The Effect of Facial Attractiveness on Attentional Resource Allocation: The Moderating Role of Evolutionary Motivation

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Abstract

Facial attractiveness is believed to influence the allocation of attentional resources. However, the specific mechanisms through which facial attractiveness influences the allocation of attentional resources remain unclear. This study aims to investigate the effects of facial attractiveness on two attentional processes: attentional capture and attentional holding. Attentional holding refers to the difficulty in disengaging attention, whereas attentional capture refers to the initial orienting process of attention. This study will employ different visual search paradigms to measure the effects of facial attractiveness on these two distinct attentional processes, particularly by distinguishing between top-down and bottom-up forms of attentional capture. Furthermore, due to the evolutionary significance of facial attractiveness, this study will also examine the influence of facial attractiveness on attention under different evolutionary motivational states (self-protection and mate-selection motivation).

Full Text

Influence of Facial Attractiveness on the Allocation of Attentional Resources: The Moderating Role of Evolutionary Motivations

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Abstract

Facial attractiveness is believed to influence the allocation of attentional resources. However, the specific mechanisms through which facial attractiveness affects attention allocation remain unclear. This study investigates the effects of facial attractiveness on two attentional processes: attention capture and attention adhesion. Attention adhesion refers to the difficulty of disengaging attention from a stimulus, whereas attention capture refers to the initial orienting of attention toward a stimulus. This research employs different visual search paradigms to measure how facial attractiveness influences these distinct attentional processes, particularly by distinguishing between top-down and bottom-up attention capture within the attention capture domain. Moreover, due to the evolutionary significance of facial attractiveness, this study examines how facial attractiveness affects attention allocation when different evolutionary motivational states (self-protection and mating motivation) are activated.

Keywords: Facial attractiveness, Attention capture, Attention adhesion, Mating motivation, Self-protection motivation

1 Introduction

An increasing number of enterprises and organizations have adopted video conferencing for work-related communication. Unlike traditional face-to-face interaction, video communication provides limited information about the other party, conveying only voice, facial expressions, and partial body postures. In contrast, the shared social context and rich body language in face-to-face interactions facilitate the expression and perception of individual personality. However, online communication tends toward depersonalization, making the expression and perception of personality traits more difficult (Joseph, 2011), and consequently, the face becomes the primary channel for transmitting personal information. As a special information source, faces contain rich social information, and people often form intuitive impressions based on others' facial features and choose corresponding interaction strategies (Verplaetse et al., 2007; Cruz, 2018). Research has found that people can form perceptions of a stranger' s personality simply by viewing their face (Burg et al., 2019; Stirrat & Perrett, 2010; Todorov et al., 2005). Verplaetse et al. (2007) discovered that merely observing faces allows relatively accurate prediction of whether an individual will adopt cooperative strategies in games. Additionally, researchers found that inferring competence from politicians' facial information alone predicts U.S. congressional election outcomes far better than chance (Todorov et al., 2005). Management scholars have found that characteristics of leaders' faces (e.g., age, baby-facedness, width-to-height ratio) not only influence subordinates' attitudes and behaviors but can even provide information about objective organizational performance (Gao et al., 2016). The scope of facial research in organizational management is not limited to leaders' faces; whenever interpersonal interaction is involved in organizational management, faces almost always play a role. When we see a face, we perceive not only the face itself but also the social information it

contains, which subsequently influences our behavior.

Current research on faces in interpersonal interaction primarily focuses on later stages of cognitive processing, such as judgments of personality traits or leadership qualities. However, the influence of facial attractiveness on early cognitive stages (e.g., attention resource allocation) also warrants attention, as early attention forms the foundation for later processing. Visual input is the primary means through which humans obtain information from the external world (Fridlund, 1994). The visual system can efficiently handle multiple objects simultaneously mainly through our attention system' s regulation (Posner & Petersen, 1990). Visual selective attention determines which information will be attended to and which will be ignored, representing the initial stage of cognitive processing: attention resource allocation. Only objects that receive sufficient attentional resources can proceed to further processing in the brain.

