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Exploring cultural variation in the emotional expressivity of online drawings

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ABSTRACT

Extensive research points to cross-cultural differences in emotional expressivity and the use of context in communication. This study explored these ideas through digital, online, drawings produced using Google's Quick Draw ($N = 4869$). The selected pictures were of fish and had been drawn by individuals from across six nations: UK, USA, Australia (individualist), Japan, Saudi Arabia and the United Arab Emirates (collectivist). Participants from individualist societies produced images expressing emotion (e.g. smiling or frowning fish) more frequently than their collectivist counterparts. Similarly, participants from individualist nations were significantly more likely to include contextualising elements within their drawings (e.g. seaweed, bubbles etc.). The results support previous work on emotional expression across cultures and research in the area of high and low context communication. This study extends these ideas into the area of computer-based drawing, suggesting Google's Quick Draw represents a useful resource for exploring emotional and cultural variation through the medium of online drawings.

1. Introduction

Cognitive and emotional processes have been observed to vary across cultures (Keller & Otto, 2009; Kuwabara & Smith, 2012). For example, individuals from cultures where wearing the hijab or headscarf is highly prevalent demonstrate an enhanced ability to process internal facial information (Wang, Thomas, Weissgerber, Quadflieg 2015). Furthermore, individuals within a given sociocultural environment generally produce "cultural products"—tangible, public, shared representations of culture—that convey dominant cultural values such as individualism and collectivism (Morling & Lamoreaux, 2008; Shah, 1978). Drawings are one such example of a cultural product that appears to vary in systematic ways across cultures (Gernhardt, Rübeling, & Keller, 2015, 2013). Jolley (2010) suggests that such differences may arise from at least three sources: perceptual input (e.g. art, and media), drawing experiences (e.g., access to drawing resources), and learning environments (schools and parenting styles). However, aligned and intertwined with these behavioural, environmental and material considerations, is the possibility that cultural values such as individualism and collectivism are also implicitly reflected in, and influence, our drawings.

Hofstede (2001) presents a dimensional model of individualism-collectivism at a societal/national level. Within this model Individualist (IDV) societies are characterised by their emphasis on personal freedoms and individual achievements. In such societies people are generally socialised to be independent, autonomous and competitive. Conversely, people socialised within relatively collectivist societies generally emphasise group harmony over individual achievements, valuing interdependence over independence. The cohesion and well-being of the broader social group are typically given precedence over personal interest and psychological autonomy (Hofstede, 2001).

The individualist-collectivist cultural dimension, most frequently operationalised as North American (Western) compared with Japanese (Eastern) participants, also suggests that collectivism is associated with less overt displays of emotion, positive and negative (Gudykunst & Ting-Toomey, 1988; Stephan, Stephan, Saito, & Barnett, 1998). Cordaro et al. (2017) explored 22 different emotions across five nations (China, India Japan Korea and the USA). They found that participants from relatively collectivist nations were more likely to engage in emotion inhibiting behaviours (emotional suppression) such as gaze aversion, covering the face or controlled smiling (Keltner, 1995). Friedlmeier, Corapci, and Cole (2011) argue that the suppression or dampening of emotional expression and the preference for low arousal emotions helps preserve group harmony. Similarly, Tsai, Louie, et al. (2007) and Tsai, Miao, et al. (2007) argue that in individualist contexts, people try to

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influence others, and to this end, high arousal emotions are optimally effective. Conversely, in a collectivist context, conforming, fitting in and adjusting to other people (harmony) is valued and for this low arousal emotions are more effective (Tsai, Miao, et al., 2007).

1.1. Literature review

The idea that these broad cultural orientations – individualism/collectivism - are reflected in drawings has received some empirical support. In particular, the emotional expressivity hypothesis (the degree to which emotion is expressed across cultures) has been fairly reliably observed. For instance, previous studies have shown that even very young children can depict different emotional states by varying the shape of the drawn mouth (Buckalew & Bell, 1985). These variations in emotional expressivity are in line with the emotional expressivity hypothesis, i.e. relatively less emotional expression (smiling) depicted by participants from collectivist societies (Matsumoto, 1991; Gernhardt et al., 2015, 2013).

