Study 3. Line (a) presents low-status products and Line (b) presents high-status products.

The second part of the experimental procedure consisted of the action observation task. First, participants received the instructions. Next, the experiment began. Each trial started with a cross fixation lasted 900ms; then, a random stimulus video showing the actor's movement was presented at the center of the screen lasted for 1660 ms (i.e., mean duration of all videos). Participants were required to categorize the color of the square appeared on the screen at the end of each movie clips. Reaction times (RTs) were recorded (Figure 4.4).

We manipulated the gender of the actors by showing two females and two males. Moreover, we manipulated the status of the products by presenting both high-status (e.g., I-pad) and low-status (e.g., notebook) products. Hence, videos depicted either a female or a male actor while showing off either a high-status (e.g., an I-pad) or a low-status object (e.g., a notebook) toward the left on the right of the screen.

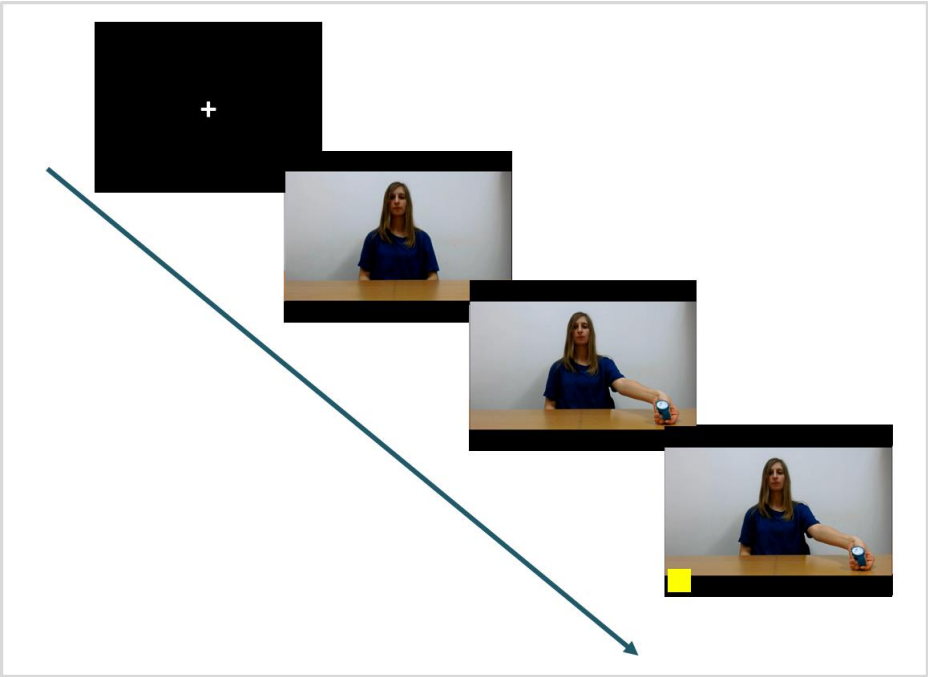

Figure 4.4
Stimuli and trial sequence of the action observation task (Study 3). An example of an incongruent trial towards a low-status product (i.e., watch).

After 4 practice trials, the experiment comprised a total of 256 trials over two blocks. In one block only videos depicting actions directed to high-status products were presented; in the other block only videos depicting actions directed to low-status products were shown. The order of the blocks was randomized.

At the end of the social attention task, participants were asked to provide personal information (age, gender, nationality), indicated whether they used a contraceptive pill or other hormone based medicine and indicated on a calendar when their last menses had started (day 1 of their last cycle). Then, they were thanked and fully debriefed.

Hence, the experimental design consisted of a 2 (product status: high-status vs. low-status) x 2 (actor gender: male vs. female) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (contraceptive: NOW vs. HCW) with the first factors manipulated within subjects and the latter between subjects. Moreover, we used the inferred LoC as continuous variable.

Results

Manipulation Check

As in Study 2, the categorization task was used to test whether our manipulation succeeded. Thus, a chi-square test of independence was performed to examine the relation between the status of the products and the status perceived by participants. The proportion of high-status products that were correctly categorized into the high-status category was 0.86 whereas the proportion of low-status products that were correctly categorized into the low-status category was 0.91. The difference in proportions is significant, N = 864, $\chi^2(1,) = 511.62$, $p<.001$. In sum, our manipulation of the status of the products appeared to be successful.

Determination of LoC

We applied the forward-counting method (McDonald et al., 2011; Navarrete et al., 2009) to the day within the participant's menstrual cycle in which the experiment took place. Hence, we assigned to each participant a value of conception-risk likelihood (LoC), according to the actuarial data from Wilcox and colleagues (2001), with higher values denoting higher conception risk (see, Piccoli et al., 2013). Participants who reported an unusually long cycle or who reported not to menstruate were excluded from the sample and from the following the analysis (N=4; 6.5 % of the sample).

Values of LoC ranged from .000 to .094 (M = 0.03, SD = 0.03).

Preliminary analysis

Training trials (1.54 % of trials), errors (1.41 % of trials) and outliers, defined as trials in which RTs were 2.5 SD above or below participant's mean (2.12 % of trials), were excluded before the means for each condition were calculated.

Reaction Times

As in the previous studies, we first calculated the magnitude of the action-cueing effect. First, we controlled that the blocks order did not interact with our crucial variables, p=.32.

Then, a first moderation model was explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with levels of LoC as an independent variable, status as a moderator, gender as a moderator of the moderator and RTs (i.e., action-cueing magnitude) as dependent variable for either the normal ovulating sample and for pill users sample.

Results showed that gender did not interact with our crucial variables, p=.71. The same result was revealed by the analogous moderation model for pill users sample, p=.23.

Therefore, a second moderation model was explored using PROCESS macro (Hayes, 2013; model 1, 5000 bootstrap resampling) with levels of LoC as an independent variable, status as a moderator, and RTs (i.e., action-cueing magnitude) as dependent variable on the NOW and HCW samples.

As for the normally ovulating women, the model revealed a significant interaction between level of LoC and products status, β = -19.17, *SE* = 9.8, *t* = -1.96, *p* =.05, 95% CI [-38.53, .19]. When our participants observed an action with a low-status product, no differences arose on the action-cueing effect across the levels of LoC, β = 5.08, *SE* = 6.93, *t* = .73, *p* = .46, 95% CI [-8.61, 18.71]. Interestingly, when participants observed actions directed to high-status products, the action-cueing effect was stronger for women in the high-conception risk phase rather than for those in the low-conception risk phase, β = -14.09, *SE* = 6.93, *t* = -2.03, *p* < .04, 95% CI [-27.78, -.40].

As expected, for women that use hormonal contraceptives (HCW), no differences arose neither for low-status, β = -12.38, *SE* = 8.67, *t* = -1.43, *p* = .16, 95% CI [-29.69, 4.92], nor for high-status, β = 12.49, *SE* = 8.67, *t* = 1.44, *p* = .15, 95% CI [-4.82, 29.80].

Discussion

Study 3 aimed at replicating findings of Study 2; as already explained, in Study 2 we presented reaching-to-grasp actions toward one of two objects located on a table. In Study 3 we showed a different kind of actions. Indeed, rather than reaching and then grasping the object, here, actors were keeping in their hand a given object that then they showed off to the observer by way of an arm movement.

This study examined the relationship between women's conception risk and social attention for arm movements involving high- and low-status products. We replicated Study 2; indeed, our results demonstrated that the higher the conception risk level the stronger the action-cueing effect when observing a target showing off high-status products.

No significant interaction effects were found for low-status products. Moreover, as in Study 2 the actors' gender did not interact with products' status and level of LoC.

As expected, such effect was found only in normal ovulating women; indeed, women who used hormonal contraceptives displayed no differences in social attention to status products throughout their cycle. Moreover, consistent with Study 2, we found a greater but negative action-cueing effect for high-status products in normally ovulating women during the high-risk conception phase. Such replications allow us to interpret our findings as an Inhibition of Return effect (IOR; e.g., Frischen & Tipper, 2004) rather than an effect of driven by the grasping action.

General discussion

The current set of studies aimed to understand the social and biological underpinnings that might play a role in women's social attention.

Consistently across three action observation studies, our data show that, in normally ovulating women but not in hormonal-contraceptive users, social attention is likely to be modulated by the conception-risk level. In comparison to hormonal-contraceptive users, in normally ovulating women we found a greater action-cueing effect for high-status products when the conception risk increases.

In all the studies we adopted an action observation paradigm; we presented participants with movie-clips depicting an actor while interacting (e.g., reaching-to-grasp in Study 1 & 2; showing off in Study 3) with both high- and low-status products.

First, Study 1 shows a positive relation between hormonal fluctuation during menstrual cycle and social attention so that, in normally ovulating women, higher levels of LoC are associated with stronger action-cueing effects. No effects were found in pill users. Then, Study 2 and Study 3 aimed to test this effect. We hypothesized that normally ovulating women's social attention for high-status products may increase with the raise of conception risk. Results of both studies are in line with our hypothesis and suggest that physiological processes, such as the flow of hormones, may affect social attention. Importantly, no difference in social attention to products associated to different status were found throughout the pill users' cycle. Indeed, it has been established that the usage of hormonal contraceptives suppresses the regular flow of hormones and eliminates cycle effects (Fleischman, Navarrete, & Fessler, 2010).

As shown, in our statistical analysis we used the magnitude score of the action-cueing effect for each condition. We calculated that as the difference between RTs in incongruent trails and RTs in congruent trials. Thus, a negative score means that RTs were smaller in incongruent trials than in congruent trials. A positive score is the result of smaller RTs in congruent trials than in incongruent trials. Here, we found a greater but negative action-cueing effect for high-status products in normally ovulating women. Such result could be interpreted as an Inhibition of Return (IOR; e.g., Frischen & Tipper, 2004). IOR is an attentional mechanism that consists in the tendency to avoid orienting attention towards previously attended locations.

Gaze-cueing studies typically show smaller RTs on congruent rather than on incongruent trials. This effect appears to remain unaltered up to a 1200 ms SOA (Galfano, Dalmaso, Marzoli, Pavan, Coricelli, et al.,2012). Interesting, in the case the duration of SOA is particularly long (i.e., more than 1200 ms), it is possible to observe such inhibitory after effect which consists in observing smaller RTs on incongruent than on congruent trials (IOR; e.g., Frischen & Tipper, 2004). That is the case of our videos, that lasted for more than 1000 ms. Since IOR phenomenon has been mostly studied with gaze-cueing paradigm, this issue need to be further addressed with action-cueing paradigm.

Our findings have a theoretical value. First, we extended the literature by linking two different lines of research, namely the social attention literature and the psychological studies on the effects of women's hormonal fluctuations on their behaviors. Here, we focused on the interplay between social and physiological factors in shaping social attention during action observation.

The fact that social attention in normally ovulating women increases as a function of the risk conception only for high-status products could be interpreted in line with the existing literature on menstrual cycle (e.g., Alvergne & Lummaa, 2009; Garver-Apgar, Gangestad, & Thornhill, 2008, Macrae, Alnwick, Milne, & Schloerscheidt, 2002). In our paradigm a target interacted with high-status (or low-status) products; as explained, we manipulated the product status but not the target's status. Thus, it could be that a neutral target in terms of status, who interacts with different objects, may be associated to the status of the objects in the context. In other words, the status of the neutral targets may be perceived as a function of the status of the product with which they are interacting. On one hand, literature on status and social attention provides evidence for greater cueing effects for high-status rather than low-status individuals (Dalmaso, Galfano, Coricelli, Castelli, 2014; Dalmaso, Pavan, Castelli, Galfano, 2011; Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010). On the other hand, literature on menstrual cycle effects investigated the role of gender (i.e., mate attraction) by illustrating that women when fertile are more attracted by dominant and high-status male (Anderson, Perea, Becker, Ackerman, Shapiro, Neuberg, & Kenrick, 2010; Gangestad, Thornhill, & Garver-Apgar, 2005; Lukaszewski & Roney, 2009) and by high-status cues (Lens, Driesmans, Pandelaere & Janssens, 2012).

Fertile women's attention to products status is notable for several reasons. Future research may explicitly explore which specific characteristics of status products are more likely to shape social attention. For instance, it could be interested to explore the role of gender stereotypes and products status by presenting both high- and low-status products stereotypically associated to male and female. It has been established that, during the high conception risk, women are more likely to pay attention to their physical appearance and attractiveness and compete with other women along

these dimensions (Durante, Griskevicius, Hill, Perilloux, & Li, 2011; Grammer, Renninger, Fischer, 2004; Haselton, Mortezaie, Pillsworth, Bleske-Rechek, & Frederick, 2007). For instance, it has been shown that, when fertile, women dress in a more appealing manner and are more prone to purchase items that enhance their appearance (Hill & Durante, 2009). Thus, stereotypically female-related high-status products might attract attention as result of higher intra-sex competition. On the other hand, it is possible that stereotypically male-related high-status products may be likely to grab attention, serving mating goals and helping women to focus on a subset of potential mates.

Notwithstanding the importance of this set of studies to understand the relationship between menstrual cycle, social factors and social attention, the current research has several limits. Firstly, our samples comprised a limited number of hormonal-contraceptive users compared to the normally ovulating women. A further limitation of this set of studies is the between-subjects design which does not test the same participants during high- and low-conception risk phases. Future studies may address this issue by adopting a within-subjects design (Lipson, & Ellison; 1996). Moreover, in our studies the determination of the level of conception risk relied on self-report measures. Further works may attempt to assess the LoC through salivary tests that allow to measure participants' level of estrogen and testosterone and, in turns, to estimate the LoC (see for instance, Grammer, Renninger, & Fischer, 2004).

Finally, we interpreted our finding according to an evolutionary perspective (Buss, 1989). However, other explanation can be possible. According to a psychosocial perspective (Eagly & Wood, 1999), the greater women's attentional focus toward high-status cues can be due to the disparity in status between men and women (e.g., occupational roles). Indeed, it has been demonstrated that in social contexts where the gender gap is reduced, women's preference for high-status men decreases (Eagly & Wood, 1999). Thus, it could be the physiological factors may activate cognitive schemes related to the role of women in the social context, resulting, for instance, in self-stereotyping processes.

In conclusion, the set of studied presented aimed to combined social and physiological variables on social attention driven by action observation. Research on the underlying mechanisms of human cognitive processes are essential for a more holistic understanding of interaction between individuals, groups, and social categories. Laboratory experiments that involve both social dimensions and biological factors can reveal the existence of new processes, reducing the distance between scientific research and real life.

Chapter 5

The role of weight bias in social attention

A pervasive and widespread bias among humans, both children and adults, is the weight bias (Allon, 1982; Yuker & Allison, 1994; Puhl & Heuer, 2009; Puhl & Latner, 2007), that leads to negative evaluations of overweight people (Puhl & Brownell, 2001). As a result, overweight individuals experience weight-based discrimination in almost every life domain such as education, employment, and health care (Puhl, & Brownell, 2001; Schwartz, Chambliss, Brownell, Blair, Billington, 2003; Teachman, & Brownell, 2001; Teachman, Gapinski, Brownell, Rawlins, & Jeyaram, 2003). This prejudice is similar in nature to racial attitudes (Andreyeva, Puhl, & Brownell, 2008). However, in contrast to racial prejudice, it has been established that motivation to appear non-prejudiced towards fat people is relatively low (Crandall, 1994; Crandall & Biernat, 1990).

Overweight people are stereotypically perceived to have multiple negative characteristics, such as less competence, less attractiveness, and even less morality than the normal weight people and a lack of willpower, laziness, agency and self-discipline (Crandall, 1994, Puhl & Brownell, 2001; Puhl & Heuer, 2009; Puhl, Moss-Racusin, Schwartz, Brownell, 2008). As a consequence, it appears that people implicitly and explicitly prefer thin to fat people (Anselmi, Vianello, & Robusto, 2013; Crandall, 1994).

In the current chapter we focused on the role of such a bias on the social attention processes. Given that actions and movements are communicative social cues through which people transmit intentions to each other (Allison, Puce, & McCarthy, 2000; Tomasello, 2000), we speculated that observing an overweight person rather than a normal weight person reaching-to-grasping objects may influence our attention.