Among various facial features, attractiveness is particularly crucial. Facial attractiveness is considered a valuable social asset in both marriage markets (Elder, 1969) and labor markets (Hamermesh & Biddle, 1994; Umberson & Hughes, 1987). For instance, research has found that physically attractive individuals have advantages in promotions and interviews (Dipboye et al., 1977). Studies also show that facial attractiveness is an important factor when selecting cooperation partners in social interactions. For example, participants playing prisoner' s dilemma games are more likely to cooperate with high facial attractiveness individuals (Mulford et al., 1998). However, research on how facial attractiveness affects attention resource allocation has not yielded clear conclusions, which is the focus of this study. Given the close relationship between facial attractiveness and mating motivation (e.g., Maner et al., 2007a; 2007b), this study further explores how different motivational states influence attention resource allocation. As a key evolutionary motivation, mating motivation is generally considered secondary to another evolutionary motivation: self-protection motivation. Research demonstrates an antagonistic relationship between these two motivations, where activating one inhibits the other (Tipper, 1992; Neuberg et al., 2004). Therefore, this study examines attention allocation priorities when these two motivations compete, helping us better understand the evolutionary significance of facial attractiveness.

2.1 Physical Attractiveness Stereotype

Walster et al.' s early experiments (1966) first introduced the concept of facial attractiveness into academic research, finding that in speed-dating scenarios, participants' sole determinant for continuing dates with randomly assigned partners was physical attractiveness, while social skills, intelligence, and personality showed no significant effects. This demonstrates the importance of physical attractiveness in mate selection. Subsequent research increasingly recognized the significance of physical attractiveness in interpersonal interaction. For example, merely observing facial images leads people to evaluate high facial attractiveness individuals as having better personalities, happier marriages, and

more successful careers (Dion et al., 1972), a phenomenon known as the "physical attractiveness stereotype" (Dion et al., 1972). Further research reveals that this stereotype manifests across many interpersonal contexts: cute infants receive more attention than less cute ones (Langlois et al., 1995); more attractive children receive less severe punishment from adults (Dion et al., 1972); in educational settings, students give more positive teaching evaluations to physically attractive teachers (Hamermesh & Parker, 2003); in the workplace, physically attractive executives have higher incomes (Hamermesh & Biddle, 1994); and in hiring and promotion processes, attractive candidates receive more favorable treatment (Dipboye et al., 1977).

Given these widespread advantages (Jones, 1995; Thornhill & Gangestad, 1993; Thornhill & Moller, 1997), researchers began investigating why physical attractiveness is so important (Rhodes, 2006). Some propose that physical attractiveness matters in human interaction because it reflects health status (Buss & Schmitt, 1993; Symons, 1995). Indeed, research finds that individuals with highly attractive faces are rated as healthier by opposite-sex observers (Grammer & Thornhill, 1994). Mate selection theory is most commonly used to explain human susceptibility to physical attractiveness (Langlois et al., 2000), proposing that high-quality mates provide direct benefits such as healthy genes for healthy offspring. Our preference for physical attractiveness serves to find high-quality mates, with facial attractiveness being one of the most important indicators. Scholars suggest that individual facial attractiveness has a direct and significant relationship with mate quality (Little & Perrett, 2002). For example, men tend to perceive women with high facial attractiveness as having stronger fertility and fewer health problems (Cunningham, 1986). Henderson and Anglin (2003) found a positive correlation between facial attractiveness and health in real life, using 50 photos from 1920s high school yearbooks and finding that individuals rated higher in facial attractiveness actually lived longer. These results suggest that facial attractiveness is important likely because it reflects individual health status and represents mate quality (e.g., Gangestad & Buss, 1993; Walster et al., 1966).

2.2 Facial Attractiveness and Attention Resource Allocation

Due to the evolutionary significance of facial attractiveness, people may be influenced by facial attractiveness when allocating cognitive resources, as human cognitive resources tend to prioritize mate-related information (Kenrick et al., 2003; Maner et al., 2003). This primarily reflects in attention resource allocation. Research shows that people intentionally allocate more attentional resources to potential mates (highly attractive opposite-sex faces), providing important insights into how the attention system prioritizes socially meaningful information. Current research on facial attractiveness and attention resource allocation includes four experimental paradigms.