Based on the drawings of professional illustrators, one study explored the facial expressions of popular characters from best-selling American and Taiwanese storybooks. The study reported significantly more depictions of high arousal positive emotion (excited, delighted, happy etc.) among the American characters, and a greater degree of low arousal positive emotions (serene, content, calm) among the Taiwanese characters (Tsai, Louie, et al., 2007). The authors interpreted their findings within an "affect valuation framework", where different cultures are viewed as idealizing different emotions (e.g. excited vs calm). In another study, this time exploring graphical representations produced by the lay populace, Gernhardt et al. (2015) compared the drawings by pre-school children (ages 3 to 6) from urban Western societies (Individualist) with those produced by their rural dwelling, non-Western counterparts (Collectivist). The drawings they focused on are widely referred to as "tadpole drawings", these are essentially a child's first recognisable drawing of a person; a circular head with two vertical lines for legs. The urban Western children depicted significantly more facial details in their tadpole self-drawings than did the children from the rural non-Western context, irrespective of the tadpole's head size. Furthermore, in line with the emotional expressivity hypothesis, urban Western children more often depicted the expression of emotion (smiling mouths) compared to the children from rural non-Western societies. In another similar study comparing Turkish, Cameroonian and German children on conventional human figure drawings, similar patterns were also observed (Gernhardt, Rübeling, & Keller, 2013). Specifically, the children from Turkey and Cameroon (relatively collectivist) most often omitted facial features and also depicted less obvious expressed emotion. The authors propose that this pattern of findings reflects the importance of the face and the respective endorsement of emotional control versus positive expressed emotionality of each cultural context and that these cultural influences become apparent in young children's earliest recognisable drawings of themselves (Gernhardt et al., 2013).

Another finding in the cross-cultural comparison of drawings concerns relative figure size. Several previous studies have reported increased figure size among the human figure drawings of participants from relatively individualistic societies. For example, Liebertz and Richter (2001) reported that in comparison to rural children from Madagascar, urban German children drew self-figures at 44% taller. This finding is in line with other research reporting that taller figures occur more frequently in cultural environments, which emphasise independence and uniqueness (Individualism) in contrast to interdependence and social relatedness (Collectivism). Similar height related findings were reported by Rübeling et al. (2011) in a comparison of children's self-drawings between Germany and Cameroon.

Beyond the individualism-collectivism dimension, another framework that has been widely used to explore cross-cultural communication is Edward Hall's high context and low context cultural dimensions (Hall 1976, 2000). This model suggests that many cultural differences can be understood as a function of communication style. Hall proposes that cultures vary based on how context is used during communication. In low context (LC) communication there is very little reliance on implied context. Consequently, communication tends to be fairly explicit with an emphasis on explicit verbal/written clarity. Conversely, in high context (HC) communication much of the intended message is implied through contextual elements, which might include situational, non-verbal and paraverbal cues. The receiver of such communication has to place greater reliance on contextual inference to interpret the message. Describing high context communication Hall writes, "… most of the information is either in the physical context or internalized in the person, while very little is in the coded, explicit, transmitted part of the message" (Hall, 1976 p79). Okabe (1983) suggests that in high context cultures the emphasis is on the receiver's ability to decode subtle contextual cues, whereas in low context cultures the emphasis is on the sender's ability to express messages explicitly. Based on survey data, HC communication has been characterised as being indirect, ambiguous, and reserved, while LC communication is described as being more direct, open and emotionally expressive (Gudykunst, 1997; Gudykunst et al., 1996). The parts of the world that are viewed as relying on HC and LC communication roughly correspond to the geography of individualism-collectivism. For example, Hall (1976; 2000) classed Japan and the Arab World as HC communicators and North American and German Speaking nations as LC communicators.

This idea of high and low context communication has been explored in the context of cross-cultural website design. Using Hall's high and low-context dimensions as the main study parameters, Würtz (2005) found significant differences reflected in the website designs of high context and low context societies respectively. For example, as hypothesized, HC societies made greater use of graphical elements. Similarly, the websites in LC societies where more explicit regarding site navigational elements, for example, using visible text-based links as opposed to the use of glyph-based mouse overs (hovering the mouse cursor over an image to reveal text-based instruction/notification). Other researchers have demonstrated similar intercultural differences in relation to information technology use and preferences (Choo, 2012; Shin, 2012).