As shown, overweight people are perceived as a low-status social group (Crandall, 1994; Rudman, Feinberg, & Fairchild, 2002), stereotypically characterized by a lack of willpower and

agency and self-discipline (Puhl & Brownell, 2001; Puhl & Heuer, 2009; Puhl, Moss-Racusin, Schwartz, Brownell, 2008).

Since gaze-cueing literature has shown that we follow high-status compared to low-status faces (Dalmaso, Galfano, Coricelli, Castelli, 2014; Dalmaso, Pavan, Castelli, Galfano, 2011), and overweight people are perceived as a low-status social group (Crandall, 1994; Rudman, Feinberg, & Fairchild, 2002), one could expect that people would be more attracted by normal weight individuals.

According to that, we hypothesized that people would follow the actions of the normal weight person more than the actions performed by the overweight person; in other words, we expected to find a smaller action-cueing effect for overweight target than for the normal weight target (*Hyphotesis 1*).

Study 1

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (*f*=.25) is N= 38 for a within-subject ANOVA (2 groups, 2 measurements). Forty students from the University of Milano-Bicocca *(M_{age}* = 23.33, SD_{age} =2.90, range 19 – 33 years, 36 females) volunteered for this study. All participants were Italian citizens except one with native knowledge of the Italian language. The participants gave informed consent and received course credit for participation.

Apparatus and stimuli

Stimuli were presented on a 22-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh rate: 59 Hz) controlled by the E-Prime v2.0 software. The monitor was located approximately 60 cm away from the participants.

Stimuli were videos (WMV format; 30 frames/s; 640 pixels × 480 pixels; 1.296 kbps; Mean Durations:1463 ms) depicting an individual performing a reach-to-grasp movement toward an object. Specifically, each video presented the front view of an actor executing an arm movement toward one out of two identical objects located on a table respectively on his left and on his right, at a distance of 55 cm from his torso and 67.5 cm apart from each other. In each video actors were wearing the same T-shirt, displaying a neutral face, looking straight ahead in the direction of the participant and were instructed not to move any body parts other than her arm while making fluent but precise actions. Reach-to-grasp movements using the right arm were always executed towards objects presented in right space, and reach-to-grasp movements using the left hand to objects in left space. The final frame of each video represents the moment in which the hand grasped the object. At the end, a square appeared in one of two possible locations: spatially congruent or incongruent with movement direction, as shown in Figure 5.1.

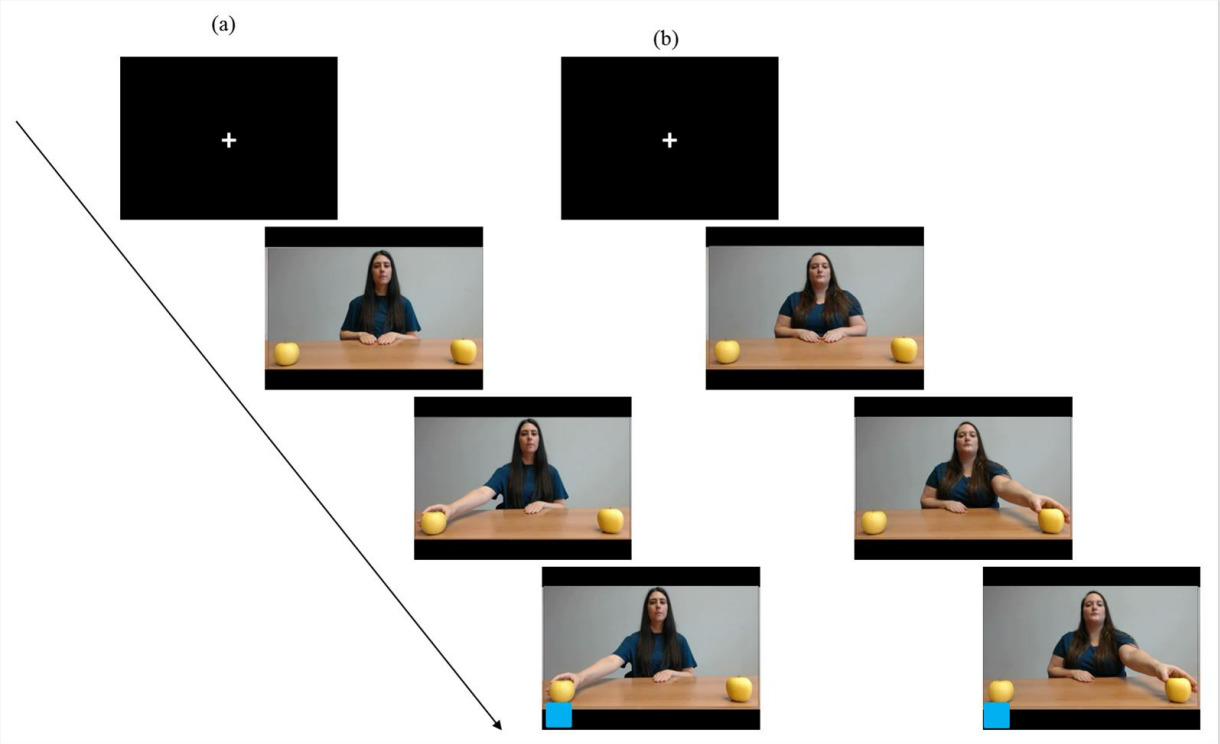

Figure 5.1
Stimuli and trial sequence of the action observation task (Study 1). Sequence (a) shows the normal weight actor while reaching-to grasp towards an apple on the left (observer's view) in a congruent trial. Sequence (b) shows the overweight actor while reaching-to grasp towards an apple on the right (observer's view) in an incongruent trial.

With respect to the studies presented in previous chapters, here, we improved our paradigm by recording and presenting two examples of each reach-to-grasp action for each condition (i.e., two examples for the overweight actor while reaching-to-grasp the object on her left) in order to rigorously control for visual quality and fluency of each movement.

Procedure

Participants came to the lab and sat approximately 60 cm from the screen. First, they were required to answer to a 13-item Antifat Attitudes Questionnaire (Crandall, 1994) on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*), in order to measure their explicit weight prejudice. Presenting the prejudice scale at the beginning of the study also had the aim to make weight a salient categorization criterion.

Next, they were asked to take part in the action observation task. Before starting the experiment, they were provided with the instructions and were introduced with a photo and a brief description (name, age, and nationality, height and weight) of the actors. Since it has been shown that overweight females are perceived more negative than overweight males (e.g., Fikkan & Rothblum, 2012), we chose as our actors two females, with same age, same nationality, similar height (171 cm vs. 168 cm) and different weight (55 kg vs. 78 kg).

Following a similar procedure to those used in the previous chapters, a cross fixation was first presented at the center of the screen and lasted 900 ms; then, a frame of the front view of the actor was shown; after 250 ms this frame was replaced by a random video of the reaching-to-grasp action. Participants were asked to make speeded detection of the color of the square appearing in the congruent or incongruent location with respect to the observed action, by pressing as quickly as possible the “Y” and “B” keys on the keyboard, located orthogonally to the left/right location of the target.

We manipulated the weight status of the on-screen actors by presenting a normal weight (BMI index=19.03) and an overweight actor (BMI index= 27.66).

The pictures of the two actors were pretested for body type and pleasantness. 20 Italian students (7 males; age range: 18–24; M_{age} = 21.10, SD_{age} = 1.68) were presented with their pictures, and they were asked to evaluate on a 7-point scale the target's height (from 1=short to 7=tall), the target's weight (from 1=extremely underweight to 7=extremely overweight) and the target's pleasantness (from 1=extremely unpleasant to 7=extremely pleasant).

Overweight target was seen as significantly more overweight (M =6.15, SD = .49) than the normal weight target (M = 3.65, SD = .75), $t(19)$= -14.69, p <.001, d =3.28, 95% CI [2.15, 4.40], and less pleasant (M = 3.45, SD = .1.05) than the normal weight target (M = 4.95, SD = 1.15), $t(19)$= 4.94, p <.001, d = 1.10, 95% CI [.54, 1.66].

No differences were found in the perception of the respective heights, $t(19)$= .78, p = .45, d = .17, 95% CI [-.27, .61].

We controlled for the eventual effects of specific objects by presenting different objects (i.e., pairs of apple, pairs of tennis balls, pairs of muffins) that require a similar grip aperture.

A total of 192 trials resulting from the combination of the variables were presented. In addition, 6 trials have been presented at the beginning of the session as training trials, producing a total of 198 trials. The experimental sessions were split in two blocks.

Then, participants were asked to self-report some personal information (age, gender, nationality, height and weight), thanked and fully debriefed.

Hence, the experimental design consisted of a 2 (actors weight status: normal weight vs. overweight) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (type of object: apple vs. muffins vs. tennis ball) within-subjects design.

Results

Preliminary analysis

Training trials (3.03 % of trials), errors (3.71 % of trials) and outliers, defined as trials in which RTs were 2.5 SD above or below participant's mean (1.93 % of trials), were excluded before the means for each condition were calculated. Concerning the explicit scales, after reversing the

items negatively phrased in the questionnaire and testing the scales reliability (prejudice: Cronbach's α = 0.82), we computed the average score.

Based upon self-reported height and weight, we calculated participants' body mass index (BMI) as the weight divided by the square of the body height. The BMI indexes ranged from 16.01 to 28.51 kg/m2 (M = 21.55, SD = 2.97), with 17.5% (N = 7) being classified as underweight, 75% (N = 30) as normal weight, and 7.5% (N = 3) as overweight.

Reaction times

The mean RTs for each participant in each condition were submitted to a 2 (actors weight status: normal weight vs. overweight) x 2 (cue-target spatial congruency: congruent vs. incongruent) x 2 (type of object: apple vs. muffins vs. tennis ball) within-subjects ANOVA.

Since the type of object did not interact with our crucial dependent variable, $F(2,38)=.67$, $p=.515$, $n_p^2=.034$, we collapsed data across these factor.

Thus, a 2 (actors weight status: normal weight vs. overweight) x 2 (cue-target spatial congruency: congruent vs. incongruent) within-subjects ANOVA was then computed on mean RTs.

The analysis yielded a main effect of Cue-Target Spatial Congruency, $F(1, 39)=25.13$, $p<.001$, $\eta_p^2 =.39$, 95% CI [.15, .56], showing the evidence for an action-cueing effect. At odds with the literature and previous studies, RTs for incongruent trials were faster (M= 522.29, SD= 47.30) than RTs for congruent trials (M=542.41, SD=59.48). No main effect of the Weight Status was found, $F(1, 39)=1.86$, $p=.18$, $\eta_p^2 =.05$, 95% CI [.00, .21]. Interestingly, an interaction effect between Weight Status and Cue-Target Spatial Congruency was found, $F(1, 39)=5.15$, $p=.029$, $\eta_p^2 =.39$, 95% CI [.00, .31]. The *post hoc* analysis revealed faster RTs on congruent trials for normal weight actor (M=536.95, SD=10.03) than for overweight actor (M=547.87, SD=9.23), $p=.013$, whereas no differences were found on incongruent trials between normal weight (M=522.64, SD=8.10) and overweight (M=521.95, SD=7.62) actors, $p=.89$. Significant differences were found between congruent and incongruent trials for both normal weight, $p=.004$ and overweight actor, $p<.000$. (Figure 5.2).

Paired comparison between action-cueing magnitude, calculated as the difference between RTs in incongruent trials and RTs in congruent trials for each condition, revealed a greater action-cueing effect for overweight actor than for normal weight actor, $t(39) = 2.69$, $p = .029$, $d = .43$, 95% CI [.10, .75], (see Table 5.1 for means and standard deviations).

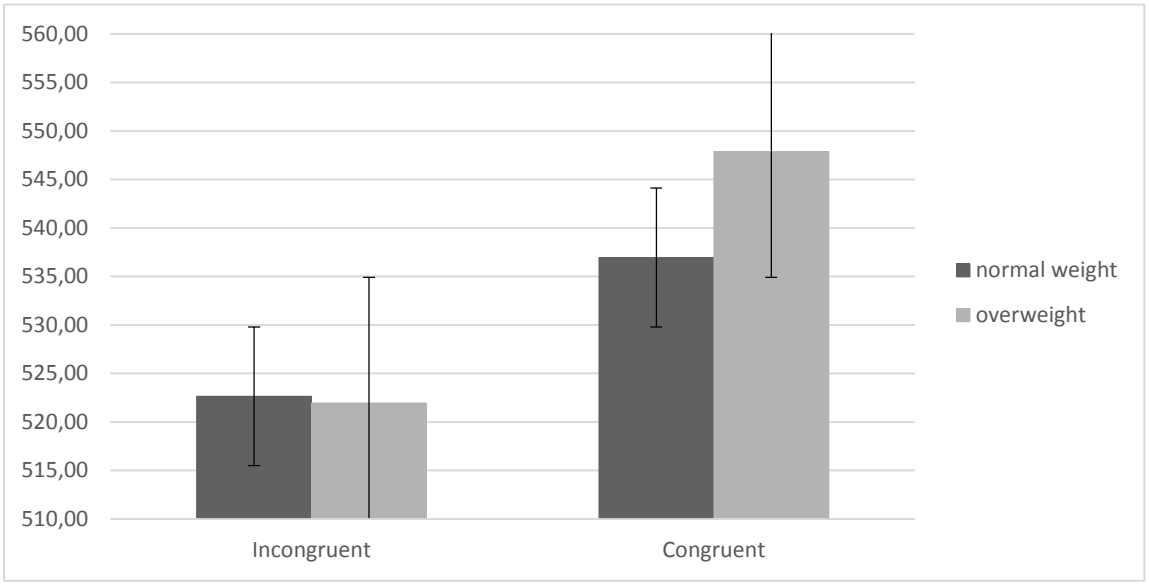

Figure 5.2
Two-way interaction between Weight Status and Cue-Target Spatial Congruency in Study 1. Error bars represent standard errors.

	Cue-Target Spatial Congruency		
	Incongruent	Congruent	Action-cueing magnitude
Actor weight status	*M (SD)*	*M (SD)*	*M (SD)*
Normal weight	522.64 (8.10)	536.95 (10.03)	-14.31 (29.71)
Overweight	521.95 (7.62)	547.87 (9.23)	-25.93 (30.50)

Table 5.1
Means and Standard Deviations (in parentheses) for RTs (ms) in Study 1. The action-cueing magnitude has been calculated as the difference between RTs in incongruent trials and RTs in congruent trials for each condition.

Subset of female participants

Since the gender of participants may have a role, we computed the same 2 x 2 ANOVA on the 36 females of the sample excluding the 4 males. The analysis yielded the same pattern as shown in the total sample; no main effect of the Weight Status emerged, $F(1, 35)=.86$, $p=.36$, $\eta_p^2 =.02$, 95% CI [.00, .18] whereas a main effect of Cue-Target Spatial Congruency, $F(1, 35) = 24.51$, $p<.001$, $\eta_p^2 =.41$, 95% CI [.16, .58] and an interaction effect between Weight Status and Cue-Target Spatial Congruency was found, $F(1, 35)= 4.94$, $p=.033$, $\eta_p^2 =.12$, 95% CI [.00, .33]. Also the *post hoc* analysis revealed the same pattern; faster RTs on congruent trials for normal weight actor (*M*=542.34, *SD*=521.02) than for overweight actor (*M*=552.38, *SD*=532.66), $p=.037$, whereas no differences were found on incongruent trials between normal weight (*M*=527.28, *SD*=510.52) and overweight (*M*=524.86, *SD*=508.75) actors, $p=.65$. Significant differences were found between congruent and incongruent trials for both normal weight, $p=.005$ and overweight actor, $p<.000$.

Moderation of prejudice

Finally, to investigate whether the individual level of prejudice toward overweight people was likely to moderate the reported effects, we explored a moderation model using PROCESS macro (Hayes, 2013; model 1, 5000 bootstrap resampling) with weight status (0 = normal weight; 1 = overweight) as independent variable, prejudice (*M* = 3.46, *SD* = 0.90; Cronbach's α = .82) as a moderator, action-cueing magnitude (i.e. difference between RTs for incongruent and congruent stimuli) as dependent variable. The model did not show any interaction effect between weight status and prejudice, β = 4.31, *SE* = 7.31, *t* = .59, *p* = .56, 95% CI [-10.25, 18.87].