First, Maner et al.' s (2003, Experiments 1-3) paradigm. In these experiments,

researchers had participants view simultaneously presented female faces of different attractiveness levels under two conditions: limited attention (shorter face presentation duration) and unlimited attention (longer presentation duration). Participants then estimated the proportion of attractive faces. Results showed that under limited attention, participants overestimated the proportion of attractive female faces, but under unlimited attention, estimates for attractive and unattractive faces were equivalent. Since participants could not view all faces under limited attention, this suggests they allocated most attention to attractive female faces, leading to overestimation. Conversely, with unlimited attention, they could view all faces, resulting in equivalent estimates. This indicates that female facial attractiveness can capture attentional resources during visual processing.

Second, Duncan et al.' s (2007) paradigm. This change detection task tested whether attention could be captured by facial attractiveness. Participants viewed an array of eight faces: two attractive/unattractive same/opposite-sex faces (2$×2×$2). One "target face" changed during presentation, and participants had to detect this change. Participants were categorized via questionnaire as either sexually unrestricted or sexually restricted (the former being more accepting of sex without emotional relationships). Results showed that sexually unrestricted men detected changes in attractive female faces faster than sexually restricted men, but no such effect emerged for female participants, suggesting sexually unrestricted men allocate more attentional resources to attractive female faces.

Third, Sui and Liu' s (2009) paradigm. This study tested whether attention allocation to high-attractiveness faces is mandatory. Participants determined whether a briefly flashed target letter ("T") was upright or inverted while ignoring a high-attractiveness face, low-attractiveness face, or square (control condition) flashed on the display's opposite side. Results showed longer response times for target letter orientation when high-attractiveness faces appeared compared to low-attractiveness faces or squares, indicating that highly attractive faces capture more attentional resources even when task-irrelevant.

Fourth, Liu and Chen' s (2012) multiple-object tracking paradigm. This study tested whether facial attractiveness affects tracking performance when simultaneously tracking multiple faces. Participants first saw ten small black squares, five of which turned white (indicating target face locations). These squares then became faces that moved randomly. Once motion stopped, all faces were occluded by black rectangles, and participants identified the locations of faces originally behind white squares. Results showed higher tracking accuracy when high-attractiveness faces were targets, supporting the notion that people allocate more attentional resources to high-attractiveness faces.

2.3 Literature Review

These studies demonstrate that facial attractiveness significantly influences attention resource allocation, directing more attention toward attractive faces. However, closer examination reveals three important issues requiring clarification. First, current experimental paradigms confound two main processes of attention resource allocation: attention capture (initial orienting toward which stimulus in the visual field attracts attention) and attention adhesion (difficulty disengaging attention after it has been oriented toward a stimulus). In other words, it remains unclear whether the observed attentional preference for facial attractiveness results from high-attractiveness faces capturing attention or from attention lingering on attractive faces (Fox et al., 2001; Devue et al., 2009). Fox et al. (2001) noted that existing paradigms cannot distinguish between attention capture and adhesion, finding through cueing paradigms (see also Posner et al., 1987) that threatening, neutral, and positive stimuli did not differ in attention capture, but participants took longer to disengage attention from threatening stimuli (attention adhesion), particularly for highly anxious individuals.

Second, previous research generally assumes that attractive faces capture more attention but fails to adequately distinguish between two types of attention capture: top-down attention capture (goal-driven) and bottom-up attention capture (stimulus-driven). Visual search or tracking tasks are influenced by two factors: task goals (whether we know what we' re searching for) and the stimuli themselves (how visual stimuli affect attention). When searching for a specific face among many images or tracking specific faces among many, only face images attract attention while non-face images do not. This represents top-down attention capture because we know our search target. In daily life, we typically have no specific visual search goal; instead, a stimulus' s unique features may capture our attention involuntarily—this is bottom-up attention capture, caused entirely by the stimulus' s distinctive features. Only sufficiently strong stimulus features can elicit bottom-up attention capture. In the facial attractiveness and attention capture literature, whether attractiveness as a facial feature is strong enough to cause bottom-up attention capture remains controversial (Sui & Liu, 2009).

