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Perception of facial attractiveness requires some attentional resources: implications for the "automaticity" of psychological adaptations

Kyunghun Jung[a,*], Eric Ruthruff[a], Joshua M. Tybur[b], Nicholas Gaspelin[a], Geoffrey Miller[a]

[a]Psychology Department, University of New Mexico, Albuquerque, NM 87131-1161, USA

[b]Department of Social and Organizational Psychology, VU University Amsterdam, 1081-BT, Amsterdam, The Netherlands

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Abstract

Traditional criteria for modularity assert that perceptual adaptations for processing evolutionarily important stimuli should operate "automatically" in the sense of requiring no central attentional resources. Here, we test the validity of this automaticity criterion by assessing the attentional demands of a well-studied perceptual adaptation: judgment of facial attractiveness. We used locus-of-slack logic in a dual-task psychological refractory period paradigm, where Task 1 was a speeded judgment of tone pitch (low vs. high), and Task 2 was a speeded judgment of whether a face was attractive or unattractive, with the Task-2 judgment manipulated to have a low or a high difficulty level. In two studies (N=36 and N=73 female participants; 384 trials each), the Task 2 difficulty effects were additive with stimulus-onset asynchronies (100, 300, 500 or 900 ms) on Task 2 response times. According to the locus-of-slack logic, this result implies that participants could not discriminate facial attractiveness level, while their central attentional resources were still occupied by Task 1. If the human capacity for perceiving facial attractiveness—a premier example of an adaptation—does not show automaticity in this sense, automaticity may not be a useful criterion for identifying psychological adaptations.

Keywords: Facial attractiveness; Modularity; Automaticity; Dual task; Attention; Cognition; Chronometrics

1. Introduction

The human capacity to perceive facial attractiveness is one of the most exhaustively researched domains in all of evolutionary psychology and constitutes a premier example of psychological adaptation (Perrett, 2010; Rhodes & Zebrowitz, 2002). It also provides an excellent opportunity to test different modularity criteria proposed for psychological adaptations. Just before evolutionary psychology coalesced as a science, Fodor (1983) proposed that every psychological adaptation should have the following criteria of modularity: mandatory operation (automaticity), domain specificity, encapsulation, inaccessibility to consciousness, speed, shallow outputs, fixed brain location, and characteristic breakdown patterns. These Fodorian criteria inspired the "massive modularity" view of the mind that dominated evolutionary psychology from around 1990 onward and led to much research on which candidate adaptations fit which criteria. For example, DeSteno, Bartlett, Braverman, and Salovey (2002) took the automaticity criterion seriously to test putative adaptations for sexual jealousy. Using a dual-task paradigm, they examined whether sex differences in a jealousy judgment could occur independently of the cognitive load imposed by a concurrent digit-string memory task. They found that the memory task reduced sex differences in forced-choice judgments about whether sexual vs. emotional infidelity would be more upsetting and inferred that the sex difference in jealousy judgment was not fully automatic. Based on these results, they speculated that the sex difference in jealousy judgment does not reflect psychological adaptation.

Many of Fodor's criteria have come under fire in recent years. For example, the automaticity criterion was challenged by Pinker (1997), Sperber (2005), Barrett and Kurzban (2006) and others as irrelevant or misconceived. Barrett, Frederick, Haselton, and Kurzban (2006) argued specifically against DeSteno et al. (2002), cautioning that automaticity may be expected only for perceptual and cognitive mechanisms under heavy time pressure. In principle, if very fast, capacity-free processing was not required to solve some information-processing problem under ancestral

* Corresponding author. Tel.: 505-277-4339.
E-mail address: khjung@unm.edu (K. Jung).

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conditions, then there would have been no selection for automaticity in that psychological adaptation. In practice, though, some psychological adaptations seem to fire unavoidably, seem to run very fast and seem rather robust against interference from other tasks (e.g., see Öhman & Mineka 2001 for a discussion of the *fear module*). The automaticity debate has continued largely at the theoretical level, with little input from empirical research on whether specific psychological adaptations actually can operate automatically, that is, without interference from other concurrent tasks.

The aim of this study is to contribute to filling that empirical gap. We test whether the automaticity criterion accurately describes facial attractiveness perception using the psychological refractory period (PRP) paradigm that has been used in hundreds of cognitive psychology experiments (for reviews, see Lien & Proctor, 2002; Lien, Ruthruff, & Johnson, 2006; Marois & Ivanoff, 2005) but has not been widely used to test evolutionary hypotheses. Our goal here is not to test whether facial attractiveness perception is an adaptation—research review below puts that beyond reasonable doubt. Rather, our goal is to test whether automaticity is a useful criterion for identifying psychological adaptations.