A second moderation model using PROCESS macro (Hayes, 2013; model 1, 5000 bootstrap resampling) was computed with weight status (0 = normal weight; 1 = overweight) as independent variable, BMI index (*M* = 21.55, *SD* = 2.97) as a moderator, and action-cueing magnitude as dependent variable. The model did not show any interaction effect between weight status and BMI, β = .96, *SE* = 2.31, *t* = .41, *p* = .68, 95% CI [-3.66, 5.57]. In sum, neither the level of prejudice

toward overweight people nor the own BMI index appear to moderate the reported effects on social attention.

General discussion

The current study replicates previous findings of the current thesis suggesting a robust effect of action on individual's attention.

Moreover, our data reveal that social attention is likely to be modulated by social factors, such as the perceived weight of social partners. Indeed, we found a greater, but negative, action-cueing effect for the overweight target rather than for the normal weight target.

Importantly, our findings reveal that both the level of prejudice toward overweight people and one's own body weight are not likely to moderate such an effect.

Overweight individuals are often targets of weight stigma (Puhl & Heuer, 2009). Some of the stereotypes associated to overweight people are that they are lazy, they possess a lack of willpower and they are less competent than normal weight people (Crandall, 1994, Puhl & Brownell, 2001; Puhl & Heuer, 2009; Puhl, Moss-Racusin, Schwartz, Brownell, 2008; Puhl, Moss-Racusin, Schwartz, Brownell, 2008). This study aimed to investigate the role of such a weight bias in shaping social attention. Our findings suggest a stronger action-cueing effect when observing actions towards objects performed by overweight person rather than normal weight individuals. Literature on stereotype and prejudice suggest that we prefer thin to fat people (Anselmi, Vianello, & Robusto, 2013; Crandall, 1994); however, that is not what we observed. In our paradigm, we showed a normal and an overweight person while doing some reaching-to-grasp actions. On one hand, our stronger effect for the overweight person might my driven by a perceived dissonance between the stereotype that led us to perceive them as lazy and lacking in the sense of agency and willpower and the onscreen person that was currently doing an action. On the other, as shown in the pretest and in line with the literature, our overweight target was seen as significantly less pleasant

than the normal weight target. Such aspect could represent a possible confounding, that need to be further addressed in future work.

Our study represents our first attempt to explore the impact of the weight based bias on social attention; further research on this topic is needed.

Furthermore, our results show faster RTs in incongruent trails than in congruent trials. As discussed in Chapter 4, such result could be interpreted as an Inhibition of Return phenomenon (IOR; e.g., Frischen & Tipper, 2004). Indeed, in the case the duration of SOA is particularly long (i.e., more than 1200 ms), as in this study, it is possible to observe such inhibitory aftereffect which consists in observing smaller RTs on incongruent than on congruent trials (IOR; e.g., Frischen & Tipper, 2004). This suggests that attention was driven by the action observation. First, observers shifted their attention to the location cued by the target. Then, due to the long SOA, they orient their attention towards the location not previously attended.

Moreover, this study examined the influence of one's own body weight on weight bias. Existing literature shows that all weight groups possess significant anti-fat bias; weight bias is so pervasive that it is still evident among obese persons themselves (Schwartz, Vartanian, Nosek, & Brownell, 2006). However, there are evidence for a reduction of weight bias as participants' body weight increased (Schwartz, Vartanian, Nosek, & Brownell, 2006). However, our results did not show any moderation effect of the prejudice toward overweight people and of one own's body weight (i.e., BMI index). Previous studies have broadly illustrated that stereotypes become automatically active in the presence of a relevant stereotyped-group features and can affect social perception and enhance stereotype-consistent behaviors independently from the individual's attitudes and prejudices toward a given social group (Devine, 1989; Devine and Elliot, 1995).

One limitation of this study is the limited range of body weights represented, with very few overweight (N=3) and no obese participants. Further research should involve a greater range of body weights to better understand the underlying moderation mechanism. Keeping in line with that, it could be interested to increase the number of males in the sample. Indeed, previous research

illustrated gender differences in anti-fat attitudes (Brochu & Morrison, 2007; Crandall, 1994; Morrison & O'Connor, 1999; Perez Lopez, Lewis, & Cash, 2001), demonstrating that men have more negative attitudes toward overweight individuals than women.

Moreover, future research could establish the role of gender in such processes, by presenting both normal weight and overweight women and men in an action observation paradigm. Given that overweight and obese women experience multiple psychological and emotional deleterious outcomes and fare worse than men for having deviant bodies (Fikkan & Rothblum 2012; Wooley, Wooley, & Dyrenforth, 1979), this could have a role in shaping attention.

The current study provides a preliminary starting point on which to build further research aiming at deepening the role of weight bias. To sum up, our work extends the existing literature by showing how weight bias can affect even basic cognitive processes, such as social attention. Given its pervasiveness even at the first stage of person and social perception, it is likely to alter the quality of the interactions and relations with other individuals; therefore, further work is needed to reduce bias based on weight and to promote more equal treatment of overweight population.

Chapter 6

Social attention task as a form of intergroup contact

Actions are important communicative social cues through which people transmit information and intentions to each other (Allison, Puce, & McCarthy, 2000; Tomasello, 2000). In the previous chapters we illustrated that actions are reliable indicators of another's locus of interest so that a human action is likely to orient out attention in the cued direction, as the gaze does (e.g, Frischen et al., 2007).

By signaling the focus of social attention, action cues convey information about the relative importance of other people and objects in the environment. Noting the relevance of such cues in social interactions, in the present chapter we speculated that the information conveyed by the observed action may modulate people's evaluations of the observed agent and, in turns, evaluations of the social group to which such agent belongs.

Let's think about the football game: during a penalty a skilled goalkeeper might moves his arm to right and then goes to the left to cheat the football player. Do the bystanders evaluate this behavior as negative and, as a consequence, the goalkeeper like a "cheater"? Are such attitudes toward the goalkeeper likely to influence attitudes toward the whole team?

Analogously, we could argue that people tend to evaluate favorably individuals whose behaviors are informative for them.

Existing literature on gaze cueing in social attention shows that the cue informativeness of eye gaze (i.e. eye gaze predicts the target location) can modify or update the impression of the sender (e.g., Macrae, Hood, Milne, Rowe, & Mason, 2002; Mason, Tatkow, & Macrae, 2005; Bayliss & Tipper, 2006; Khurana, Habibi, Po, & Wright, 2009).

In one of the earliest study on this topic, Mason and colleagues (2005) provide evidence for an effect of gaze shifts on person evaluation. Indeed, in this study, participants were required to rate either the likability (Experiment 1) and the physical attractiveness (Experiment 2) of female targets

that exhibited gaze shifts either toward or away from the raters, as a signal of respectively attentional engagement or disengagement with the raters. Results show that female targets were evaluated more favorably when their gaze shifts were directed toward the raters than away from them.

In more recent studies, Bayliss and Tipper (2006) employed a gaze cueing paradigm using faces that behaved differently throughout the experiment. Indeed, participants were presented with some faces always looked to the target (predictive-valid), some always gazed away the target (predictive-invalid), and some faces that half time looked toward and half time looked away from the target (non-predictive). Results suggested that predictive-valid faces were judged to be more trustworthy than the predictive-invalid faces whereas individuals who showed greater cueing effects had better memory for predictive-invalid cueing faces. In a following study Bayliss, Griffiths and Tipper (2009) extended these findings by showing that such effects are only detected when faces create a positive social context by smiling, but not in the negative context when all the faces held angry or neutral expressions. In addition, it has been established that target's attractiveness increased after the cueing experiment as a function of eye gaze validity (Khurana, Habibi, Po, & Wright, 2009). Indeed, by presenting both observer's own and cross gender faces, the authors compared the effects different gaze cueing validities (i.e., gaze shifts that predicts – or not - the target appearance) on judgments of attractiveness of the observed target. Results showed both own and cross gender targets always looked to the target (predictive-valid condition) increase in attractiveness whereas only cross gender faces that always gazed away the target show increases.

Thus, it appears that infomativeness of social cues may influence facial evaluations and impression formation; informative and predictive eye gaze seems to result in more positive judgments of the sender.

However, this line of research did not explore the role of target's membership when individuals are involved in an intergroup context rather than in an interpersonal relation, leaving the

effects of social attention processes on prejudice totally unexplored. The present study aims at filling this gap.

Starting from the aforementioned studies (Bayliss et al., 2009), we reasoned that observing a cooperative behavior from a partner might result in good impression on such target even when s/he belongs to a different social group. Thus, this interaction could work as a positive intergroup contact and be generalized from the target-group member to the whole social group.

Intergroup contact occurs when members of different groups interact and come to know each other across group lines (Allport, 1954). Decades of research showed the great potential of intergroup contact; importantly, positive intergroup contact can contribute meaningfully to reducing prejudice between groups (Pettigrew, & Tropp, 2006). Researchers often questioned whether positive contact experiences with individual outgroup members would generalize to more positive views of the entire outgroup (Rothbart & John, 1985; Wilder, 1986). Thus, although some limitations for generalization (see Rothbart, 1996; Rothbart & John, 1985; Wilder, 1984), intergroup contact may lead group members to view each other in a positive light and typically generalize beyond targets in the immediate contact situation to the entire outgroup, and even to outgroups not involved in the contact (Pettigrew, & Tropp, 2006).

Building on this line of research, the present work aims to investigate if social cueing during an attentional task may be likely to influence impression formation on an outgroup member and, thus, to reduce prejudice.

In the current study, we followed the usual action-cueing procedure by showing to participants videos of an outgroup member while reaching-to-grasp on of two objects located on his left or on his right. Moreover, we manipulated the predictability of action cueing by presenting three conditions: predictive-congruent, (in the 80% of trials the target appeared in the reached-to location), predictive-incongruent (in the 80% of trials the target appeared in the opposite reached-to location), and non-predictive (in the 50% of trials the target appeared in the reached-to location and in the other 50% of trials the target appeared in the opposite reached-to location). At the end of the

cueing task, we assessed both implicit and explicit attitudes toward the outgroup and the level of identification with the ingroup.

Given previous research on gaze-cueing effects (Bayliss & Tipper, 2006) and previous findings reported in the current thesis, we predicted to find the typical result of faster response times in congruent trails than in incongruent trials. Thus, we expected that the action-cueing effects would not differ consistently across the different conditions (*Hyphotesis 1*).

More importantly, since it has been shown that cooperative agents are judged to be more trustworthy (Bayliss and Tipper, 2006), and, in turn, more positive, we assumed that an interaction with a cooperative outgroup member might be considered as a positive interaction and might result in good impression on target outgroup. We hypothesized such a positive interaction, even if in a subtle and simple attentional task, to have a role in reducing prejudice toward the whole social group. In particular, we expected that facing an outgroup member that behaves in a "cooperative" mood rather that "non-cooperative" mood would result in a reduction of prejudice toward the outgroup (*Hypothesis 2*), in particular for people highly-identified with their ingroup (*Hypothesis 3*). This hypothesis is in line with several works on the contact hypothesis (e.g., Hodson, Harry, & Mitchell, 2009) showing that contact and friendship exerts greater effects among highly-ingroup identified individuals. In a similar vein, we expected participants highly-identified with their ingroup to feel more positive intergroup contact after the "cooperative" social attentional task and this might result in a reduction of the prejudice level.

Study 1

Methods

Participants

An a priori power analysis was conducted for sample size estimation (using G Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007). With an α =.05 and power = .85, the projected sample size needed to detect a medium effect size (*f*=.25) for a regression with three predictors is N= 54.

We advertised the study and we enrolled all the individuals who answered the call and volunteered to participate even if the final number of participants exceeded the number suggested by the G-Power analysis. Eighty-seven adults *(M_{age}* = 22.69, *SD_{age}* =3.37, range 18 – 44 years, 65 females) volunteered for this study. All participants were Italian citizens except for 5 of them with native knowledge of the Italian language. The participants were recruited from the University of Milano-Bicocca, gave informed consent, and received course credit for participation.

Apparatus and stimuli

Stimuli were a subset of those presented in detail in the Chapter 3. Here, we used videos depicting the Arab actor while reaching-to-grasp one of two neutral objects (i.e., boxes of juice) located on the right and on the left on the table.

Procedure

Participants came to the lab and sat approximately 60 cm from the screen. First, after filling the consent, they were required to answer to a 7-items national identification scale (e.g., "I identify with Italians"; Centrality Factor; Cameron, 2004) on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). Next, the action observation task started. On the screen participants were provided with the instructions and were introduced with a photo and a brief description of the actor they were going to watch during the experiment (name, age, and nationality).

The action observation task was identical to that detailed in Chapter 3 (Study 1, 2 & 3) with the exception that, in the present study, participants faced only with the outgroup member (i.e., the Arab actor) while reaching-to-grasp a neutral object (i.e., juice). Hence, participants were required to make speeded identification of the color of the square appearing in the congruent or incongruent location with respect to the observed action, by pressing the "Y" and "B" keys on the keyboard as quickly as possible. As in the previous studies, because the ''Y'' key is directly above the "B", this up/down response was orthogonal to the left/right location of the target.

We manipulated between participants the cue informativeness (i.e., the direction of the observed action predicts the target location), by manipulating the ratio of the amount of congruent

and incongruent trials; specifically, in the action observation task we presented three combinations: predictive-congruent, (in the 80% of trials the target appeared in the reached-to location), predictive-incongruent (in the 80% of trials the target appeared in the opposite reached-to location), and non-predictive (in the 50% of trials the target appeared in the reached-to location and in the other 50% of trials the target appeared in the opposite reached-to location).

Participants were randomly assigned to the non-predictive, predictive-valid, and predictive-incongruent condition. A practice block consisting of 6 trials proceeded two experimental blocks of 120 trials in total.

In the last session, participants were asked to answer to a 9-item Modern Prejudice Scale Toward Islamic people (e.g., "For Italians it's normal to have a relationship with an Islamic person"; McConahay, 1986) on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). Next, they were asked to perform two Implicit Association Tests (IAT: Greenwald, McGhee, & Schwartz, 1998), to measure their implicit level of prejudice towards Arab people and towards homosexual people, as a control group. We presented the standard seven-block IAT. In the Arab version, participants were asked to categorized names (e.g., Luca, Mohammed). "Italian names" and "Arab names" served as target labels and the words "Positive" and "Negative" as attribute labels. Eight positively valenced and eight negatively valenced words served as attribute stimuli (e.g., love, joy, horrible, evil) whereas Italian and Arab names served as the target stimuli. In the homosexual version, the target labels were "Heterosexual" and "Homosexual" and the words "Positive" and "Negative" as attribute labels. The order of the two IATs was counterbalanced.

At the end, they were asked whether they had noticed the fact that the action direction was predictive (or not) of the target position ("Out of 100, how many times do you think the actor was moving toward the object located in the location in which the square appeared?") on a 11-point scale ranging from 0% to 100%. The manipulation check was administered for assessing whether the informativeness of the observed actions was explicitly noticed.

Then, participants were asked personal information (age, gender, nationality), thanked and fully debriefed.

Hence, the experimental design consisted of a 3 (cue informativeness: predictive-congruent, predictive-incongruent, non-predictive) between-subjects design. Level of prejudice was our dependent variable.

Results

Preliminary analysis

Training trials (4.76 % of trials), errors (3.14 % of trials) and outliers, defined as trials in which RTs were 2.5 SD above or below participant's mean (2.67 % of trials), were discarded before the means for each condition were calculated.

On the explicit scales, after reversing the items negatively phrased in the questionnaire and testing the scales reliability (national identification: Cronbach's $\alpha = 0.78$; prejudice: Cronbach's $\alpha = 0.75$; motivation to avoid prejudice: Cronbach's $\alpha = 0.66$), we computed the average scores for each measure.