Third, motivational states during facial information processing represent a critical issue. Given limited cognitive resources, their allocation is substantially influenced by motivational states. Research shows that depressed individuals attend to and remember negative information more readily, while anxious individuals attend more to threatening information (Öhman et al., 2001). Due to the evolutionary significance of facial attractiveness, how motivation influences attention allocation across faces of varying attractiveness has profound implications. For example, research indicates that when romantic feelings are primed (mating motivation), sexually unrestricted individuals attend more to attractive opposite-sex faces (Maner et al., 2007). However, can such brief priming truly alter attentional processing mechanisms? This study addresses this question while also examining self-protection motivation priming. Since self-protection moti-

vation has higher priority than mating motivation, will the facial attractiveness effect that emerges due to mating motivation disappear under self-protection motivation?

Building on previous research, this project proposes three questions regarding facial attractiveness' s influence on attention resource allocation: (1) Does facial attractiveness affect attention resource allocation through attention capture, attention adhesion, or both? (2) Is facial attractiveness as a stimulus feature distinctive enough to elicit bottom-up attention capture? (3) Can the two key evolutionary motivations—mating and self-protection—influence attention allocation across faces of different attractiveness levels, and if so, how?

3.1 Standard Definition of Facial Attractiveness

Although facial attractiveness is a subjective experience, research finds considerable consistency in attractiveness ratings across different cultural backgrounds (e.g., Langlois et al., 2000; Rhodes, 2006), suggesting universal evaluation standards exist. Previous research indicates that facial averageness, symmetry, masculine/feminine traits, pleasant expressions, makeup, youthfulness, and smooth skin significantly influence attractiveness ratings (Cunningham, 1986; Etcoff, 1999; Rhodes & Zebrowitz, 2002; Thornhill & Gangestad, 1999; Perrett et al., 1999). Rhodes (2006) identified three primary widely-adopted standards based on previous research. The first is facial averageness: Langlois and Roggman (1990) found that faces representing population averages are consistently rated as attractive. The second is facial symmetry: symmetrical faces created by blending normal faces with their mirror images are rated more attractive than slightly asymmetrical original faces (Rhodes et al., 1998; Rhodes, 2006). The third is facial sexual dimorphism (Rhodes, 2006; Koehler et al., 2004; Keating, 1985): masculine male faces and feminine female faces are perceived as more attractive. Masculine features primarily include prominent chins, cheekbones, brow ridges, mid-face regions (from eyebrows to nose base), and facial hair due to relatively high testosterone. Correspondingly, feminine features include less pronounced hair in these areas but fuller lips due to relatively high estrogen.

In current online communication software, computer graphics techniques enhance facial attractiveness by adjusting facial features rather than compositing multiple faces, as people prefer to retain individual characteristics, and multi-face composite images, while increasing attractiveness, weaken unique individual features (Langlois & Roggman, 1990; Rennels et al., 2008). Both averageness and symmetry involve compositing: averageness requires synthesizing numerous faces, while symmetry requires flipping and partial compositing of the current face. Adjustment of facial sexual dimorphism is the primary method for graphics enhancement in communication software, such as adjusting skin smoothness, eye size, lip thickness, and color. Facial secondary sexual characteristics convey information about gender and sexual maturity, signaling sexual maturity and mate potential, which is highly relevant to mating motivation and a source of attractiveness (Li et al., 2020; Johnston & Franklin, 1993; Symons, 1995; Thorn-

hill & Gangestad, 1996; Takahashi et al., 2006). This study particularly focuses on attention resource allocation to facial attractiveness under different motivational states (self-protection vs. mating motivation). Since masculine features are considered threatening and dangerous in some research (Zheng et al., 2017; Li et al., 2019; Rhodes et al., 1998), they may attract more attention under self-protection motivation. For these reasons, this project adopts facial sexual dimorphism as the standard for attractiveness research.

