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# Facial cues to depressive symptoms and their associated personality attributions

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ABSTRACT

Depression is a common mental health disorder, with 12% of the UK population diagnosed at any one time. We assessed whether there are cues to depressive symptoms within the static, non-expressive face, and if other socially relevant impressions might be made by these cues. Composite "average" face images were created from students scoring high and low on self-report measures of depressive symptoms, capturing potential correlations between facial appearance and symptoms of depression. These were then used in a warping procedure, creating two versions of individual faces, one warped towards the high symptom composite, and the other towards the low. In Experiment 1, we first found observers were able to identify images representing high and low symptom occurrence at levels significantly greater than chance. Secondly, we collected observer impressions of the two versions of each face. The faces reflecting high levels of depressive symptoms were picked as less socially desirable over a broad range of personality trait estimates compared to low symptom images. In Experiment 2, we replicated the key finding that the static face contains cues to levels of depression symptoms, using composites created from a new database of student photos and depression inventory scores.



## 1. Introduction

Depression is a disabling mental disorder which affects 12% of the adult UK population at any one time (Singleton et al., 2001). The effect of this widespread diagnosis is far-reaching; by 2030, depression is proposed to be the second largest cause of world-wide disability, rising to the leading cause in high-income countries (Mathers and Loncar, 2006). At an individual level, those with depression are more likely to have fewer qualifications, a lower socioeconomic status (Singleton et al., 2001), and form a group that have a higher suicide incidence rate than the general population (Simon and Vonkorff, 1998). Depression also has a negative impact on the economy, with patients requiring more doctors, community care and medication than others (Singleton et al., 2001). A deeper understanding of the ability to discriminate between individuals with and without depressive symptoms, alongside how this affects perceptions of social desirability, may aid knowledge of the social implications of perceived depression.

There are two main types of cues that could be utilised to help discriminate between depressed and non-depressed individuals. The first considered here is that of live cues, where participants are able to use cues from body motions. In a study of "thin slices" of non-verbal behaviours and appearance, Waxer (1976) showed two-minute silent video segments of depressed and non-depressed patients to undergraduate and clinical graduate students. The patients' Minnesota Multiphasic Personality Inventory depression subscale scores and participants' depression ratings showed a correlation of 0.60, suggesting an ability to recognise depressive symptoms from non-verbal cues. These live cues included information from physical movements such as body motion, facial expressions, posture and proximity to others which could help to identify individuals with depression. Use of these live cues has been explored in other studies; for example, Michalak et al. (2009) found that body motion in minimal point-light displays was a reliable cue to depression, with depressed participants walking more slowly and with less amplitude in limb movements. Geerts and Brüne (2011) discuss findings of other live cues of depression, such as the ability to predict depression course from the impaired social behaviour of depression-prone patients.

However, recent research indicates an unexpected richness from a second type of cue — static cues. An example is the static, non-expressive face. Many of the Big Five personality traits, as measured by self-report, can be accurately estimated from "passport"-type photographs of people looking straight-ahead and with a neutral expression, both using individual photos (Penton-Voak et al., 2006) and composite images comparing the highest and lowest trait levels (Little and Perrett, 2007; Kramer and Ward, 2010). Composite images are computer-generated averaged faces of a number of individuals. These composite images reduce

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individual variation and preserve the common facial features of those within the group. Besides Big Five personality traits, the face can also reliably cue socially relevant traits such as socio-sexual orientation (Boothroyd et al., 2008) and trustworthiness (Stirrat and Perrett, 2010).

Limited research has been conducted into the ability to recognise clinically related conditions from facial images. Shevlin et al. (2003) demonstrated that participants were able to accurately judge levels of psychoticism from facial photographs. However, as jewellery, clothing and hairstyles of the stimuli were not kept consistent, it cannot be determined whether the accuracy reported is a product of facial cues, or aided by additional cues such as clothing type. Research by Holtzman (2011) has helped to overcome these criticisms by using images in which individuals have removed all make-up and jewellery, and tied their hair away from their face. Even after removing these confounds, participants were able to accurately identify the 'dark triad' of personality disorders (machiavellians, narcissists and psychopaths) from composite facial images.

Results like those above raise the question of whether reliable cues for symptoms of depression (and other mental health conditions) may be present in the non-expressive face. The possibility of a link between facial appearance and symptoms of depression is strengthened by two findings. First, high trait Neuroticism is a risk factor for depression; and second, trait Neuroticism is one of the factors reliably signalled on the face. We discuss these findings in turn.

