



# Emotion expression modulates perception of animacy from faces



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## HIGHLIGHTS

- Participants rated whether faces appeared animate at points along a morph continuum.
- Animacy perception was influenced by both stimulus and individual variability.
- Male faces were judged to appear more animate than female faces.
- Happy faces were perceived as more animate than neutral faces.
- An externally-oriented thinking style was associated with lower animacy thresholds.

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## ABSTRACT

Discriminating real human faces from artificial can be achieved quickly and accurately by face-processing networks, but less is known about what stimulus qualities or interindividual differences in the perceiver might influence whether a face is perceived as being alive. In the present studies, morphed stimuli differing in levels of animacy were created. Participants made judgements about whether the face appeared animate at different levels along the morph continuum. The faces varied in terms of emotional expression (happy vs. neutral) and gender. Male faces were judged to be animate at a lower threshold (i.e., closer to the inanimate end of the continuum) than female faces. Animacy was also perceived more readily in faces with happy expressions than neutral. These effects were observed across two separate studies involving different participants and different sets of stimuli (animate faces morphed with dolls or those morphed with computer generated faces). Finally, the influence of interindividual variability in personality traits on animacy perception was examined. This revealed that an externally oriented cognitive style, a component of alexithymia, was associated with lower thresholds for perceiving animacy, for animate faces morphed with dolls. The findings are discussed in relation to inter- and intra-individual variability in animacy perception and social interaction.

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## 1. Introduction

The accurate identification of animate (i.e., living beings capable of independent actions, thoughts, and emotions) human faces from inanimate objects is vital for social interaction and carries a key evolutionary advantage. This process relies on perceptual cues from the whole face, including structural and featural information (Balas & Horski, 2012; Balas & Tonsager, 2014). Two features of particular importance are the eyes and mouth (Looser & Wheatley, 2010), which are thought to play a key role in detecting animacy as they convey socially relevant information such as speech, intentions, and emotional expressions (Emery, 2000; Langton, Watt, & Bruce, 2000).

Previous experiments on the perception of animacy have used stimuli that are morphed between human and dolls' faces, and report a threshold for perceiving life at 67% (Looser & Wheatley, 2010). Several studies also compare the 'Point of Subjective Equality' (PSE). This refers to the point on the morph continuum at which stimuli are judged to be 50% animate. A stimulus at this point on the continuum is therefore equally likely to be perceived as either animate or inanimate. This point consistently falls closer to the animate end of the stimulus continuum, and ranges between 56–68% (Balas, 2013; Balas & Horski, 2012; Hackel, Looser, & Van Bavel, 2014; Looser & Wheatley, 2010). Two stimulus factors that have been shown to influence the PSE are the social identity of the stimulus (e.g. Hackel et al., 2014; Swiderska, Krumhuber, & Kappas, 2012) and stimulus gender (e.g. Balas, 2013). With regards to gender, Balas demonstrated that female faces are less likely to be perceived as animate than male faces; and animate faces less likely to be perceived as female than male. These results have led to suggestions that they reflect the dehumanisation or objectification

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of the faces of women (Balas, 2013), but this has not yet been empirically tested for animacy perception. A purely perceptual account of why gender of a face may influence animacy judgments can also be made. Female faces are associated with narrower jawlines and lighter skin pigmentation compared with male faces (Brown & Perrett, 1993; Frost, 1988) and as such share a closer similarity with the doll faces typically used in animacy experiments than male faces do. This may result in female face stimuli being rated as less animate than male stimuli. These differing hypotheses are not mutually exclusive, and it is possible that both processes contribute to the reported gender differences in animacy perception. Here we sought to investigate both the objectification and perceptual hypotheses of gender difference. Objectification is addressed by incorporating a measure of the extent to which participants objectify women's bodies. If objectification underlies the gender differences seen in animacy perception, then participants who demonstrate greater objectification of women should show higher animacy thresholds for female faces than those who score low on objectification of women.

In addition to gender and social identity a number of other factors may be important to animacy perception. For example, face perception research frequently uses achromatic stimuli to avoid confounding effects of differences in facial pigmentation. However, the majority of previous facial animacy perception studies (Balas, 2013; Hackel et al., 2014; Looser & Wheatley, 2010; Powers, Worsham, Freeman, Wheatley, & Heatherton, 2014; Swiderska et al., 2012; Wheatley, Weinberg, Looser, Moran, & Hajcak, 2011) have used chromatic stimuli. It is therefore unclear how important colour cues such as skin pigmentation are for detecting animacy in a face. This casts some doubt on the validity of comparing animacy thresholds for different stimulus faces (e.g. gender and racial groups) where colour cues have not been controlled. Where achromatic stimuli have been used (Balas & Koldewyn, 2013; Balas & Tonsager, 2014; Looser, Guntupalli, & Wheatley, 2013), there has been no direct comparison of achromatic and chromatic stimuli, and so it remains unclear whether the results can be applied to animacy judgements made with chromatic stimuli, either in previous studies or real-world perception.