Research shows that higher femininity in female faces is generally perceived as more attractive. Rhodes's (2006) meta-analytic review found that increased femininity enhances female facial attractiveness across cultures, whether through objective facial feature measurement or subjective femininity ratings. Even studies using computer graphics to manipulate facial sexual dimorphism observe universal preferences for feminized female faces (Perrett et al., 1998). However, preferences for masculine features in male faces are inconsistent (Fink & Penton-Voak, 2002; Little et al., 2002; Rhodes, 2006). Some studies find that women prefer more masculine male faces. For example, Keating (1985) found masculine male faces were preferred over feminine ones (see also Grammer & Thornhill, 1994; Johnston et al., 2001). However, Perrett et al. (1998) used novel computer graphics technology to enhance or diminish facial sexual characteristics, finding that women rated significantly feminized male faces as most attractive (see also Penton-Voak & Perrett, 2000). Some research suggests these divergent findings result from different methods of processing masculine and feminine traits. Specifically, when using graphics technology to enlarge or reduce certain facial features to make faces more masculine or feminine, feminized male faces are rated more attractive. Conversely, when people rate natural male faces, those rated as masculine are also considered more attractive. This study will use natural face images from a Chinese face database to evaluate sexual dimorphism and attractiveness, and employ "morphing" technology to process faces with the highest sexual dimorphism ratings. Before using these processed stimuli, participants will be recruited to re-evaluate them to ensure differences in facial attractiveness levels.

3.2 The Role of Facial Attractiveness in Attention Capture

Faces provide rich information that may determine subsequent social interactions. For example, an angry face may signal potential warnings of imminent aggression and violence (Scherer & Wallbott, 1994) and is therefore likely detected quickly. Öhman et al. (2001) found that angry faces were detected faster than happy or sad faces in visual search tasks—this represents top-down attention capture because participants were instructed to search for faces differing only in expression. In fact, even neutral or expressionless faces can be salient stimuli producing bottom-up attention capture (e.g., Palermo & Rhodes, 2007). Given that (a) face processing is automatic, (b) facial attractiveness is important for mate selection, and (c) facial attractiveness can be evaluated even with limited visual information (Sui & Liu, 2009), it is reasonable to expect that

high-attractiveness faces should capture more attention than low-attractiveness faces in a bottom-up manner.

Research indicates that attention may be captured by high-attractiveness faces. However, controversy persists in the literature regarding whether high-attractiveness faces can elicit genuine bottom-up attention capture. According to Yantis (1993), genuine bottom-up attention capture must be independent of participants' goals and beliefs. That is, only when face images are not directly relevant to participants' tasks and participants are unaware of the relationship between the task and faces can genuine bottom-up attention capture be observed. However, most current paradigms studying facial attractiveness attention capture use face-related tasks directly, such as estimating proportions of attractive faces, detecting face changes, tracking multiple target faces, or searching for specific faces. In these tasks, participants expect to process face-related stimuli, so such paradigms can only demonstrate top-down attention capture effects. Although Sui and Liu' s (2009) paradigm used a task irrelevant to faces and presented faces away from fixation (potentially indicating bottom-up attention capture), faces appeared on two-thirds of trials —above chance level (50%)—so participants may have guessed the task was face-related. Thus, these results likely reflect top-down rather than bottom-up attention capture for facial attractiveness.

Few studies on facial attractiveness have employed truly bottom-up attention capture paradigms. However, research on faces themselves (rather than their attractiveness) has addressed pure bottom-up face attention capture. For example, Langton et al. (2008) had participants search for a non-face target (a butterfly) among six-item arrays containing fruits, flowers, leaves, trees, houseplants, and faces. Results showed longer search times for butterflies when faces appeared in the array than when they did not, indicating that face processing is unavoidable —attention shifts to faces regardless of goals. In this study, participants' goal was to find butterflies; faces could appear anywhere but were task-irrelevant. If butterfly search performance was affected by face presence, this would demonstrate bottom-up attention capture by faces. However, Langton et al. (2008) did not address facial attractiveness, only examining bottom-up attention capture by faces themselves. This study adapts this paradigm to investigate bottom-up attention capture by facial attractiveness.