Manipulation check

Higher ratings in the manipulation check mean that participants noticed that the actor helped them in performing the task by anticipating with his movement direction the location of the square, whereas lower scores mean that participants noticed that the actors moved most of the times to the opposite direction in which the square appeared.

Thus, a one-way between-subjects ANOVA was conducted to compare the effect of Cue Informativeness on the ratings in the manipulation check. There was a significant effect of the Cue Informativeness on ratings in the three conditions, $F(2, 84) = 3.21$, $p = .046$, showing that the actors was perceived to be more cooperative in the predictive-congruent condition (M=54.14, SD=15.93) than in the non-predictive (M=50.69, SD=20.34) and predictive- incongruent (M=42.07, SD=19.53). In particular, ratings did not differ from the mid-point of the scale (50) both in the predictive-

congruent, $t(28)=1.40$, $p=.17$, $d=.26$, 95% CI [-1.92, 10.20] and non-predictive conditions, $t(28)=.18$, $p=.86$, $d=.03$, 95% CI [-7.05, 8.43], while ratings in the predictive-incongruent differ from the mid-point, $t(28)=-2,19$, $p=.037$, $d=-.41$, 95% CI [-15,36, -50]. These data show that participants in the non-predictive condition correctly noticed that the direction of the actor movement was not related to the location of the square appearance. The same pattern was found in the predictive-valid condition, even though in this condition the direction of the action was related to the location of the square appearance in the 80% of trials. Finally, in the predictive-incongruent condition they correctly noticed that the action direction was opposite to the square position in most of the trials.

Reaction Times

Then, to explore whether participants effectively followed the target's action, we analyzed the action-cueing effect. To this purpose, the mean RTs for each participant in each condition were submitted to a 3 (Cue Informativeness: predictive-valid, predictive-incongruent, non-predictive) x 2 (Cue-Target Spatial Congruency: congruent vs. incongruent) ANOVA with the first factor varied between-participants and the last one between-participants. In line with previous studies, the analysis yielded a main effect of Cue-Target Spatial Congruency, $F(1, 84)=13.81$, $p<.001$, $\eta_p^2 =.14$, showing an action-cueing effect. Responses RTs for congruent trials were faster ($M= 606.08$, $SD= 20.37$) than RTs for incongruent trials ($M=589.65$, $SD=18.76$). Nor main effect of the Cue Informativeness, $F(1, 84)=.26$, $p=.77$, $\eta_p^2 =.006$, neither interaction effects between Cue Informativeness and Cue-Target Spatial Congruency , $F(1, 84)=2.19$, $p=.12$, $\eta_p^2 =.05$, were found.

Effects on Cue Informativeness on prejudice

After these preliminary analyses, we tested the effect of cue informativeness on the level of prejudice moderated by the level of the identification with the ingroup using PROCESS macro (Hayes, 2013; model 1, 5000 bootstrap resampling) with cue informativeness (1 = predictive-incongruent; 2 = non-predictive; 3 = predictive-valid) as an independent variable, the level of identification with the ingroup ($M = 4.37$, $SD = 1.11$) as a moderator, the explicit and implicit

measures of prejudice as dependent variables. The explicit measures used were: explicit prejudice toward Islamic people (M = 3.50, SD = 0.90), and implicit prejudice (IAT) toward Islamic people (M = .53, SD = .35) and toward homosexual people (M = .39, SD = .40).

The IAT was scored according to the revised scoring algorithm described by Greenwald, Nosek, & Banaji (2003), which produces a D score of implicit prejudice.

Interestingly, the model revealed a significant interaction between informativeness and identification on the explicit level of prejudice, β = .25, SE = .10, t = 2.41, p =.018, 95% CI [.04,45]. Specifically, no difference arose between the three experimental conditions on the level of prejudice for low-identified participants (M - 1 SD = 3.26), β = .12, SE = .16, t = .72, p = .47, 95% CI [-.21, .44], and medium-identified participants (M = 4.37), β = -.16, SE = .12, t = -1.35, p = .18, 95% CI [-.39, .07]. In contrast, with high-identified participants (M + 1 SD = 5.47), a significant impact of the experimental manipulation on the level of prejudice arose, β = -.43, SE = .16, t = -2.67, p = .009, 95% CI [-.75, -.11]. More specifically, in the predictive-valid condition the level of prejudice was reduced. No effects were found neither on the other explicit measures nor on the level of implicit prejudice, $p_s > 0.38$.

General discussion

Our data show an effect of the cue informativeness on the explicit level of prejudice moderated by the level of identification with the ingroup.

In our study, unbeknownst to the participants, the direction of the observed action predicted target location with 80%, 50%, or 20% validity. In the first case, the direction of the action performed by on-screen actor was predictive of the target position in the 80% of the trials. These “cooperative” actions helped participants perform the task more efficiently, by causing them to orient their attention to the target, thereby reducing reaction time. In the second case, as in the usual action-cueing procedure, the direction of the action was half the time predictive of the target

position and in the other half was not predictive. In the third condition the direction of the action was predictive of the target position in the 20% of the trials, and so actors were ‘‘non-cooperative”.

Our results reveled that when participants faced a “cooperative” outgroup member, as in the predictive-valid condition (i.e., where the actor predicts the target position in the 80% of trials), the explicit level of the prejudice was reduced for high-identified participants. No effects were found on the implicit prejudice toward the outgroup.

These findings reveal that a positive experience, even when subtle and in irrelevant task as in this case, may be effective in changing attitudes not only on a single target but also on entire social category.

Literature has clearly established that direction of gaze can influence person perception (e.g., Mason et al., 2005); for instance, Bayliss and Tipper (2006) showed that the faces that consistently looked towards targets were subsequently judged to be more trustworthy than the faces that consistently looked away from targets. Thus, a cooperative behavior as an informative gaze seems to lead to a more positive evaluation of the sender. The current study aimed at investigating whether such effects can be extended to action cues: in other words, whether the informativeness of action is likely to influence impression formation and prejudice.

First, as in previous experiments on action-cueing, the present results confirm that participants’ attention is automatically drawn in the direction of observed actions. This result is in line with Bayliss and Tipper (2006) that found that the gaze direction of predictive-valid, predictive-incongruent and non-predictive faces produced identical cueing effects.

Such findings suggest that the action-cueing system appears to be automatic, rapid and insensitive to the reliability of the social cues produced by different people.

More importantly, this study investigated the effect of multiple exposures to outgroup members that consistently moved toward the target location (predictive-valid condition) or consistently moved away from the target location (predictive-incongruent) on the prejudice toward the observed outgroup. In particular, we expected that facing an outgroup member that behaves in a

“cooperative” mood rather that “non-cooperative” mood would result in a reduction of prejudice toward the outgroup, in particular for people highly-identified with their ingroup.

Our results provide a first empirical support to this hypothesis: indeed, data suggest a general reduction of explicit prejudice when high-identified participants were facing an outgroup member helping them. As mentioned, we found a reduction of explicit prejudice rather than of the implicit prejudice. This finding is in line with the huge body of research showing that implicit attitudes are more difficult to control and to monitor as compared to explicit attitudes (Dovidio & Gaertner, 2004; Dovidio, Kawakami & Gaertner, 2002). In addition, it has been proposed that explicit attitudes change relatively easily, whereas implicit attitudes are much more difficult to change (Wilson, Lindsey, & Schooler, 2000).

Interestingly, the manipulation check on the ratings revealed that participants in the predictive-valid condition thought that the action direction was not related to the position in which the target would then appear. Hence, our manipulation appears to be implicit and subtle. Even though these participants in the predictive-congruent condition did not perceived the outgroup member’s behavior as cooperative, a reduction in the level of explicit prejudice toward the outgroup was found. Thus, it appears that a positive experience, even during fairly simple attentional cueing task, may be effective in changing attitudes. Notably, this reduction seems to be effective not only on the single individual but also on the entire category.

By the present study we contributed to extend the existing literature by addressing some novel elements. First, going beyond the role of gaze, we investigated the role of actions showing that not only gaze behavior influences person perception, but also the observation of others' actions. Second, in previous studies (Bayliss and Tipper, 2006), researchers presented 100% validly and 100% invalidly cueing faces. As noted by Khurana et al. (2009), both types of faces are equally predictive as 100% valid faces consistently predicts the target location by looking in its direction and 100% invalid faces consistently predicts the target location by looking in a direction away from it. Here, we choose to vary the combinations of cue informativeness by presenting 80% predictive-

valid, 80% predictive-incongruent and 50% non-predictive action directions. Thus, since in everyday interactions it is not so common to face with people that constantly cooperate or constantly deceive us, such choice appears to be more ecological.

Third, we moved from an interpersonal to an intergroup context.

To our knowledge, this represents the first attempt to study the effect of a simple and subtle positive intergroup interaction during an attentional task on prejudice reduction.

One limitation of the current work is that we assessed only the level of prejudice toward the outgroup; in order to better understand the interplay between impression formation on a group-target and prejudice toward the whole social group, future studies should also assess the impression formation on the target after and before the cueing task.

Of particular importance for future research is to investigate the effects of both ingroup and outgroup combinations of cue informativeness on prejudice. Indeed, in the current study we presented only an outgroup member and we manipulated the cue informativeness between- subjects. It could be interesting to combine the cue informativeness provided by both ingroup and outgroup in within subjects designs. Further research could for instance presented a combination of "cooperative ingroup" and "non-cooperative outgroup" versus "non-cooperative ingroup" and "cooperative outgroup" and test the effects on the level pf prejudice toward the outgroup.

Furthermore, one task for future research will be to establish the generality of the current effects across different outgroups (i.e., ethnic groups, sexual orientation) associated to different stereotypes (i.e., positive, negative, threatening) and across time.

Further studies could also consider face-to-face interactions between social agents, aiming to a more ecological experimental validity.

Finally, our study is also relevant for applied research. We demonstrated a reduction in the level of prejudice by adopting a rigorous paradigm but effective and easy to manipulate. Our results encourage further work in this direction with the main aim to reduce prejudice and to promote positive intergroup relations.

Chapter 7[7]

Can action observation influence other processes beyond social attention? Effects on motor resonance

As mentioned in the theoretical background (Chapter 1), social attention is an essential ability for social development and social competence throughout the life-span (e.g., Baron-Cohen, 1995; Emery, 2000; Richardson & Gobel, 2015) reciprocally related to social understanding and interconnected with other processes.

The current thesis has illustrated so far the effects of action observation on such a process. In Chapter 2 we have shown that observing a shift in the direction of an observed action toward an object is likely to modulate social attention; in Chapter 3, 4, and 5 we have explored in detail the impact of some social (e.g., group membership, social threat, status, weight) and physiological (e.g., hormonal fluctuations during menstrual cycle) factors in modulating the action-cueing effect. Taken together these studies clearly demonstrate that the observation of actions performed by other individuals is likely to shape social attention in a rapid and reflexive way and that social factors may modulate such a process.

However, at the same time, action observation may impact several cognitive processes besides social attention. For instance, our attention to actions automatically activates corresponding motor programs (Bertenthal & Longo, 2008; Kilner, Marchant, & Frith, 2006; Michael et al., 2014; Rizzolatti & Craighero, 2004).

The present chapter focuses on a different process from social attention that can also be influenced by action observation, namely motor resonance (MR) (e..g., Brass, Bekkering, & Prinz, 2001; Craighero, Fadiga, Rizzolatti, & Umiltà, 1999). Specifically, here we investigate the relationship between action observation, MR and group membership. More specifically, the present experimental study explores whether and how the perception of social threat elicited by an outgroup

[7] This chapter is based on: Capellini, R., Sacchi, S., Ricciardelli, P., & Actis-Grosso, R. (2016). Social Threat and Motor Resonance: When a Menacing Outgroup Delays Motor Response. Frontiers in psychology, 7.

member and by contextual cues is likely to modulate motor responses when facing an agent's action.

Several studies involving the use of different neuroscience techniques ranging from fMRI to TMS (see for instance the body of research on motor neuron systems: Rizzolatti et al., 2001; Rizzolatti and Craighero, 2004; Rizzolatti and Sinigaglia, 2010) and behavioral measures consistently show that observing someone else performing an action elicits a motor activation similar to an activation that occurs when one performing the observed action personally (Fadiga et al., 1995, 2005; Dijksterhuis and Bargh, 2001; Sebanz et al., 2003; Iacoboni, 2005; Fourkas et al., 2006; Press et al., 2011).

Thus, this phenomenon of MR implies one's capacity to embody a representation of others' actions, and it seems to contribute to several complex and crucial social skills, such as one's understanding of others' actions, intentions and emotions (Hurley, 2008; Iacoboni, 2009) and the facilitation of interpersonal coordination and cooperation (Knoblich and Sebanz, 2006). For this reason, this type of ability is fundamental to our success as individuals and as a species and confers significant adaptive social advantages (e.g., Frith, 2007).

Although MR is an uncontrolled and automatic process (Gallese et al., 1996; Rizzolatti and Craighero, 2004; Wilson and Knoblich, 2005), over the last decade several studies have focused on the possibility that biological, individual and social factors may modulate such an effect.

In this regard, neuroscience evidence (fMRI) suggests that specific motor brain regions (i.e., right rostral parietal foci) are active only when observing biological movements (Perani et al., 2001; see also Kilner et al., 2003) and actions performed by conspecifics (Buccino et al., 2004). Moreover, previous research has shown that tendencies to simulate observed actions (Fadiga et al., 1995, 2005; Urgesi et al., 2006; Aglioti et al., 2008) or sensorimotor states of other individuals (Avenanti et al., 2005; Minio-Paluello et al., 2009) can be affected by individual differences such as gender (Cheng et al., 2008) or high-level personality traits such as empathy (Avenanti et al., 2009).

Among social factors, the actor and perceiver's group membership seem to play a central role. For instance, Molnar-Szakacs et al. (2007) found that witnessing actions performed by an individual of one's cultural and ethnic ingroup increases corticospinal excitability to a greater extent than observing actions performed by an outgroup member (see also Liew et al., 2011). In line with this, other recent research has suggested a 'group bias' in MR (Gutsell and Inzlicht, 2010, 2013; for exceptions see Désy and Théoret, 2007; Losin et al., 2012). Moreover, such an effect has been proven to be stronger for those presenting high levels of racial prejudice. Starting from the assumption that an ingroup can be conceived of as an extended self (Aron et al., 1992; Brewer and Gardner, 1996), these results are in line with prior findings showing that action observation related regions are more active in response to stimuli associated with the self than with others (Uddin et al., 2006; Kaplan et al., 2008) and when facing agents physically similar to oneself (Molnar-Szakacs et al., 2007).

Although these studies started to explore the influence of social factors on MR, this line of research leaves open questions on the role of social threats in such a process. As already mentioned in Chapter 3, social threat has been shown to be crucial to several cognitive processes, such as attention and social perception. On one hand, threat perception is likely to influence human attention; indeed, threatening stimuli are effective at capturing attentional resources, as suggested by the extensive literature on attentional processes (e.g., Öhman et al., 2001; Fox et al., 2002).

On the other hand, the perception of social threat is also important for the interpersonal and the intergroup relations. Indeed, research on impression formation suggests that when evaluating others we are primarily interested in defining whether others could represent an advantage or a threat (Wojciszke et al., 1998; Wojciszke, 2005; Fiske et al., 2007; Cuddy et al., 2008).

Given its importance, social threat elicited by a menacing social group and social threat elicited by threatening contextual cues may interact. Indeed, as revealed by previous studies, contexts systematically influence social categorizations (Freeman et al., 2013), may modify the interpretation of what a facial expression represents (Righart and De Gelder, 2008) and may affect

person perception. Hence, contextual cues may influence the impression of a social target. Threatening contextual cues, for instance, can weaken or strengthen race-based stereotypes of aggressiveness and menace (Trawalter et al., 2008): a threatening context is likely to activate negative stereotypes associated with specific social categories.