Personality traits are heritable constructs that serve as risk factors for mental health disorders (Krueger et al., 2000; Sen et al., 2003). Neuroticism has been identified as a personality trait with special importance for depression, as it may increase the likelihood of an individual experiencing distress (Bagby et al., 1996), which can in turn manifest itself as anger, anxiety or depression (Bagby et al., 1997). Indeed, individuals with depression are consistently found to have higher than average levels of Neuroticism (Widiger and Trull, 1992; Trull and Sher, 1994; Bagby et al., 1997). Although there is controversy surrounding the direction of the neuroticism–depression link, the general consensus suggests that Neuroticism forms a diathesis for depression (Trull and Sher, 1994; Krueger et al., 2000). The ability to use Neuroticism levels to predict later depression provides some supporting evidence for this theory (Roberts and Kendler, 1999).

Neuroticism also seems to be one of the traits which is most reliably signalled from the neutral face. Kramer and Ward (2010) found that composite images of women with high and low levels of trait Neuroticism could be identified at levels significantly greater than chance, even from internal facial features alone. In fact, Kramer and Ward (2010) found that removing the outer facial features (top of the head, jaw-line, etc.), leaving only the eyes, nose, and mouth areas within the images, did not impair identification of Neuroticism. More recently, Jones et al. (2012) created high and low Neuroticism composite images on the basis of 3D facial scans, to remove potential postural or alignment cues from subsequent comparisons. Again, identification of Neuroticism composites was robust even without these cues.

We sought to determine whether symptoms of depression might be similarly cued in the static, non-expressive face in two experiments. In Experiment 1, we tested the possibility that, within a non-clinical sample, people who score high for symptoms of depression have a distinct facial appearance from those who score low for depressive symptoms, and if so, whether such differences in appearance can be identified by untrained observers. We also explored how appearance impacted observer impressions of "social desirability", that is, whether the person depicted in the photo was perceived to be a desirable social partner. In particular, we examined whether the facial appearance correlated with depressive symptoms might leave negative impressions on observers. These observer impressions might be important even if they are not accurate, as they could mean that people at risk of depression receive unfavourable social reactions, even in the absence of overt depressive behaviour. This unfavourable reaction could then increase social isolation and negative social consequences associated with depression. In Experiment 2, we created a new database of photographs and depression inventory scores, to replicate the identification task used in Experiment 1, with a new set of composite images.

## 2. Experiment 1

### 2.1. Method

This experiment consisted of two phases, the first of which ("stimulus creation") involved the collection of photographs and a measure of depressive symptoms to create our face stimuli. In the second phase, these stimuli were used to investigate the ability of observers to discriminate between faces representing high and low depression symptom occurrence (Experiment 1a), and to measure observer impressions from the high and low images of important social traits (Experiment 1b). All stages of the study were approved by Bangor University's departmental ethics committee.

#### 2.1.1. Stimulus creation

Our aim in this phase was to create stimuli which reflected the actual differences, if any, in the faces of people who report high and low levels of depressive symptoms. To do so, we created composite ("averaged") images from the faces of people who reported they had high levels of depressive symptoms, and another set of composites from the faces of people reporting low levels of symptoms. These composites were then used as anchor points to let us create new images, by warping individual faces towards the high and low depression appearances.

*2.1.1.1. Participants.* Two hundred and twenty five Bangor University students (130 females, age $M=21.45$, S.D.$=5.04$) were recruited and paid £5 for their participation.

*2.1.1.2. Measures.* Depressive symptoms were assessed using questions based on the revised Beck's depression inventory (BDI, Beck et al., 1996), in which depression symptom severity was indicated on a 4-point Likert scale ranging from 0 (disagree) to 3 (very much agree). Summed scores on the BDI can give an indication of depressive symptom severity, with scores between 0 and 13 indicating minimal depression, 14 and 19 mild, 20 and 28 moderate and 29 and 63 severe depression (Beck et al., 1996). Question nine, asking participants about suicidal thoughts, was removed in accordance with the Bangor University's departmental ethics committee, resulting in a 20 item questionnaire with a possible score range of 0–60. This adaption did not appear to impact upon the reliability of the questionnaire (Cronbach's $\alpha=0.91$). Male scores ranged from 0 to 49, $M=14.94$, S.D.$=12.36$, female scores ranged from 0 to 43, $M=16.41$, S.D.$=10.53$. These scores were later used to separate individuals reporting the highest and lowest levels of depression symptoms; purely for simplicity of exposition, these will be referred to as depressed and non-depressed groups, although to be clear, these were both non-clinical samples.

*2.1.1.3. Procedure.* Facial photographs were taken with a professional camera from a distance of 2 m whilst camera height, zoom and flash were kept consistent. Participants were