Hypothesis 1: Facial attractiveness facilitates top-down attention capture.
Hypothesis 2: Facial attractiveness facilitates bottom-up attention capture.

For Hypothesis 1 (top-down attention capture), this study plans to adopt Levin' s (2000) visual search paradigm, Langton et al.' s (2008) visual search paradigm, and a modified cueing paradigm (Theeuwes & Stigchel, 2006). In Levin' s (2000) visual search paradigm, both targets and distractors are faces (differing only in attractiveness level), focusing on top-down attention capture. This paradigm measures attention capture through visual search asymmetry, first proposed by Treisman and Souther (1985), referring to differential search efficiency when searching for target A among background B versus target B among background

A. For example, searching for a complete circle among circles with gaps is easier than the reverse. In face research, Hansen and Hansen (1988) found visual search asymmetry between negative and positive emotional faces—searching for negative faces (e.g., angry) among positive (e.g., happy) or neutral faces was faster than searching for positive faces among negative or neutral backgrounds. This study' s adaptation of Levin' s (2000) paradigm involves participants first viewing a single target face, then indicating as quickly and accurately as possible whether the target face appears among subsequent face arrays. Response accuracy and reaction times are recorded. According to visual search theory, if facial attractiveness captures attention, searching for a high-attractiveness face among low-attractiveness faces (background) should be faster and/or more accurate than searching for a low-attractiveness face among high-attractiveness faces, demonstrating visual search asymmetry and a high-attractiveness advantage effect.

Langton et al.'s (2008) visual search paradigm simultaneously presents faces with other image types (e.g., leaves, fruits, animals). When faces are search targets, if facial attractiveness captures attention, searching for a high-attractiveness face among non-face background images should be faster and/or more accurate than searching for a low-attractiveness face under the same conditions.

In the modified cueing paradigm (e.g., Theeuwes & Stigchel, 2006), participants report the location of a dot (target). Before the dot appears, a cue image may appear at the same location (valid cue) or at a non-target location (invalid cue). Cue validity depends on whether the image effectively indicates the target location. This study uses faces as cue images. When the target dot appears at the cued location (valid cue), participants' response times reflect attention capture by the cue image. To observe top-down attention capture, participants are explicitly instructed to attend to face cue images when they appear. To ensure compliance, a face recognition task follows the location judgment, requiring participants to identify whether the face was the previously instructed cue face. Since participants are guided to attend to face images, any differences in responses to high- versus low-attractiveness faces reflect top-down attention capture.

For Hypothesis 2 (bottom-up attention capture), this study primarily adopts Langton et al.'s (2008) visual search paradigm and the modified cueing paradigm (Theeuwes & Stigchel, 2006). In Langton et al.' s (2008) paradigm, the distinction between top-down and bottom-up processing lies in instructions: the former explicitly asks participants to search for faces, while the latter asks them to search for non-face images. If faces are not targets, participants' visual systems are not prepared for face search. Therefore, if high-attractiveness faces in the display cause slower or less accurate search for non-face targets than low-attractiveness faces, this demonstrates bottom-up attention capture by facial attractiveness.

The modified cueing paradigm approximates natural visual search and avoids a fundamental problem in previous visual search paradigms: participants always

prepare to search for some target regardless of instructions. In the bottom-up attention capture version, participants receive no information about faces and are only told to respond to dot location. Face images appear as cues. When the target dot appears at the cued location (valid cue), any differences in responses to high- versus low-attractiveness faces reflect bottom-up processing.