Building on this body of work, the present study aimed to explore whether and how MR triggered by observations of others' arm movements toward an object can be modulated by social variables such as ethnic group membership. Specifically, we predicted an increased MR when participants observe an action performed by an ingroup member rather than by an outgroup member in line with prior studies (Gutsell and Inzlicht, 2010). In going beyond prior research showing that MR is modulated by social categorization, we investigated whether the perceived threat posed by a social target is likely to modulate a social perceiver's MR response. More specifically, we expected that social threat elicited by a specific outgroup (i.e., stereotypically aggressive) in a specific context (i.e., threatening contextual cues) is likely to amplify the pattern. This hypothesis is in line with previous studies on the effect of morality on MR (Liuzza et al., 2015), which shows that the phenomenon is significantly reduced when observing immoral actions (namely actions related to social threats; Brambilla et al., 2013) in individuals presenting high levels of harm avoidance.

To investigate these hypotheses, we carried out an experimental study where using an action observation paradigm we asked participants to provide responses through computer mouse movements. More specifically, participants observed a movie clip showing an actor moving his arm toward an object; then on the screen, a square appeared in a congruent or incongruent position relative to the direction of the actor's movement. Participants were asked to indicate the square position by performing a computer mouse movement toward one of two labels denoting the position (i.e., left or right). We manipulated the group membership of the actors (ingroup vs. outgroup) and the social valence of objects present in the context (neutral vs. threatening) to elicit social menace through contextual cues. MR has been assessed through the use of an action observation paradigm implemented by MouseTracker software (Freeman and Ambady, 2010), a tool that measures

behavioral responses by recording computer mouse trajectories and that provides multiple informative dependent variables as detailed in the results section [e.g., initial response times, total response times, the maximum deviation (MD) point of the trajectory and the area under the curve (AUC)].

Moreover, our paradigm, which orthogonally manipulates directions of an actor's arm movement and participant's response direction, allowed us to distinguish the effect of MR from effects elicited by social attention. Indeed, whether the underlying process was social attention, we would expect to find task facilitation when target-stimuli appeared in a position congruent with the direction of the actor's movement when compared to incongruent positions. Otherwise, if we measured MR, we would expect to find task facilitation when actors move the same arm as the one used by participants to provide their answers. If the congruence between response directions and actors' arm movements does not have an effect, the hypothesis on social attention may be discarded.

The procedure of this study was approved by the Ethical Committee of the University of Milano-Bicocca, Milan, Italy. The study was conducted in accordance with the ethical standards outlined in the 1964 Declaration of Helsinki and with the standard ethical procedures recommended by the Italian Association of Psychology (AIP).

Study 1

Methods

Participants

The initial sample comprised 82 participants who volunteered to participate in the study in exchange for course credit. Seventy-nine participants were Italian citizens. Three non-Italian participants (1 Ukrainian, 1 Peruvian, and 1 Italo-Argentine) were excluded. Thus, the final sample included 79 participants (M_{age} = 23.43, SD_{age} = 3.76, range 18–44 years, 40 males, 39 females). Sixty-seven participants were right-handed, 10 were left-handed, and 2 were ambidextrous

according to self-reports; all of them were naive as to the purpose of the experiment. An a priori power analysis for within-subject ANOVA (medium effect size = 0.20; power = 0.95) suggested minimum $N = 46$. We advertised the study and enrolled all individuals who had responded and volunteered to participate. All participants provided written informed consent before participating in the study.

Apparatus and stimuli

Experimental stimuli were the same videos (WMV format; 25 frames/s; 640 pixels × 480 pixels; 1.296 kbps; Duration = 1.388 ms) to those presented in Chapter 3. Each movie-clip presented the front view of an actor performing an arm movement toward one out of two objects located on a table on his left and right. The actors used their right hand to move to the right (the participant's left) and left hand to move to the left (the participant's right).

Procedure

The experiment was carried out in a dimly lit room. Participants were asked to complete a questionnaire. On the cover page of the questionnaire, participants provided their demographic data. Participants were then presented with a 7-item national identification scale (e.g., "*I identify* with Italians"; Cameron, 2004), a 9-item Modern Prejudice Scale for Islamic people (e.g., "*For Italians it's normal to have a relationship with an Islamic person*"; McConahay, 1986), and a 10-item Motivation to Respond Without Prejudice Scale (e.g., "*Being non-prejudiced toward Islamic people is important to my self-concept*"; Plant and Devine, 1998). Participants answered these questions on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

The second part of the experiment was run on an Intel® Pentium® G630 @ 2.70 GHz personal computer interfaced with a 22-in LCD computer monitor (Asus® VW226; Resolution: 1680 pixels × 1050 pixels; Refresh rate: 59 Hz) equipped with the MouseTracker software program (Freeman and Ambady, 2010). After signing the consent form, participants were comfortably seated in a chair positioned approximately 60 cm away from the monitor from which they received instructions and were presented with photos and brief descriptions of the actors they were going to

watch during the experiment (name, age, and nationality). Hence, the ingroup (Gabriele, 26 years old, Italian) and outgroup targets (Haashim, 27, Iraqi) were introduced.

The experiment was then conducted. Each trial began with the computer screen showing a small box labeled "Start" at the lower center of the screen and two response boxes labeled "Left" and "Right" on the upper left and upper right corners of the screen, respectively. After 500 ms, a random video was shown at the center of the screen. At the end of each movie clip, a blue square appeared to the left or right of the screen. Participants were required to ignore the direction of the actor's arm movement and to indicate with a computer mouse movement the position (left or right) in which the square appeared. They were asked to do this as quickly and accurately as possible by moving their computer mouse cursor from the "Start" button to the chosen response box at the top. Responses were allowed only after the square appeared. A blank screen of 500 ms was inserted between each response box click and the following trial (Figure 7.1). We manipulated within participants the actor's ethnic membership (ingroup vs. outgroup) by presenting an Italian and an Arabian target, which is an outgroup stereotypically related to aggression or threat as suggested by recent research (Oswald, 2005; Mange et al., 2012). Moreover, the object valence (neutral vs. threatening) was manipulated by showing box of juice as a neutral object or a gun as a menacing object. Both actor and objects were pretested as detailed in Chapter 3.

We thus showed a total of 16 different videos as a result of combinations of these four variables (membership: ingroup vs. outgroup; actor's movement direction: left vs. right; object valence: neutral vs. threatening; square position: left vs. right). Each video was presented randomly six times throughout the experiment, resulting in a total of 96 trials with four additional trials presented at the beginning of the session as training trials, producing a total of 100 trials. Trials were split into two blocks: half of the participants were presented with a first block showing actors moving toward neutral objects (e.g., box of juice) followed by a second block with actors moving toward threatening objects (e.g., gun); the other half was presented with a first block showing actors

moving toward threatening objects followed by a second block with actors moving toward neutral objects.

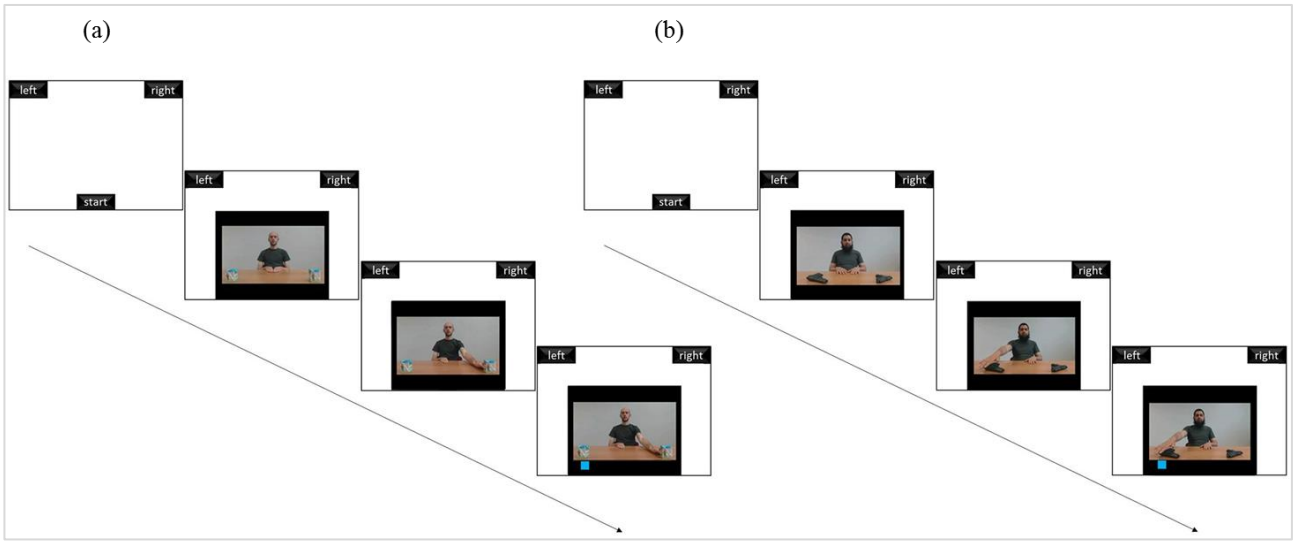

Figure 7.1
An example of the experimental procedure adopted in Study 1, Stimuli, trial sequence and timing of the action observation task (Study 1).

Hence, the experimental design consisted of a 2 (block order: neutral first vs. threatening first) × 2 (membership: ingroup vs. outgroup) × 2 (object valence: neutral vs. threatening) × 2 (actor's movement direction: left vs. right) × 2 (square position: left vs. right) design, with the first factor manipulated between subjects and the latter factors manipulated within subjects. It is important to note that 'left' and 'right' always refer to the participants' point of view (the position on the screen); thus, for instance an actor's movement to left means an actor's movement performed with his right hand to his right side. Moreover, as we excluded errors from the data, square positioning corresponds to the direction of a participant's response. Participants were randomly assigned to one of the two experimental groups. As provided by the MouseTracker software, the initial times (IT), response times (RT), AUC, and MD measures were recorded.

Results

Preliminary analysis

Regarding the mouse-tracking data, we conducted the analyses on four different indices provided by MouseTracker that represented our crucial dependent variables. Indices are the following: initial response times (IT), that represents the starting point in which participants begin the mouse trajectory in order to indicate their responses; total RT, which represents the total amount of time taken by participants to perform their responses, MD, which is a common index for assessing response competition, and AUC, which represents another index for evaluate response competition in terms of larger positive AUC values that indicate greater response competition.

Seventy-seven of the 79 participants performed the task using the mouse with their right hand. Since it was not feasible to conduct statistical analyses on two cases, participants who performed the task using their left hand were excluded from the sample.

Then, training trials have been eliminated from the analysis. Moreover, trials in which participants did not provide a correct response (e.g., answer 'left' when the square compared on the right or vice versa) were discarded (15 of 7,968 recorded trials, corresponding to 0.19%).

Next, we removed trials in which the dependent variables indices (IT, RT, AUC, and MD) were greater or lower than ±2.5 SD. With this procedure 485 trails were removed (485 of 7,968 recorded trials, corresponding to 6.09%). Finally, we excluded three outlier data points with standardized values greater than ±3 from the IT, RT, MD, and AUC averages. Thus, final analysis was conducted on a sample of 74 subjects.

Regarding the three explicit scale analysis, after reversing the items negatively phrased in the questionnaire and testing the scales reliability (national identification: Cronbach's $\alpha = 0.72$; prejudice: Cronbach's $\alpha = 0.79$; motivation to avoid prejudice: Cronbach's $\alpha = 0.85$), we computed the average scores for each measure.

Then, to control for possible effects of block order and square position, a 2 (block order: neutral first vs. threatening first) × 2 (membership: ingroup vs. outgroup) × 2 (object valence:

neutral vs. threatening) × 2 (actor's movement direction: left vs. right) × 2 (square position: left vs. right) ANOVA was computed, using the first variable as between-participants factor and the other variables as within-participants factors. The ANOVA carried out on the crucial dependent variables (IT, Total RT, MD, and AUC) did not reveal any interaction effect with block order ($p_s > 0.05$).

Moreover, the five- and four-way interaction with square position (corresponding to the participant's response direction) was non-significant ($p_s > 0.05$). This result was crucial in order to exclude a possible influence of social attention (namely the congruence between agent's movement direction and the position of the target stimulus to which participants were called to respond). Indeed, if the underlying process were due to social attention, we would expect to find task facilitation when square appeared in a position that was congruent with respect to the direction of the actor's arm movement (e.g., actor's movement toward left – square on the left) and, on the other hand, to find a greater response delay in incongruent positions (e.g., actor's movement toward right – square on the left). Also participants' handedness, when introduced as factor in the aforementioned analysis, proved to be ineffective ($p_s > 0.05$). Therefore, we collapsed data across these factors and the following analyses do not consider these variables.

Initial Times

After the preliminary analyses a 2 (membership: ingroup vs. outgroup) × 2 (object valence: neutral vs. threatening) × 2 (actor's movement direction: left vs. right) within participants ANOVA on the IT was computed. In line with the hypothesis, the analysis yielded a significant main effect of membership, $F(1,73) = 17.41$, $p < 0.001$, $\eta 2p\eta p2 = 0.19$; indeed, participants started their response with mouse earlier when observing an ingroup actor arm's movement ($M = 78.99$, $SD = 3.08$) than when observing an outgroup actor ($M = 85.89$, $SD = 3.31$). This result can be interpreted as a higher level of motor activation when perceiving ingroup members' acts. As displayed in Figure 7.2, the ANOVA yielded a significant three-way interaction between membership, actor's movement direction, and object valence, $F(1,73) = 21.89$, $p < 0.001$, $\eta 2p\eta p2 = 0.23$. As showed by *post hoc* analyses (LSD tests), when the objects presented in the context were threatening (i.e.,

guns), and the actor was an ingroup member, participants were faster while perceiving the agent moving to left (it is worthy to note that this condition would imply MR since the actor in front view was executing the movement with his right hand, that was the same hand participants were using to perform the task; M = 73.95, SD = 3.49) than to the right (M = 83.80, SD = 3.57), $p < 0.001$. On the other side, with threatening object but in outgroup condition, participants were even slower while perceiving the agent moving to the left (M = 93.04, SD = 4.27) than to the right (M = 77.70, SD = 3.76), $p < 0.001$. These results can be interpreted as a higher MR with the ingroup member; in stark contrast, the outgroup member's movement seems to delay motor response. Interestingly, in the other block, when the objects were neutral, in ingroup condition, there was no difference in IT between trials directed to the left (M = 78.98, SD = 3.42) and to the right (M = 79.24, SD = 3.93), p = 0.94. Analogously, in outgroup condition, no difference arose in IT between trials directed to the left (M = 86.17, SD = 3.80) and to the right (M = 86.64, SD = 3.93), p = 0.86. Thus, these results seem to suggest that the crucial interaction between actor's movement direction and membership arouses only when cues in the social context elicit threat.

Moreover, *post hoc* analyses (LSD tests) showed also significant differences in IT between neutral and threatening objects when participants observed an outgroup member; in particular, they were faster when the actor was moving to the left toward the box of juice than when he was moving to the left toward the gun, p = 0.05. Conversely, they were slower when the outgroup member was moving to the right toward the box of juice than when he was moving to the right toward the gun, p = 0.03. Interestingly, no differences arose in IT between neutral and threatening objects in the ingroup condition, neither when the actor was moving to the left, p = 0.14, nor to the right, p = 0.16. Moreover, the ANOVA revealed a significant two-way interaction between membership and actor's movement direction, $F(1,73) = 17.83$, $p < 0.001$, $\eta^2_p = 0.20$, which may be justified by the three-way interaction. The analysis did not yield any other significant effect, $p_s > 0.36$.