Perception of facial attractiveness fits many of the criteria that have been proposed for identifying species-typical, psychological adaptations (Fink & Penton-Voak, 2002; Gallup & Frederick, 2010; Perrett, 2010; Rhodes & Zebrowitz, 2002; Rhodes, 2006). It emerges early in infant development (Geldart, Maurer, & Carney, 1999; Rubenstein et al., 1999; Slater, Quinn, Hayes, & Brown, 2000; Van Duuren, Kendell-Scott, & Stark, 2003). It shows many similarities across cultures (Cunningham, Roberts, Barbee, Druen, & Wu, 1995; Langlois et al., 2000; Rhodes, Lee et al., 2005; Rhodes, Yoshikawa, et al., 2001). Its early stages can occur preattentively (Palermo & Rhodes, 2007) in specialized brain areas, such as the fusiform face area and lateral occipital cortex (Chatterjee, Thomas, Smith, & Aguirre, 2009) and right orbitofrontal cortex (Tsukiura & Cabeza, 2011). It focuses on facial cues thought to reveal underlying genetic quality and phenotypic condition (Grammer, Fink, Møller, & Thornhill, 2003; Lie, Rhodes, & Simmons, 2008; Thornhill & Gangestad, 1999), including bilateral symmetry (Jasienska, Lipson, Ellison, Thune, & Ziomkiewicz, 2006; Jones et al., 2001; Koehler, Rhodes, & Simmons, 2002; Rhodes, Zebrowitz et al., 2001), structural averageness (Komori, Kawamura, & Ishihara, 2009a,b; Little & Hancock, 2002; Rhodes, 2006), sexually dimorphic hormone markers (DeBruine et al., 2006; Johnston, Hagel, Franklin, Fink, & Grammer, 2001; Law-Smith et al., 2006; Little, Jones, DeBruine, & Feinberg, 2008; Thornhill & Gangestad, 2006), and quality of skin and lip coloration (Matts, Fink, Grammer, & Burquest, 2007; Stephen & McKeegan, 2009). Some aspects of female perception of male facial attractiveness show adaptive shifts across the ovulatory cycle (Anderson et al., 2010; Jones et al., 2008). Face attractiveness perception is also sensitive to cues of self-resemblance (DeBruine, Jones, Little, & Perrett, 2008) and cues of youthfulness (Gunn et al., 2009).

Given its impressive credentials as an adaptation, we might expect facial attractiveness perception to fit the classic Fodor (1983) mandatoriness/automaticity criterion. Mandatoriness means that once a relevant (domain specific) stimulus is presented, the modular process should start without any voluntary intention and should proceed without conscious awareness or control. This mandatoriness is often referred to as automaticity (Barrett & Kurzban, 2006), but automaticity can mean a few different things (Bargh, 1994; Palermo & Rhodes, 2007). For example, automaticity can mean processing of a stimulus without focused attention or conscious awareness (Bargh, 1997). Automaticity can also mean that a process is rapid (Palermo & Rhodes, 2007). Finally, automaticity can mean a process that requires little or no attentional resources, so it would not interfere with other tasks that require attentional resources (Schneider & Chein, 2003). Below, we will address several different meanings of automaticity with respect to facial attractiveness perception and then describe the specific concept of automaticity we are going to test in the current study.

1.1. The automaticity of facial attractiveness perception

To investigate whether a target stimulus can be processed without a participant's focused attention or conscious awareness, many studies use brief target presentation with forward and/or backward masks. Olson and Marshuetz (2005) showed that participants could unconsciously perceive the attractiveness level of a face presented for only 13 ms with forward and backward masks. Based on a study using a similar experimental setting with a target face presentation time of 100 ms, Locher, Unger, Sociedade, and Whal (1993, p. 741) concluded that "perception of differential attractiveness occurs effortlessly or automatically with the initial encoding of sensory data." Electrophysiological studies have also provided evidence of very rapid facial attractiveness perception, suggestive of automaticity. Werheid, Schacht, and Sommer (2007) observed that, while their participants were performing facial attractiveness judgments, attractive faces induced an early posterior negativity (EPN) between 230 and 280 ms after target onset, indicating fast appraisal of facial attractiveness. In another study, Schacht, Werheid, and Sommer (2008) also observed early event-related brain potentials (~150 ms after stimulus onset) from attractive and unattractive faces compared with intermediate faces. Hooff, Crawford, and Vugt (2010) further reported that task-unrelated attractive or unattractive opposite-sex faces induced large P2 amplitudes (observed in a similar time window as the EPN: 150–250 ms), suggesting a fast attentional bias toward attractive or unattractive faces rather than intermediate level faces.

The studies mentioned above support the notion that facial attractiveness perception is automatic in the sense of