3.3 The Role of Facial Attractiveness in Attention Adhesion

Maner et al. (2007) found that male participants took longer to disengage attention from attractive female faces than from less attractive female faces, indicating greater reluctance to shift gaze from attractive opposite-sex faces. Another study by the same team found that participants (regardless of gender) took longer to disengage from attractive female faces than from average female faces, but no similar effect emerged for male faces (Maner et al., 2007). Chen et al. (2012) found similar results using a different paradigm, where participants observed four simultaneously presented same-sex faces to detect whether any changed during presentation. Results showed longer observation times when four attractive faces were presented compared to four unattractive faces, suggesting attractive faces generate additional viewing time (attention adhesion). Leder et al. (2010) reported similar findings in eye-tracking data: people showed longer fixation durations on attractive than unattractive faces (see also Maner et al., 2003). These studies collectively indicate that once people notice attractive faces, they are reluctant to shift attention away from them.

Based on this converging evidence, this study proposes that facial attractiveness positively affects attention adhesion.

Hypothesis 3: Facial attractiveness enhances attention adhesion.

For Hypothesis 3 (attention adhesion), this study adopts Levin' s (2000) visual search paradigm and the modified cueing paradigm (Theeuwes & Stigchel, 2006). In Levin' s (2000) paradigm, since both targets and backgrounds are faces, if high-attractiveness faces indeed make attention difficult to disengage, then when backgrounds consist entirely of high-attractiveness faces without a target face, participants should take longer to search through all background faces than when backgrounds consist entirely of low-attractiveness faces. In the modified cueing paradigm (Theeuwes & Stigchel, 2006), participants report dot location rather than face identity. If high-attractiveness faces produce attention adhesion effects, then when face images are invalid cues (face location inconsistent with dot location), participants should respond slower or less accurately to target dot location with high-attractiveness faces than with low-attractiveness faces. This occurs because participants must disengage attention from the invalid high-attractiveness face cue (attention adhesion) and reorient to the target dot location.

3.4 Motivational States Moderate the Influence of Facial Attractiveness on Attention Allocation

Evolutionary psychologists propose that given the importance of survival and reproduction in evolution, stimuli related to these domains may receive priority in attentional processing. For instance, research shows that attention is more readily captured by threat-related stimuli (e.g., angry faces, snakes, or spiders) because noticing threatening stimuli first allows time for survival and facilitates self-protection (Neuberg et al., 2004). Simultaneously, attention may also be captured by mate-related stimuli (e.g., attractive opposite-sex faces) because this facilitates reproduction. However, only one of these motivations dominates at any given time—activating one inhibits the other (Tipper, 1992; Neuberg et al., 2004). For example, when mating motivation is activated, mate-related features become more noticeable while irrelevant features are ignored. Conversely, when self-protection motivation is activated, threat-related information becomes more noticeable while other information is likely ignored. Although both motivations have clear functional significance from an evolutionary perspective, when threat and mate-related stimuli appear simultaneously, self-protection should take priority over reproductive goals because failing to respond to threat-related information may result in injury or death, whereas missing mate-related information still allows future opportunities with other potential mates (Neuberg et al., 2004). While research exists on how threatening and mate-related stimuli separately affect attention mechanisms, few studies have simultaneously examined how these competing motivations influence attention mechanisms.

Leder et al. (2010) had participants view complex, realistic scenes with embedded attractive or unattractive faces. They found that mating-motivated male participants viewed attractive faces longer than unattractive faces. However, under self-protection motivation, male participants' viewing time of male faces was no longer affected by attractiveness. Yet even under self-protection motivation, male participants still viewed attractive female faces longer than unattractive female faces. The researchers explained that male faces represent high-aggression potential threats, so self-protection-motivated male participants focused only on the danger of male faces, ignoring mate-related information (attractiveness). Female faces, lacking threat, still allowed mate-related information (attractiveness) to influence attention. This illustrates how different motivational states increase sensitivity to different information types (Neuberg et al., 2004). These findings suggest that facial attractiveness' s influence on attention may strengthen when mating motivation is activated but weaken when self-protection motivation is activated.

Hypothesis 4: Mating motivation moderates the effect of facial attractiveness on attention resource allocation; activating mating motivation enhances the positive effect of facial attractiveness on attention allocation.
Hypothesis 5: Self-protection motivation moderates the effect of facial attractiveness on attention resource allocation; activating self-protection motivation weakens the positive effect of facial attractiveness on attention allocation.