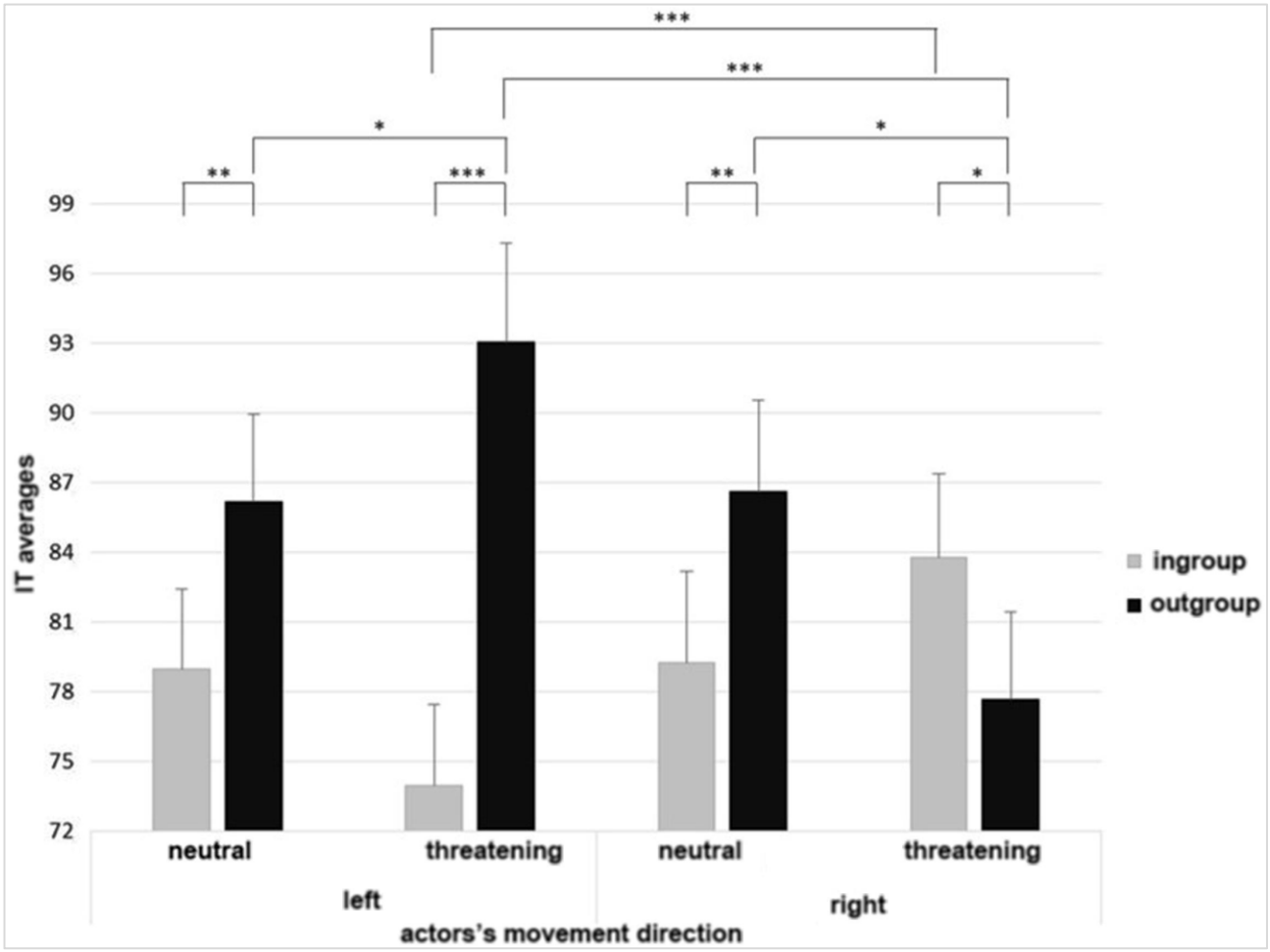

Figure 7.2
Three-way interactions between membership, actor's movement direction, and object valence [Initial Times (IT)]. Asterisks highlight significantly different means comparisons (∗p < 0.05, ∗∗p < 0.01, ∗∗∗p < 0.001). Error bars represent standard errors.

Total Response Times

Then a 2 (membership: ingroup vs. outgroup) × 2 (object valence: neutral vs. threatening) × 2 (actor's movement direction: left vs. right) ANOVA on total RT was carried out.

As displayed in Figure 7.3, the ANOVA yielded a significant three-way interaction between membership, actor's movement direction, and object valence, $F(1,73) = 5.84$, $p = 0.02$, $\eta^2_p = 0.07$. As showed by *post hoc* analyses (LSD tests), when the objects presented in the context were threatening and the actor was an outgroup member, participants were slower when observing an agent moving to the left ($M = 785.73$, $SD = 19.19$) than to the right ($M = 763.64$, $SD =$

18.59), p = 0.03. On the other side, in ingroup condition with menacing objects, no differences in RT were revealed between trials directed to the left (M = 759.09, SD = 16.30) and to the right (M = 761.97, SD = 18.84), p = 0.75. Interestingly, in the other block, when the objects were neutral and in outgroup condition, participants were faster when the agent was moving to the left (M = 756.75, SD = 18.72) than to the right (M = 772.49, SD = 18.62), p = 0.08. In ingroup condition with neutral objects, no differences in RT were revealed between trials directed to the left (M = 763.71, SD = 18.15) and to the right (M = 763.11, SD = 19.36), p = 0.97. *Post hoc* analyses (LSD tests) showed also significant differences in IT between neutral and threatening objects when the agent was an outgroup member; in particular, when he was moving to the left, participants were slower in the threatening condition (i.e., with guns) than in the neutral one (i.e., with box of juice), p = 0.04. There were no differences between neutral and threatening objects when the outgroup member was moving to the right, p = 0.59. No differences in RT arose between neutral and threatening objects in ingroup condition, neither when the agent was moving to the left, p = 0.70, nor to the right, p = 0.93. Furthermore, the ANOVA revealed a significant two-way interaction between object valence and actor's movement direction, $F(1,73) = 3.94$, p = 0.05, η^2_p = 0.05, which may be justified by the three-way interaction. In sum the results partially confirmed data on IT. We should consider that the present index represents the total time used by participants for providing their response, thus participants could use the entire time of the trajectory to adjust their answer, until they clicked the response box.

No other effects were found, $p_s > 0.17$.

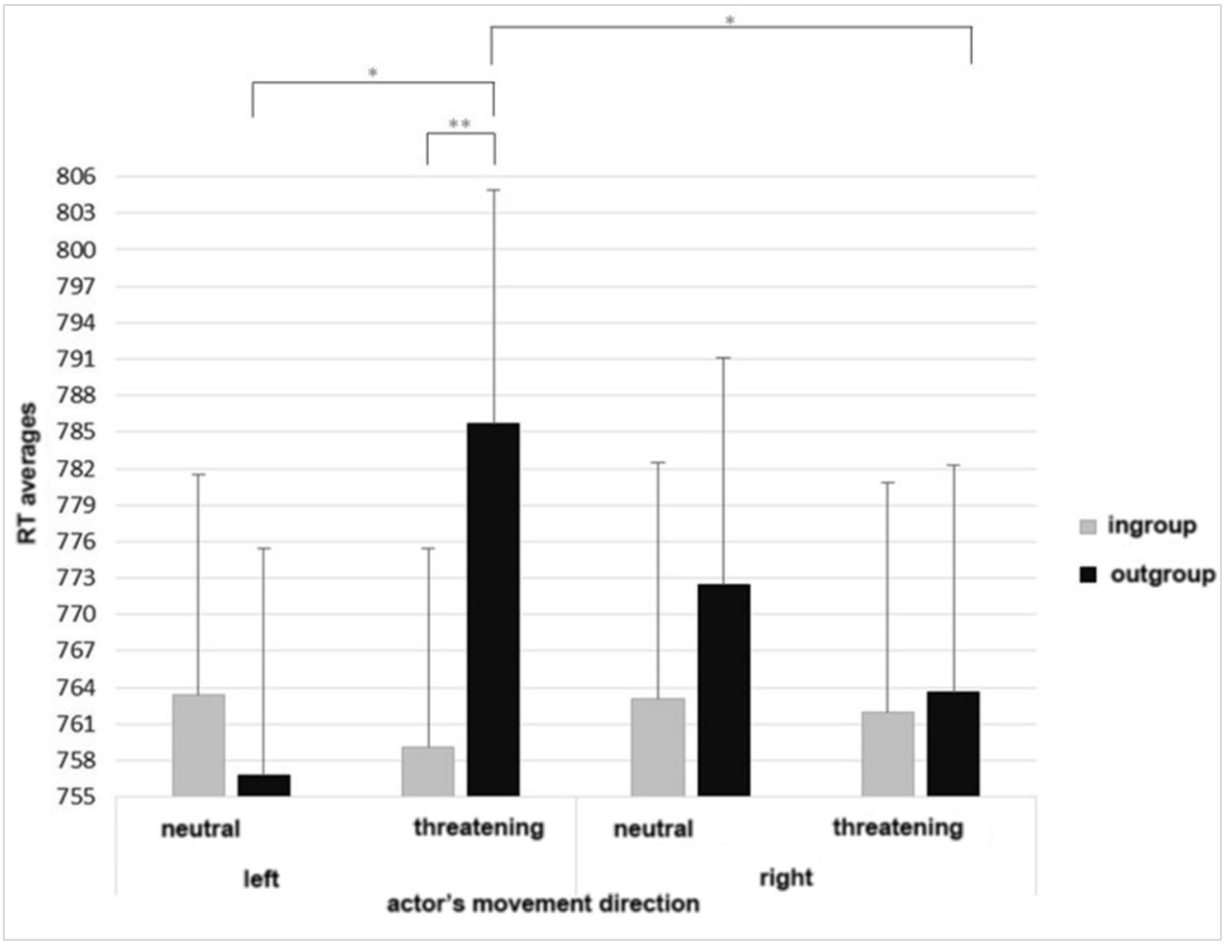

Figure 7.3
Three-way interactions between membership, actor's movement direction, and object valence (Total Response Times). Asterisks highlight significantly different means comparisons (∗p < 0.05, ∗∗p < 0.01, ∗∗∗p < 0.001). Error bars represent standard errors.

Maximum Deviation and Area Under the Curve

We also computed a 2 (membership: ingroup vs. outgroup) × 2 (object valence: neutral vs. threatening) × 2 (actor's movement direction: left vs. right) ANOVA on two other indices used to measure the response competition: MD and AUC. As shown, using MD versus AUC for the same data does not substantially change the results (Freeman et al., 2008). No effects were found neither on MD nor on AUC, $p_s > 0.08$.

These results revealed that participants did not experience response competition in providing their mouse responses. The fact that we found effects on initial and RT and not on the trajectories can be ascribed to the type of task. As shown, we asked participants to indicate the

position (left/right) in which the stimulus appeared, that is a simple and quite effortless task. The easiness of this kind of task could have led participants to provide their responses without uncertainties.

Explicit Scales

Finally, in order to investigate whether participants' level of identification with the national group (i.e., Italians), level of prejudice and level of motivation to avoid prejudice were likely to moderate the effects, moderated moderation models were explored using PROCESS macro (Hayes, 2013; model 3, 5000 bootstrap resampling) with actor's movement direction (left vs. right; left defined the condition in which participants provided their responses using the same hand as the one used by the actor in the videos) as an independent variable, membership (ingroup vs. outgroup) as a moderator, the explicit measures as moderator of the moderator, and IT and total RT as dependent variables. The explicit measures used were: identification with the ingroup (M = 4.16, SD = 0.91), prejudice toward Islamic people (M = 3.20, SD = 0.87), and motivation to avoid prejudice (M = 3.88, SD = 1.06). None of these models revealed significant interaction, $p_s > 0.35$. Thus, these measures of identification and prejudice did not moderate our effects on MR revealed by previous analyses.

General discussion

A robust line of research has widely suggested that observing another person's action activates corresponding motor representations in the observer (Iacoboni et al., 1999; Rizzolatti et al., 2001; Rizzolatti and Craighero, 2004); moreover, prior studies have shown that MR may be influenced by characteristics of an action made and of the performer of that action (Molnar-Szakacs et al., 2007; Cheng et al., 2008). The present study investigated whether and how perceptions of social threat elicited by an outgroup member and by social cues can modulate motor responses when a person observes others' actions.

Our findings suggest that MR during action observation is likely to be modulated by ethnic group membership. Indeed, consistent with our hypothesis and in line with the existing literature (Molnar-Szakacs et al., 2007; Avenanti et al., 2010; Gutsell and Inzlicht, 2010, 2013), participants tended to resonate better with their ingroup; in fact, when the ingroup actor executed a movement with the same hand as the one used by participants to provide their responses, motor facilitation was found. Conversely, when the outgroup member performed an action using the same hand as participants, a delay in response was found.

These results can be interpreted in the light of the existing literature on group membership and social interactions. Indeed, people empathize more with the ingroup members than the outgroup members (Dovidio and Gaertner, 2010; Trawalter et al., 2012; Gutsell and Inzlicht, 2013) and tend to perceive the ingroup members more favorably and as more similar to themselves (Hewstone et al., 2002). Studies on spontaneous synchrony, mimicry and motor coordination consistently show that individuals are less likely to synchronize their movements with those whom they harbor negative feelings for (Miles et al., 2010). Moreover, this effect may be partially due to familiarity: ingroup members are usually the ones with whom we most often interact (Fiske, 1992). Therefore, moving with others or resonating with their movements could be considered an early embodied form of relation with our conspecifics that could be affected by social perception and cultural inter-individual differences (Sacheli et al., 2015).

However, the present research complements and extends this emerging line of research, going beyond a mere ingroup bias effect and exploring the role of social threat. Our main finding suggests that the perception of social threat, elicited by an outgroup member stereotypically associated with social aggression (Oswald, 2005) and by contextual cues, is likely to interfere with motor response provided when facing an agent's action. In fact, when participants faced a stereotypically aggressive outgroup member moving toward a weapon, they were slower to initiate motor responses. Interestingly, the interaction effect between membership and movement direction disappeared when contextual cues were neutral and unlikely to elicit social threat.

It is worthy to note two additional nuances of our results. First, in neutral conditions, the MR effect disappeared when participants viewed an ingroup member. One possibility for why we did not find MR in this condition is because in this specific context (i.e., when threat is not salient), an individual may be likely to focus on the task and to disregard social stimuli. By contrast, when social threat is elicited, an individual is more heavily influenced by the presence and movements of social targets that can become potentially menacing. As highlighted by the literature of threat and attention, evolutionary relevant threatening stimuli are effective at ensnaring attentional resources (Öhman et al., 2001; Fox et al., 2002), thus interfering with goal-directed activity (Williams et al., 1988, 1996).

Second, no difference was found between neutral and threatening conditions when participants faced the ingroup members: RT differed between neutral and threatening conditions only when participants observed an outgroup agent's movements. This pattern could suggest that threatening objects are likely to activate negative stereotypes associated with specific social categories (e.g., Arabians). As revealed by a prior study, threat cues might weaken or strengthen race-based stereotypes of aggressiveness and menace (Trawalter et al., 2008): hence, only in particular conditions (e.g., in our experiment when participants were presented with guns), negative stereotypes associated with racial minorities may be active and likely to garner attention. As argued by Trawalter et al. (2008), information gleaned from bottom-up (e.g., contextual cues) and top-down processing (e.g., stereotypic expectancies) may have interactive effects on social perception. From these findings, future studies could further explore effects of group membership by presenting participants with control outgroups not stereotypically associated with threat or aggression. In this way, it would be possible to control whether effects that emerge are to be ascribed to the presence of a generic outgroup or to a particular and specific menacing outgroup.

This result seems to be at odds with previous research (Gutsell and Inzlicht, 2013) showing that when outgroup behavior is negative and threatening, individuals begin to process them as ingroup members, thus reducing ingroup bias effects on MR. However, the results are in line with

functional perspectives on person perception (e.g., Todorov et al., 2009), suggesting that when an outgroup behavior is threatening, people can allocate cognitive resources to the threatening individual. This form of cognitive resource allocation does not necessarily apply to active movements. In fact, the delay found in response to the Arabian outgroup member as he moved toward a gun can be interpreted as a freeze reaction to a harmfully perceived event as suggested by several studies that show that spontaneous body responses to social threat cues elicit freeze-like behaviors in humans (Roelofs et al., 2010). Moreover, our findings are in line with previous studies on the effects of morality on MR (Liuzza et al., 2015) showing a decrease in MR when observing immoral actions, in particular in individuals presenting high levels of harm avoidance. As an extension of this work, it will be interesting to investigate the relation between MR and visual attention. Indeed, future works could explore whether motor freezing arising as a reaction to a menacing outgroup could be associated with greater visual attention to this agent; participants, for instance, could be attracted to a menacing target while at the same time being frozen in their motor reactions. For this reason, it will be useful to integrate the measure of RT and computer mouse trajectories provided through MouseTracker with the analysis of eye movements using an eye tracker.