Further, to our knowledge, no previous research on animacy perception has considered the effect of the emotional expression of the stimulus on animacy thresholds. The studies mentioned above have averaged together ratings for several different stimuli, regardless of the emotion expressed. Given the social significance of emotion expression (Keltner & Kring, 1998), it seems likely that this factor may influence animacy perception from faces. More specifically, if animacy reflects a capacity for experiencing emotion (Looser et al., 2013), it follows that a face expressing emotion would be more likely to be perceived as animate than a face with neutral expression. The importance of the eyes and mouth in making animacy judgements (Looser & Wheatley, 2010) lends further support to this hypothesis, since these features are also particularly relevant for conveying and perceiving emotion (Eisenbarth & Alpers, 2011; Emery, 2000; Langton et al., 2000; Yuki, Maddux, & Masuda, 2007). Collectively, this evidence indicates that emotional expression may influence animacy perception judgements.

In conjunction with properties of the stimulus, individual differences in the observer can influence animacy perception judgements. For example, the readiness with which facial animacy is perceived has recently been linked to the desire for social connection. In this study by Powers et al. (2014), scores on a Need to Belong Scale (NTBS; Leary, Kelly, Cottrell, & Schreindorfer, 2013) correlated with animacy perception thresholds, such that individuals with a greater desire for social acceptance and belonging perceived animacy at a lower threshold. Further, participants subjected to an experimental manipulation to induce feelings of social disconnection also judged animacy to occur at a lower threshold than those who received a 'socially connected' induction. The authors proposed that these results reflect an adaptive strategy on the part of individuals who feel socially isolated, where perceiving animacy more readily increases the likelihood of valuable social interaction. This idea ties in with the suggestion that animacy is perceived

more readily for in-group members than out-group due to a greater motivation for social interaction with the in-group (Hackel et al., 2014). If attributing animacy to an ambiguous stimulus indeed reflects a strategy to gain social interaction, then thresholds should also be lower for individuals with increased loneliness. Epley, Akalis, Waytz, and Cacioppo (2008) report that self-reported loneliness correlates positively with mental state attribution in objects. In this study more lonely individuals were more likely to describe an inanimate object as having "a mind," "intentions," and "emotions." Further, experimentally induced social disconnection led to greater attribution of anthropomorphic traits related to social connection to their pets. As yet the relation between loneliness and animacy perception has not been explored.

Previous results linking desire for social connection with increased animacy perception (Powers et al., 2014) suggest that other social factors may also influence how animacy is perceived. Individuals with high trait social anxiety appear to demonstrate attentional biases towards socially relevant stimuli. However, the direction of this bias is not yet clear, with increased attention observed in certain contexts, and avoidance in others (for reviews see Bögels & Mansell, 2004; Heinrichs & Hofmann, 2001). In either case we might predict socially anxious individuals to demonstrate altered detection of animacy in human faces, compared with controls. In the case of increased attention, individuals with social anxiety may identify animacy more readily, leading to lower animacy thresholds; and in the case of avoidance individuals may be less likely to detect animacy in the face, leading to higher thresholds. Evidence from Epley et al. (2008) favours the former hypothesis, demonstrating that experimentally induced fear leads to greater likelihood of perceiving faces in ambiguous line drawings, compared with induced social disconnection. The hypothesised relation between social anxiety and animacy perception therefore provides an interesting research question, as well as a tool for understanding the cognitive biases associated with the condition.

A final trait factor that could be implicated in the detection of animacy is alexithymia. Alexithymia is a subclinical personality trait reflecting difficulties identifying and describing emotions, and the tendency to focus attention externally, while reducing emotional experiences (Bagby, Parker, & Taylor, 1994). It is reported in higher levels in males than females (Franz et al., 2008). Alexithymia is thought to involve deficits in processing emotion information (Lane et al., 1996) and in facial emotion recognition specifically, though studies of the latter have so far yielded mixed results (Cook, Brewer, Shah, & Bird, 2013; Grynberg et al., 2012; Jongen et al., 2014; Pandey & Mandal, 1997; Parker, Taylor, & Bagby, 1993). If, as we hypothesise, emotion recognition is involved in detecting animacy, then it may follow that individuals high in alexithymia show differential facial animacy processing, compared with those who score low. Alexithymia has also been associated with impairments in empathy (Bird et al., 2010; Parker, Taylor, & Bagby, 2001) and in 'mentalizing,' understanding the mental states of others (Moriguchi et al., 2006). Since animacy perception involves making a judgement about whether a stimulus has the capacity to possess mental states, this provides further support for the notion that alexithymia would be associated with reduced perceptions of animacy.

### 1.1. Current study

With the aforementioned studies in mind, the current online study compared the effect of stimulus qualities and individual differences of the perceiver on perception of animacy in ambiguous face stimuli. These stimuli were created by morphing images of human faces with visually matched doll faces that varied in colour (achromatic vs. chromatic), gender (male vs. female) and emotional expression (happy vs. neutral). The influence of individual differences in the perceiver relevant to social interaction on animacy judgements was also assessed. The relation between interindividual variability in the following traits and facial animacy perception were examined: 'Need to Belong' (as

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