For Hypothesis 4, this study plans to use Levin' s (2000) visual search paradigm, activating participants' mating motivation through images and videos before the visual search task. Images will be selected from the Chinese Affective Picture System as romantic or neutral. Videos will primarily use previously validated emotion-inducing clips (Bassett et al., 2002), with mating motivation priming videos excerpted from *Before Sunrise* and neutral videos showing fish swimming. Since this film is older and foreign, pilot testing will assess priming effectiveness, potentially replacing it with more culturally appropriate or recent clips if the effect is weak.

For Hypothesis 5, this study plans to use Levin' s (2000) visual search paradigm, Langton et al.' s (2008) visual search paradigm, and the modified cueing paradigm (Theeuwes & Stigchel, 2006). In Levin' s (2000) paradigm, consistent with Hypothesis 4, images and videos will activate self-protection motivation, with images selected from the Chinese Affective Picture System as dangerous or neutral, and self-protection priming videos excerpted from *The Shining*. In Langton et al.' s (2008) paradigm and the modified cueing paradigm (Theeuwes & Stigchel, 2006), self-protection motivation can be activated by presenting dangerous animal images. The former includes dangerous animals in presented images, while the latter uses dangerous animal images as valid or invalid cues. To enhance participants' awareness of dangerous animals' threat, they will read a paragraph describing the animal' s threatening nature (dangerous animals) or general habits (ordinary animals) before the task, following Neuberg et al. (2004). Afterward, participants will answer two questions to ensure they carefully read and understood the content.

4 Theoretical Framework

As online video communication becomes increasingly frequent, people increasingly value faces as important information sources in video communication. Because faces themselves, as special information sources, contain rich social information, people form intuitive impressions based on others' faces and choose corresponding interaction strategies (e.g., Verplaetse et al., 2007; Cruz, 2018). Previous research has found that people allocate more attentional resources to faces, particularly high-attractiveness faces (e.g., Rhodes, 2006), driving the development of various beauty-enhancement technologies for video faces. This study aims to contribute to understanding attention mechanisms in face processing by exploring how facial attractiveness affects different types of attentional processes.

First, this study distinguishes between attention capture and attention adhesion effects of facial attractiveness. Previous paradigms confounded these effects, making it unclear whether attentional preferences for facial attractiveness resulted from capture or adhesion. The paradigms employed in this study minimize attention adhesion effects when measuring attention capture, focusing participants' tasks on initial attentional orienting toward faces (attention capture) rather than later disengagement (attention adhesion). This allows relatively

independent observation of facial attractiveness' s effect on attention capture, while other paradigms specifically focus on attention adhesion effects, enabling clearer differentiation between the two processes.

Second, this study distinguishes between top-down and bottom-up attention capture by facial attractiveness. Most previous research on facial attractiveness and attention capture employed top-down paradigms without clearly distinguishing between top-down and bottom-up effects (Duncan et al., 2007; Maner et al., 2003). This study attempts to observe both capture modes independently. Based on previous research, we may find clear top-down attention capture effects for facial attractiveness. However, some researchers propose that if facial attractiveness is indeed a particularly strong facial attribute, this capture effect should also be noticeable through bottom-up processing (e.g., Theeuwes & Van der Stigchel, 2006; Theeuwes, 1991).

Finally, this study explores how different motivational states may differentially influence facial attractiveness' s effects on attention mechanisms. Human information processing capacity is considered inherently limited—people cannot attend to all information simultaneously (Pashler, 1994). Evolutionary psychologists propose that given the importance of survival and reproduction in evolution, self-protection or mate-related information may capture attention. While some research exists on mating motivation' s influence on facial attractiveness, few studies have examined how facial attractiveness affects attentional processing when mating and self-protection motivations compete for attentional resources—precisely this study' s focus. Our research investigates the processing preference mechanisms for attractive faces, which can help improve online video communication applications while enriching understanding of how facial attractiveness influences attentional processing mechanisms.

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Note: Figure translations are in progress. See original paper for figures.