Furthermore, an added value of this work lies in the experimental methodology we adopted; on one hand, we used an action observation paradigm implemented using MouseTracker software (Freeman and Ambady, 2010), which is a tool that measures behavioral responses by recording computer mouse trajectories and that provides multiple informative dependent variables (e.g., initial RT, total RT, MD point of the trajectory, and AUC). In this way, it is possible to monitor and implicitly investigate the entire motor response to understand at what level of the process the effects interfere. Thanks to this experimental tool, it was possible to highlight that the effects of our variables are particularly precocious, as they interfered with the task early on in the process (IT).

Moreover, the paradigm we used allows to discriminate between two competing underlying processes. Through our action observation paradigm, we presented participants with

congruent (i.e., actor's movement toward the left – square on the left) or incongruent (i.e., actor's movement toward the right – square on the left) stimuli. In our study, the orthogonal manipulation of the square's position (corresponding with participant response directions) alongside membership and actor's movement directions allowed us to disentangle effects of MR from effects elicited by social attention. Indeed, if the underlying process were due to social attention, we would expect to find task facilitation when stimuli (i.e., square) appeared in a position congruent to the direction of the actor's movement. With incongruent positions, we would expect to find greater response competition and thus an increase in the difficulty in making a decision. Otherwise, if we measured MR, we would expect to find task facilitation with an actor moving the same arm as the one used by participants to provide their answers. The motor facilitation result found when the actors moved the same arm as the one used by participants to provide their answers supports the hypothesis on MR. Moreover, as the square's position did not interact with our crucial effects, the hypothesis on social attention can be discarded. Here, to measure motor facilitation we introduced an important change in the task; differently from the studies presented in the previous chapters of the current thesis, participants were required to answer performing a mouse movement. Thus, in a similar paradigm whereby participants' motor responses are needed, action observation may have impact more on the motor responses rather than social attention. It could be interesting to further investigate the relationship between social attention, action observation and motor responses. Previous research has shown that gaze shifts may evoke a motor activation in the observer, similar to that elicited by action observation (e.g., di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992). For instance, Mansfield, Farroni, & Johnson (2003) recorded eye movement responses to a target presented to the left or right of a face with averted gaze and found a response facilitation to the target previously cued by the gaze direction. Interestingly, observing shifted gaze evoke spontaneous saccades in the direction of the cue prior to target appearance, even though participants were instructed to fixate on the center during this period.

Thus, it appears that social attention may be involved during motor program. However, further research is needed to better understand the temporal dynamics and the processes underlying the relationship between social attention and motor behaviors.

Moreover, we showed that our findings are not affected by levels of prejudice; both people with a high level of prejudice toward Arabian people and those with low prejudice were influenced when performing the task. From a social psychology perspective, the results are compatible with stereotype activation rather than with prejudice effects. Stereotypes are fixed and over-generalized beliefs about people that are based on their membership to a particular social category (for a review, see Hilton and von Hippel, 1996). Previous research has widely demonstrated that trait concepts and stereotypes, which are generally shared within a community and stable over time, become automatically active in the presence of a relevant behavior or stereotyped-group features. Given their pervasiveness in cultural contexts, stereotypes can have detrimental effects on social perception and elicit stereotype-consistent behavioral responses independent from the individual's attitudes and personal values (i.e., prejudices) toward that social group (Devine, 1989; Devine and Elliot, 1995). From our results and in consideration of the fact that most people internalize stereotypes in the course of normal socialization, future studies could also investigate the role of individual characteristics (e.g., age) in the development of stereotypes. From a lifespan perspective, it will be interesting to explore the development of adaptive human skills (Knoblich and Sebanz, 2006) to resonate with co-specifics during different stages of human life and particularly in relation to ingroup bias and social threat perception.

Finally, from an intergroup point of view, the effect of social threat on MR could have important implications; such an effect may affect the first stage of social perception and may alter communication and interactions with outgroup individuals and the quality of intergroup relations. Moving together and coordinating with other movements can bridge the gap between the self and others and create a sense of social connection. Therefore, investigating the effects of facilitating and hindering factors of MR could help understanding the challenges associated with intergroup

interactions. To conclude, the present study provides avenues for further studies on the role of variables likely to reduce intergroup threats and to promote more cooperative relations between members of different social groups.

Chapter 8

General discussion and future directions

Social attention is the ability to coordinate or to share the attentional focus on an object, another person, or an event with social partners (e.g., Nummenmaa & Calder, 2009). Such ability is crucial to successfully interact with social partners in our environment. Typically, humans can signal what they are attending by shifting their eyes or pointing with the finger or orienting their head and body to that direction. Research on social attention has extensively investigated the role of social signals, primarily focusing on the role of eye gaze and pointing (e.g., Frischen et al., 2007; Langton & Bruce, 2000; Perrett & Emery, 1994).

However, beyond eye gaze and pointing, we can infer others' attentional focus from watching their movements (Allison, Puce, & McCarthy, 2000; Tomasello, 2000). Let's think about the scenario presented in Chapter 1. Probably, while trying to steal the wallet in my pocket, the man was looking to the opposite direction: however, by observing his action, it was clear in what he was interested in.

Surprisingly, although the actions of other individuals are relevant attentional cues, prior research has mainly investigated how action observation affects the observer's own motor programs (e.g., Brass, Bekkering, & Prinz, 2001; Craighero, Bello, Fadiga, & Rizzolatti, 2002) rather than how it affects the observer's attention. Moreover, the available studies on actions and attentional processes corroborated the idea that hand gestures are relevant social cues in social interactions; however, particularly with regard to the grasping gesture, they focused on the congruence of the configuration of a grasping hand and an object rather than on attentional shift. More importantly, they reported some contradictory evidence (e.g., Fischer & Szymkowiak, 2004; Mazzarella et al., 2012; Fischer, Prinz & Lotz 2008; Tschentscher & Fischer, 2008; Vainio, Tucker, & Ellis, 2007).

The main goal of the present thesis is to explore the role of human gestures in shaping social attention processes, with a focus on reach-to-grasp movements. Second, it aims at

investigating the moderating effects of some social variables on such a process. For this purpose, we carried out a set of experimental studies where we adopted an action observation paradigm. Such a paradigm, as the classical spatial cueing paradigm (Posner, 1980) and the gaze-cueing paradigm (Friesen & Kingstone, 1998), allows to infer where the observer's attention has been directed by comparing response speed on different trials. Specifically, in our paradigm, participants were shown a centrally-placed actor while performing a reach-to grasp movement rightwards or leftwards toward an object. Then, they were asked to make a speeded categorization of a target appearing on the screen in a spatially congruent or incongruent location with respect to the direction of the actor's action. The rationale behind this: if the observed action was likely to shift the observer's attention, the observer should have been faster in categorize the target when it appeared to the side of space that was prior cued by the action.

Such a versatile paradigm allowed us to directly investigate the role of several social variables on social attention (e.g., group membership, product status, weight status), to introduce different types of experimental stimuli (e.g., pictures, movie-clips), and to measure different behavioral responses (Reaction Times, Eye movements, Mouse Trajectory).

Specifically, in the first set of studies (Chapter 2), we employed the action observation paradigm to investigate whether the observation of an action performed by another person is likely to shape social attention and whether such attentional shifts are specifically promoted by human movements rather than by an asymmetry in our perceptual field. In sum, our findings suggested a robust effect of action on social attention. According to our hypothesis, we found faster responses to cued targets (i.e., when targets appeared in a congruent location with respect to the direction of the actor's action) than to uncued targets (i.e., when targets appeared in an incongruent location with respect to the direction of the actor's action), namely an action-cueing effect (Study 1). Importantly, our data supported the idea that the attentional orienting is emphasized when triggered by other people's movements rather than by non-biological cues; indeed, we found a greater cueing effect for human actions than for non-human actions (Study 2).

After having demonstrated that action observation is likely to influence social attention, we focused on possible social moderators of such an effect.

In line with the existing literature on gaze-cueing effect showing that attentional orienting can be modulated by social factors (e.g., Bayliss, di Pellegrino, & Tipper, 2005; Frischen & Tipper, 2006; Pavan et al., 2011; Dalmaso et al., 2011) our findings revealed that higher order variables may influence social attention even when it is triggered by action observation.

The set of studies presented in Chapter 3 analyzed in detail the role of group membership and social threat, showing an overall stronger action-cueing effect for the threatening outgroup (i.e., Arab). Indeed, when social threat was elicited by the presence of threatening contextual cues (i.e., guns; Study, 2), it appeared that individuals hyper-monitor the threatening outgroup rather than the ingroup or a non-threatening outgroup (i.e., Japanese; Study 3). These results can be ascribed to the stereotype activation; observing a menacing outgroup grasping a gun could have activated the threat-related outgroup stereotypes and led to a hyper-monitoring of such an outgroup.

In Chapter 4 we explored the interplay between social and physiological factors in shaping social attention during action observation. Specifically, we analyzed the interaction between variables such as social status and hormonal shifts during the female's menstrual cycle on social attention. Overall, our results showed that in normally ovulating women the higher the conception risk level the stronger action-cueing effect towards high-status products. The pill users did not show the same effect.

Chapter 5 provided a preliminary evidence of a moderating effect of target's weight status on social attention. Indeed, our results revealed a greater (but negative) action-cueing effect for the overweight person than for the normal weight person.

Chapter 6 represented a change in perspective with respect to the previous chapters since here we analyzed the potential outcomes of observing social cues provided by other individuals on person perception and prejudice. It has been illustrated that the direction of gaze can influence person perception (e.g., Mason et al., 2005) so that a cooperative behavior such as a gaze that

consistently looked towards targets seems to lead to a more positive evaluation of the sender (Bayliss and Tipper, 2006). Aiming at extending these interesting finding to action cues, we provided a first empirical evidence showing a general reduction of explicit prejudice when high-identified participants were facing a cooperative outgroup member.

Finally, in Chapter 7 we explored a complementary field of research related with our main topic. It has been shown that action observation may impact several cognitive processes besides social attention (Bertenthal & Longo, 2008; Kilner, Marchant, & Frith, 2006; Michael et al., 2014; Rizzolatti & Craighero, 2004); here, we focused on motor resonance, aiming to obtain a more holistic comprehension about the role of social cues on human cognitive processes. Our main finding suggests that the perception of social threat is likely to interfere with motor responses during action observation so that observing a threatening outgroup grasping a menacing object delayed motor responses.

Overall, the current thesis provides novel evidence for a deeper understanding of social attention processes.

First, our studies consistently suggest a robust effect of human actions on such a process. Such a result is theoretically important for several reasons. As reviewed, even though human actions are crucial in social interactions and represent reliable indicators of others' attention (e.g., Allison, Puce, & McCarthy, 2000; Tomasello, 2000), the majority of the existing literature has neglected their role in driving social attention focusing mostly on the role of eye gaze. However, due to the specificity of actions such as social cues, it is not possible to extend and generalize the impact of eye gaze on social attention toward actions. Specific research on action-cueing effect was required.

On the one hand, from observing a shift in the eye gaze direction or in the action direction we can differently infer other's intentions. For instance, an action such as grasping an apple, may be more effective in communicating the immediate intentions (i.e., to eat), because it depicts an ongoing interaction with the given object (Mazzarella et al., 2012; Sartori, Becchio, & Castiello,

2011). Conversely, eye gaze not always implies a current interaction with an object, thus it can be more likely to communicate the future intentions (Mazzarella et al., 2012; Sartori, Becchio, & Castiello, 2011; but see also Pierno, Becchio, Turella, Tubaldi, & Castiello, 2008).

Moreover, eye gaze and actions rely on different temporal and spatial dynamics; for instance, the eye gaze shift is more rapid than the execution of an action. On the other hand, actions are a sequence of movements (Neuman, 1987) that develop in time and space. Thus, it appears that specific and tailored work on action-cueing effect was needed. The current thesis represents a first attempt in this direction.

Furthermore, these findings extend our knowledge about attentional processes, particularly in relation to overt and covert attention. As mentioned in Chapter 1, overt attention involves directed eye movements to consciously shift the attention on a target stimulus. On the other hand, covert attention does not require eye movement and occurs when, for instance, we attend something in the periphery while not overtly looking there. In the presented set of studies, our participants were required to fixate a central focus and to ignore the actors movements while categorizing the color of a target. Thus, as for Posner-like paradigms, but with an action observation task, our paradigm encourages covert shifts of attention in response to cueing.

Added value of the present thesis lies on the adopted methodology. For instance, most of the gaze-cueing studies reduces the stimulus situations to disembodied faces shifting their gaze leftwards or rightwards. In our paradigm we decided to introduce videos of reaching-to-grasp movements unfolding in in time and visible from the start to the end of the action. This represents to us the first attempt in the direction of a more ecological social cognition aiming at reducing the distance between laboratory settings and real social interactions. Keeping with that, up-to-date tools and methodologies (i.e., wearable eye-tracker, virtual reality) could represent an innovative way to study social attention during realistic and even real social interactions.

Notwithstanding the importance of this set of studies to understand the role of action observation on social attention, the current research has some limitations. As shown, we found

mixed evidence in the direction of the action-cueing effects. Indeed, in Chapter 2 and 3 our results showed faster responses in congruent trials than in incongruent trails. That is what typically happens in gaze-cueing paradigm at short SOA (Stimulus Onset Asynchrony) up to a 1200 ms (Galfano, Dalmaso, Marzoli, Pavan, Coricelli, et al., 2012). Notably, in the set of studies presented in Chapter 2 the SOA was 200 ms; in Chapter 3, since we introduced movie-clips, the stimulus onset occurred at the end of videos (1000 ms).

Conversely, in Chapter 4 and 5 our data revealed a reverse pattern; quicker responses in incongruent trails than in congruent trials. As discussed, we interpreted such reverse pattern as an Inhibition of Return (IOR; e.g., Frischen & Tipper, 2004). IOR is an attentional mechanism that consists in the tendency to avoid orienting attention towards previously attended locations. The function of such inhibitory mechanism is to prevent individuals from repeated sampling of space that have already been searched (Klein, 1988) allowing to a more efficient exploration of the surrounding environment (e.g., Galfano, Betta, & Turatto, 2004; Klein, 2000; Lupiáñez et al., 2006). What typically occurs is that, in case the duration of SOA is particularly long (i.e., more than 1200 ms), it is possible to observe an inhibitory aftereffect which consists in observing smaller RTs on incongruent than on congruent trials (IOR; e.g., Frischen & Tipper, 2004). This suggests that attention was driven by the action observation. First, observers shifted their attention to the location cued by the target. Then, due to the long SOA, they orient their attention towards the location not previously attended.

One possible explanation about why we found mixed results between Chapter 3 and Chapter 4 and 5 could be ascribed to the role of the threat perception. In all the studies we showed videos; thus, the target appeared on the screen after at least 1000 ms (i.e., the duration of the videos). However, in the set of studies presented in Chapter 3 we presented a threatening outgroup (Study 1 and 4) and threatening contextual cues (Study 2 and Study 3). Conversely, no threat manipulation was conducted in Chapter 4 and 5. As already mentioned, it has been broadly established that threatening stimuli preferentially catch attention (Öhman et al., 2001; Fox et al.,

2002). For instance, harmful animals (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Öhman, Flykt, & Esteves, 2001; Öhman & Mineka, 2001) or other dangerous stimuli are likely to capture human attention because they are relevant for survival (Anelli, Borghi, & Nicoletti, 2012; Anelli, Nicoletti, Kalkan, Sahin, & Borghi, 2012; Anelli, Ranzini, Nicoletti, & Borghi, 2013). Hence, it could be that social threat elicited by the presence of a menacing outgroup or dangerous objects may have drawn the observers' attention and lead to faster responses in congruent trails than in incongruent trails. On the other side, where threat was not activated (Chapter 4 and 5), the long SOA may have resulted in IOR effects. Importantly, IOR phenomenon has been mostly studied with gaze-cueing paradigm. However, as discussed above, due to the specificity of actions such as social cues, this issue needs to be further addressed with action-cueing paradigm. Further research should for instance test this idea by directly comparing trails in which social threat is elicited and neutral trials and verify which conditions are consistent with a facilitation effect (as in Chapter 2 and 3) or with a IOR (as in Chapter 4 and 5). Furthermore, it is possible to investigate the effects of different SOAs; in our paradigm, we calculated the SOA as the interval between the actual grasping action and the appearance of the target. Thus, in each experiment the SOA was short (i.e., 250 ms). However, in our paradigm we showed videos rather than pictures (with an exception in Chapter 1) and this aspect may have affect the temporal dynamics. We acknowledge that our interpretation of these mixed findings might sound as rather speculative. Our aim is to encourage further research to achieve a robust and a consistent increase of knowledge of the role of human actions on social attention.

