



## From Likert scales to images: Validating a novel creativity measure with image based response scales



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### ABSTRACT

The use of image-based testing to assess individual differences has increased substantially in recent years, with proponents arguing that they offer a more engaging alternative to text-based psychometric tests. Yet research examining the validity of these tests is near to non-existent. Traditional image-based formats have been little more than an adaptation of self-reports, with images replacing questions but not response options. The current study develops a novel image-based creativity measure, where images replace conventional response scales, and scores on the measures are obtained using a linear regression scoring algorithm to predict three self-reported creativity measures. Using sequential forward selection on a set of 77 image-based items, an optimal solution of 14 items that were valid predictors of self-reported creativity scores were identified. The image-based measure had good test-retest reliability. Implications are discussed in terms of the usefulness of image-based testing for practitioners seeking engaging and short test formats.

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### 1. Introduction

The assessment of individual differences in psychological traits, such as personality, intelligence, and creativity, stretches back more than a century (Chamorro-Premuzic, 2007). The most common way of measuring differences between people is through psychometric tests (Ahmetoglu & Chamorro-Premuzic, 2013). Psychometric tests are used extensively in settings from selection (Rothstein & Goffin, 2006) to psychiatric diagnosis (Gilbody, Richards, Brealey, & Hewitt, 2007), and consumer profiling (Matz, Gladstone, & Stillwell, 2016). Despite their widespread use, psychometric tests are criticised for their inability to engage the test taker (Krosnick, 1991), the ease of faking responses (Morgenson et al., 2007), and adverse impact (Hough, Oswald, & Ployhart, 2001).

Perhaps in response to these criticisms, and fuelled by technological advances, recent years have seen mounting interest in more engaging forms of assessment (Attali & Arieli-Attali, 2015), including gamification (Chamorro-Premuzic & Steinmetz, 2013; Landers & Callan, 2011; Reeves & Read, 2013) and social media analytics (Kosinski, Matz, & Gosling, 2015; Pennebaker, 2011). However, innovative assessment tools often serve entertainment purposes, with little indication to their validity (Naglieri et al., 2004). The increase in the quantity of these instruments has not been synonymous with an increase in research into their quality, that is, their reliability and validity. Indeed, the desire to use innovative assessment by professionals has outpaced the peer-

reviewed literature (e.g., Roth, Bobko, Van Iddekinge, & Thatcher, 2013). This gap between research and practise is problematic if tests are used to make hiring decisions or provide clinical diagnosis.

Consequently, developing scientific evidence for the validity and utility of image-based tests is critical, not only from an academic, but also an applied perspective. The current study takes a step in this direction. Specifically, an image-based creativity assessment and a predictive scoring algorithm are developed. The test-retest reliability, as well as its concurrent validity in relation to three text-based, self-report creativity measures are assessed, so that practitioners may better understand how such image-based tests compare to traditional tests.

#### 1.1. Advantages of image-based formats

One of the most common innovations in psychological assessment formats has been to replace item questions with visual representations, thereby increasing user engagement (Barrett & Ebbeling, 2003; Downes-Le Guin, Baker, Mechling, & Ruylea, 2012; Hamari, Koivisto, & Sarsa, 2014; Lugtigheid & Rathod, 2005). Beyond engagement, image-based formats could provide theoretical and practical advantages over text-based psychometric tests. First, they may be more suitable for culturally and linguistically diverse test takers, and remove misunderstanding of text items (Paunonen, Jackson, & Keinonen, 1990). Second, responding to image-based items may require less attention, reducing test taker fatigue. Finally, image stimuli evoke stronger preferences in respondents than verbal stimuli, providing for reduced length of image-based tests (Lugtigheid & Rathod, 2005; Meissner & Rothermund, 2015).

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## 1.2. Past research on image-based tests

Despite being innovative, image-based formats in assessment are not new. Geist's (1959) Pictorial Interest Inventory pictures a person engaged in three activities, of which respondents pick the most appealing one. More recent image-based tests adapt text-based personality measures such that the question is replaced with an image: The Nonverbal Personality Questionnaire (Paunonen et al., 1990) measures Murray's (1938) psychological needs such that participants report the likelihood that they would engage in visually displayed behaviours. A version of the test measuring the Big Five also exists (Paunonen, Ashton, & Jackson, 2001).

These adaptations of verbal personality tests have gained support in the academic literature for their internal reliabilities and validities (Hong, Paunonen, & Slade, 2008; Moore, Schermer, Paunonen, & Vernon, 2010; Paunonen, 2003; Paunonen, Jackson, Trzebinski, & Forsterling, 1992; Paunonen, Zeidner, Engvik, Oosterveld, & Maliphant, 2000). However, research examining the validity of image-based tests is scarce, and their use is mostly limited to special populations, such as children or illiterates. In addition, the use of response scales and scoring methodologies developed for verbal formats is not ideal: by using images to replace the question stem, questions are limited to those that can be visually represented.

## 1.3. Assessment of creativity

Creativity encompasses both personality and cognitive aspects related to the production of unique and useful ideas (Runco & Jaeger, 2012; Simonton, 2000). Three of the many components associated with creativity are: Cognitive Flexibility, the ability to switch cognitive sets to adapt to changing environmental stimuli (Scott, 1962); Curiosity, the recognition, pursuit, and intense desire to explore novel and uncertain events (Kashdan & Silvia, 2009) and Openness to Experience, the Big Five personality trait considered as a proxy of creativity (Feist, 1998; Furnham & Bachtiar, 2008; Martindale, 1989).

Because of the broadness of the construct, multi-trait, multi-method approaches have been proposed as most suitable (Cropley, 2000; Plucker & Makel, 2010). An image-based measure of creativity may add to this array of measurement methodologies available for creativity testing. In addition, image-based response scales may be particularly effective in measuring creativity because images elicit aesthetic preferences, such as preferences for complexity, which in turn are indicative of self-reported creativity and aesthetic styles (Barron, 1953; Chamorro-Premuzic, Reimers, Hsu, & Ahmetoglu, 2009; Rawlings, 2003; Swami, Stieger, Pietschnig, & Voracek, 2010; Wiersema, van der Schalk, & van Kleef, 2012). A preference for complex polygons is associated with higher self-reported creativity, such that Eisenman and Robinson (1967, 1968) suggested the use of polygons varying in their level of complexity as measures of creativity. Accordingly, the present research aimed to a) develop a novel format image-based creativity measure, b) investigate its concurrent validity in relation to three text-based measures of creativity, and c) assess its test-retest reliability.

## 2. Method

### 2.1. Measures

#### 2.1.1. Curiosity and Exploration Inventory-II (CEI-II; Kashdan et al., 2009)

A 10-item, five-point Likert self-report scale. The CEI-II measures two traits: stretching (e.g., 'I actively seek as much information as I can in new situations') and embracing (e.g., 'I am the type of person who really enjoys the uncertainty of everyday life'). The CEI-II demonstrates reliability estimates of 0.85, construct validity, discrimination, desirable breadth of difficulty (Kashdan et al., 2009), and predictive validity for task performance (Kashdan, Rose, & Fincham, 2004).

#### 2.1.2. Cognitive Flexibility Inventory (CFI; Dennis & Vander Wal, 2010)

A 20-item, seven-point Likert scale, self-report measure of adaptive thinking in stressful situations. Thirteen items assess behaviours related to alternatives (e.g., 'I consider multiple options before making a decision'), and seven items behaviours related to control ('When I encounter difficult situations, I feel like I am losing control'). The CFI shows a reliable factor structure, internal consistency, test-retest reliability, and concurrent validity (Dennis & Vander Wal, 2010).

#### 2.1.3. Openness to experience (Goldberg, 1999)

Measured on a five-point Likert scale ('very inaccurate' to 'very accurate') using the 10-item Openness scale from the International Personality Item Pool (e.g. 'I enjoy hearing new ideas').

## 2.2. Item design

The question stem of image-based items retained its verbal format, but the response scale presented a range of images (see Fig. 1). Each item consisted of a text-based question and between two and eight image response options. The image response options took one of two forms: they either assessed varying levels of the same trait, or they represented different traits. Seventy-seven items were designed to reflect Cognitive Flexibility, Curiosity, and Openness.

## 2.3. Scoring

The scoring algorithm was developed on a sample of 964 participants, recruited using a UK panel company, and compensated for their participation. The panel had an equal distribution of males and females, and participants were UK residents. Approximately half of the users were 18–25 and the other half 25–36 years old. Participants completed the three creativity measures as well as all 77 image-based items.

Rather than stipulating which responses were indicative of which underlying trait, responses to image-based items were scored in relation to standard measures. This method is commonly used in measure validation procedures when testing concurrent validity between new and existing measures (Rust & Golombok, 2009), as well as for predictive personality measures (Bachrach, Kosinski, Graepel, Kohli, & Stillwell, 2012; Boyd et al., 2015; Lambiotte & Kosinski, 2014; Youyou,

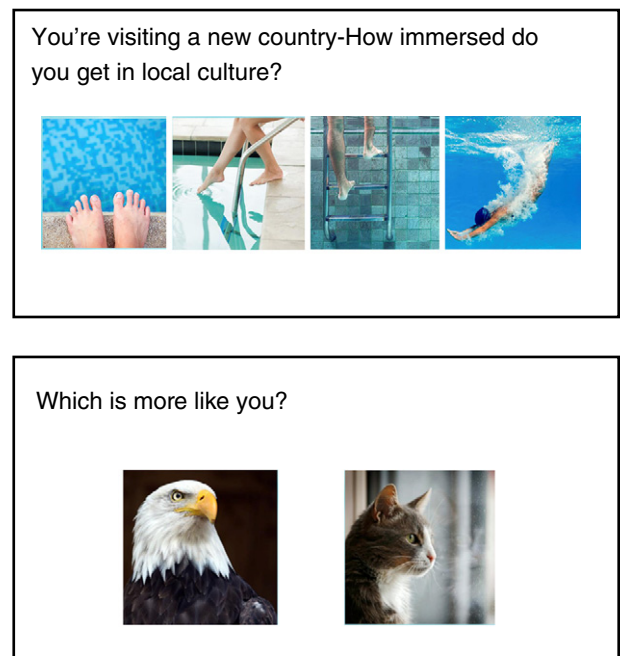


Fig. 1. Example image response scales.

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