Second, with regard to the modulating effect of social threat in social attention we interpreted the reported greater cueing effect for the threatening outgroup as a hyper-monitoring of such an outgroup. Further empirical evidence is needed to support any speculative reasoning on these findings. For instance, recent work on the gaze-cueing effect (Chen et al., 2017) suggests that humans may have more difficulty disengaging from threatening stimuli than from non-threatening stimuli (i.e., involuntary holding of attention) rather than staying vigilant for threatening stimuli

(i.e., more vigilance or facilitated attention to detect threat). Future studies should address this issue exploring the effect of action observation in drawing or holding attention.

Third, in our paradigm we presented actors moving their arm towards an object, while having their gaze straight ahead in the direction of the observer. During real social interactions, it would be unusual to observe someone interacting with an object without looking at it and/or without moving the head. This aspect could have influenced the attentional process. Given the crucial role of the eye-gaze (e.g., Frischen et al., 2007), one could assume that the reported action-cueing effect may be due to the fact that in our paradigm the eye gaze was not relevant for the purpose of the task. Thus, further research could deepen this issue by means of an eye-tracker to analyze the role of action observation in interaction with other social cues (i.e., eye-gaze, head orientation, body posture) in shaping social attention.

Furthermore, in Chapter 3 we used within design subjects in which threatening and non-threatening trails were randomly presented. As shown, given the pervasiveness of threat, it could be that social threat elicited by the presence of a gun could have influenced even the perception of the neutral objects. Thus, further studies should address this issue by implementing between-subjects design

As a matter of fact, as demonstrated by the set of studies presented in the current thesis, the action observation paradigm is a versatile and easy to manipulate tool. Despite the limits illustrated above, due mostly to the fact that research is in the early stage of this topic, the present work encourages further research directions. On one hand, further work on the temporal dynamics of action observation in social attention is required (i.e., IOR effect). In addition, it is worth exploring the role of different reaching-to-grasp postures (e.g., the grasping posture for a handled mug is different from the grasping posture for a pen) on the social attention. Does a power grip influence social attention differently from a precision grip? Yet, does action speed play a role? Future research should aim at answering such questions.

On the other hand, future work should also take into account other social variables that can influence social attention driven by action observation. It could be interesting to study the role of agents' ages. One could expect for instance differences when observing action performed by young adults and by elderly people (see Ciardo et al., 2014 on gaze following). Moreover, future research should explore the role of action observation in such a process throughout the lifespan.

Research on this topic is not conclusive, however it is encouraging. From an intergroup perspective, our results suggest that, even though people do not resonate with the outgroup (Chapter 7), in some conditions we allocate our cognitive resources to the outgroup, in terms of attentional hyper-monitoring (Chapter 3, Study 2 and 3) or our level of prejudice is influenced by the quality of interactions with the outgroup (Chapter 6). Future research should take into account this aspect to improve our understanding of social cognition. As mentioned, the ability to share intentions facilitates social understanding and foster positive communication, help and justice (Cialdini et al., 1997). Hence, a bias in catching outgroup's actions and intentions, especially at the first stage of social perception, is likely to have severe consequences for intergroup relations, resulting in, for instance, negative and less effective interactions. On the plus side, we showed that a positive experience with an outgroup may turn out in reduction of the prejudice.

Therefore, investigating the factors that enable or hinder our attention to the outgroup could help the understanding of challenges associated with intergroup interactions. Actions are potential tolls for communications; paying attention to the actions of others, moving together and coordinating with other movements can bridge the gap between the self and others and create a sense of social connection.

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Appendix

Ingroup Identification scale (English version; Cameron, 2004)

Instructions
Indicate your agreement with the following statements by choosing the appropriate response for each. Please do not leave any statements unanswered.

Response scale for all items
strongly disagree (1) (2) (3) (4) (5) (6) (7) strongly agree

Items
1. I often think about the fact that I am Italian
2. Overall being Italian has very little to do with how I feel about myself.
3. In general, being Italian is an important part of my self-image.
4. The fact that I am Italian rarely enters my mind.
5. I am not usually conscious of the fact that I am Italian
6. Being Italian is an important reflection of who I am.
7. In my everyday life, I often think about what it means to be Italian.

Modern Prejudice Scale Toward Islamic (Italian version; McConahay, 1986)

Instructions
Indicate your agreement with the following statements by choosing the appropriate response for each. Please do not leave any statements unanswered.

Response scale for all items
strongly disagree (1) (2) (3) (4) (5) (6) (7) strongly agree

Items
1. Agli italiani piace mischiarsi con gli islamici.
2. Per gli italiani è normale avere una relazione intima con un/a islamico/a.
3. Per gli italiani è normale frequentare luoghi dove vanno anche gli islamici.
4. Gli italiani accettano con difficoltà un matrimonio tra uno/a di loro e un/a islamico/a.
5. Gli italiani pensano sia "figo" uscire con amici islamici.
6. Gli italiani non hanno nulla in contrario a lavorare alle dipendenze di una persona islamica adeguatamente qualificata.
7. Gli italiani accettano di buon grado che un membro della loro famiglia abbia un figlio/a con un/a partner islamico/a.
8. Gli italiani guardano male uno/a di loro che va in giro con islamici.
9. Gli italiani eviterebbero di farsi curare da un medico islamico anche se adeguatamente qualificato.

Motivation to Respond Without Prejudice Scale (English version; Plant and Devine, 1998)

Instructions

Indicate your agreement with the following statements by choosing the appropriate response for each. Please do not leave any statements unanswered.

Response scale for all items

strongly disagree (1) (2) (3) (4) (5) (6) (7) strongly agree

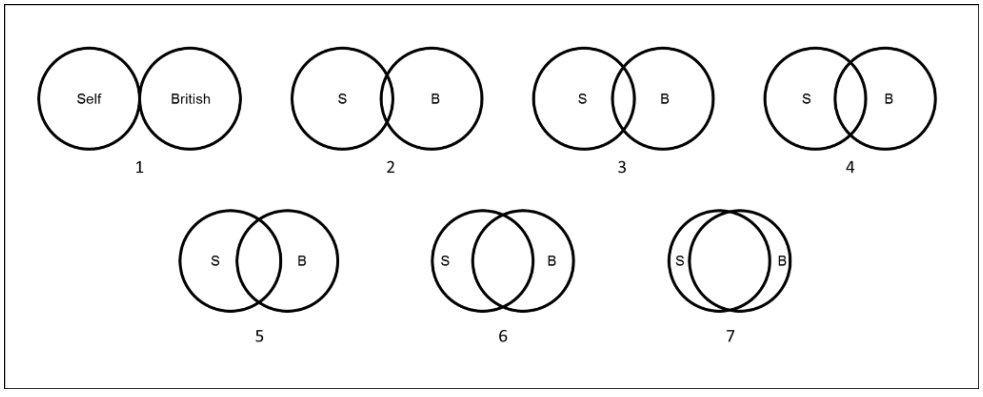
Items

1. Because of today's PC (politically correct) standards I try to appear nonprejudiced toward Black people
2. I try to hide any negative thoughts about Black people in order to avoid negative reactions from others
3. If I acted prejudiced toward Black people, I would be concerned that others would be angry with me
4. I attempt to appear nonprejudiced toward Black people in order to avoid disapproval from others
5. I try to act nonprejudiced toward Black people because of pressure from others
6. I attempt to act in nonprejudiced ways toward Black people because it is personally important to me
7. According to my personal values, using stereotypes about Black people is OK
8. I am personally motivated by my beliefs to be nonprejudiced toward Black people
9. Because of my personal values, I believe that using stereotypes about Black people is wrong
10. Being nonprejudiced toward Black people is important to my self-concept

The inclusion of ingroup in the Self measure (IIS; Tropp, & Wright, 2001)

Instructions

Choose the pair of circles that best represents your level of identification with your national group (i.e., British), with possible choices ranging from 1 (no overlap) to 7 (high degree of overlap).



Social dominance orientation (SDO) (English version; Pratto, Sidanius, Stallworth 1994)

Instructions

Indicate your agreement with the following statements by choosing the appropriate response for each. Please do not leave any statements unanswered.

Response scale for all items

strongly disagree (1) (2) (3) (4) (5) (6) (7) strongly agree

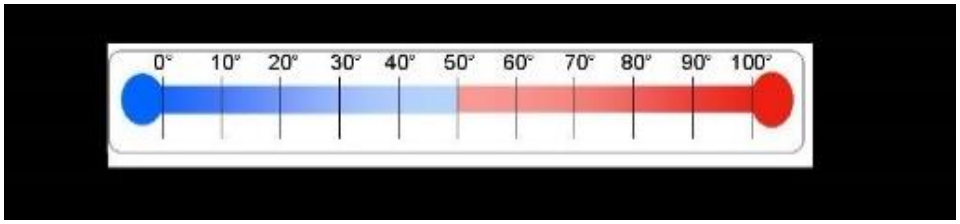
Items

1. Some groups of people are simply inferior to other groups
2. In getting what you want, it is sometimes necessary to use force against other groups
3. It's OK if some groups have more of a chance in life than others
4. To get ahead in life, it is sometimes necessary to step on other groups
5. If certain groups stayed in their place, we would have fewer problems
6. It's probably a good thing that certain groups are at the top and other groups are at the bottom
7. Inferior groups should stay in their place
8. Sometimes other groups must be kept in their place
9. It would be good if groups could be equal
10. Group equality should be our ideal
11. All groups should be given an equal chance in life
12. We should do what we can to equalize conditions for different groups
13. Increased social equality
14. We would have fewer problems if we treated people more equally
15. We should strive to make incomes as equal as possible
16. No one group should dominate in society

Feeling-Thermometer

Instructions

Please use this feeling thermometer scale of 0–100 to tell us how favorable or unfavorable you feel toward these groups: Arabs



Islamophobia Scale (English version; Lee, Gibbons, Thompson, & Timani, 2009)

Instructions

Using the scale below, please select the number that best describes to what extent you agree or disagree with each of the following items. There is no right or wrong answer. Please do not leave any item blank.

Response scale for all items

strongly disagree (1) (2) (3) (4) (5) strongly agree

Items

1. I would support any policy that would stop the building of new mosques (Muslim place of worship) in the UK.
2. If possible, I would avoid going to places where Muslims would be.
3. I would become extremely uncomfortable speaking with a Muslim
4. Just to be safe, it is important to stay away from places where Muslims could be
5. I dread the thought of having a professor that is Muslim.
6. If I could, I would avoid contact with Muslims
7. If I could, I would live in a place where there were no Muslims.
8. Muslims should not be allowed to work in places where many British gather such as airports.
9. Islam is a dangerous religion
10. The religion of Islam supports acts of violence.
11. Islam supports terrorist acts.
12. Islam is anti-UK
13. Islam is an evil religion.
14. Islam is a religion of hate.
15. I believe that Muslims support the killings of all non-Muslims
16. Muslims want to take over the world.

BIS/BAS Scale (English version; Carver and White, 1994)

Instructions

Indicate your agreement with the following statements by choosing the appropriate response for each. Please do not leave any statements unanswered.

Response scale for all items

strongly disagree (1) (2) (3) (4) strongly agree

Items

1. If I think something unpleasant is going to happen I usually get pretty "worked up.
2. I worry about making mistakes.
3. Criticism or scolding hurts me quite a bit
4. I feel pretty worried or upset when I think or know somebody is angry at me.
5. Even if something bad is about to happen to me, I rarely experience fear or nervousness.
6. I feel worried when I think I have done poorly at something.
7. I have very few fears compared to my friends.
8. When I get something I want, I feel excited and energized.
9. When I'm doing well at something, I love to keep at it.
10. When good things happen to me. it affects me strongly.
11. It would excite me to win a contest.
12. When I see an opportunity for something I like, I get excited right away.
13. When I want something. I usually go all-out to get it.
14. I go out of my way to get things 1 want.
15. If I see a chance to get something I want, I move on it right away.
16. When I go after something I use a "no holds barred" approach.
17. I will often do things for no other reason than that they might be fun.
18. I crave excitement and new sensations.
19. I'm always willing to try something new if I think it will be fun
20. I often act on the spur of the moment.

Manipulation of social context in Study 4 (Chapter 3)

Instructions

The article you are going to read is taken from "The Times" newspaper. Please read the article carefully, look at the picture and try to form a clear impression about the article as a whole. Then, you will be asked to answer some questions about what you have read.

Neutral scenario

London Arab-British Centre inauguration: A new step in the friendship between Britain and Arabia

The Times
23rd August 2017

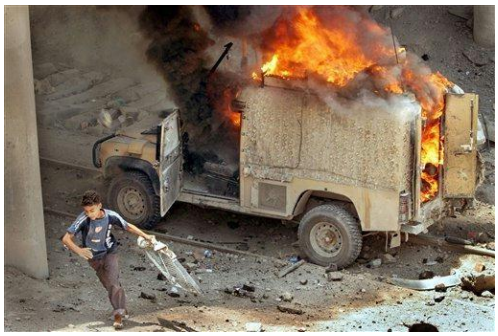
Description*: The Arab British Centre has been named co-winner of the prestigious UNESCO-Sharjah Prize for Arab Culture. The Centre has been recognized for the various activities and events organized, within and outside the Centre, to promote a better understanding of Middle East culture and foster intercultural dialogue*

"British Foreign Secretary, in conjunction with Labour Shadow minister Emily Thornberry on Sunday reiterated the UK's historic ties with the Middle east. Addressing a joint press conference during the inauguration of the Arab British Centre in London, he said, "I am here to emphasize the friendship that exists between Britain and our Middle Eastern friends. This friendship is developing and expanding, strengthening multilateral relations. And it is also fair to say that we believe in honesty in our relationship. Now is the time for us to talk about the many positive things that we are doing together" the Secretary said. Then, Thornberry added: "The Arab British Centre is a symbol of our friendship. We work to improve the British public's understanding of the Middle East. The Centre organizes cultural and artistic events relating to the Middle East to foster intercultural dialogue between British and Middle Eastern people."

Threatening scenario

Report: Strong Dislike for Brits in Iraq due to British military operations

The Times
23rd August 2017



Description: *A youth runs away with a piece of armor from a burning British military vehicle after a roadside bomb attack in Basra, Iraq. The bomb wounded two soldiers that required little medical attention, according to a British Army spokesman.*

"The British Army joined the coalition in a military intervention In Iraq to free the Iraqi people and achieve security. There, it is using hard-won experience to help to fight Islamic State, following a formal request for assistance from the Iraqi government. British forces in Iraq are not in a combat role but are on the ground providing training and equipment to Iraqi Security Forces (ISF). However, after months of work, many experts now are claiming that British operations in Iraq are increasing the willingness of Iraqis to engage in terrorism and violence. The result is that British people are strongly disliked and distrusted across the Middle East. The Shadow British Foreign Secretary said: "Our presence in Iraq has threatened the stability of the free world, has challenged the relationship between Britain and Middle East, increasing the likelihood of future attacks against the United Kingdom." Lone-wolf terrorist attacks, such as the one in Westminster last 22nd March are on the rise. A senior British military official told us "the question is when, not if" another large-scale terrorist attack will occur in Britain, and that "nowhere is absolutely safe from terror."