The extent to which culture influences our drawing, and perhaps even our design decisions, has potentially important implications for effective graphical communication in a globalised world. Crafting messages that are culturally resonant, arguably means they are more likely to have the desired impact. Much of the research to date, however, has relied upon relatively small samples of children, comparing just two or three nations. The proliferation of the internet and online drawing games, such as Google Quick Draw, provides an excellent opportunity for psychologists to further explore the socio-cultural influences upon our production of graphical/pictorial representations of the world, hand drawn or otherwise.

In the present study, we explored digital drawings produced by people from across six nations, three LC/Individualist (USA, UK and Australia) and three HC/Collectivist (UAE, KSA and Japan) societies. The selection of these nations reflects some of those scoring highest on collectivism (Japan), highest on individualism (USA) and nations from the "Arab world", originally ranked as moderately collectivist. This study used data/drawings from Google Quick Draw's open source archives. Google Quick Draw is a collection of 50 million online drawings made by users from around the world. The present study focused on drawings of fish (relatively easy to draw and universally familiar). Based on Hall's and Hofstede's dimensional models of culture, we make several hypotheses. (1) Fish drawn in collectivist/HC nations will less frequently be depicted as expressing emotion, compared with those drawn in Individualist/LC nations. (2) In line with Hall's model, fish drawn in the LC nations will include more explicit contextual information. Finally, (3) in line with previous cross-cultural research exploring drawings, we hypothesise that the fish drawn in individualist societies will include more facial details (mouths and eyes) than those produced in collectivist societies.

Table 1
Count of drawings by nation, including percentage contribution to sample.

	Frequency Count	Percentage of Whole Sample
KSA	832	17.1
USA	832	17.1
UAE	800	16.4
UK	801	16.5
JAP	802	16.5
AUS	801	16.5

KSA = Kingdom of Saudi Arabia, USA=United States of America, UAE = United Arab Emirates, UK = United Kingdom, JAP = Japan, AUS = Australia.

2. Method

2.1. Google's Quick Draw

Google's Quick Draw was released as an online game in November 2017. Although offered for free to the public as a game, the primary intention of Google Quick Draw is to employ (crowdsource) players' sketches to train a computer algorithm (neural network). The project is essentially a study in artificial intelligence and machine learning, exploring the ability of a computer algorithm to recognize human drawings. At the time of writing more than 50 million drawing have been produced (Ha & Sonnad, 2017). As a game, Google Quick Draw presents users with the challenge of drawing various objects (e.g. cat, toilet, house, fish etc.). Users have just 20 s within which to draw six prescribed objects using whatever computer input device they have at their disposal, for example, the mouse, trackpad, input stylus etc. Upon completion, the artificial intelligent agent (computer algorithm) outputs its guess as to what the user's drawing is attempting to represent. The expanding Google's Quick Draw data set is made publicly available to help further research.

2.2. Sample of drawings

In the present study, all drawings of fish for the following six nations (USA, UK, Australia, Japan, United Arab Emirates and Saudi Arabia) were obtained from the publicly available (open-source) Google's Quick Draw dataset as of August 2017. A random extract of approximately 800 fish drawings in jpeg format was obtained for each nation. In the case of the UAE and KSA, this constituted the entire collection of drawings. The combined final sample of drawings across the six nations was 4869; the breakdown for each nation is presented in Table 1. Examples of drawings are also presented in Fig. 1.

2.3. Procedure

Each drawing was coded dichotomously (yes/no) for the presence of independent facial features (i.e. mouths and eyes), unambiguous displays of basic emotion (happy, sad, angry) and the presence of contextual elements (e.g. plants, rocks, bubbles). Coders were provided with prototype fish drawings depicting emotion and were also given written instructions as to what to look for (e.g. smiles, as indicated by mouths curving upwards). Coders were also told to be conservative in their judgments of emotional expression ("if it is ambiguous, or you have any doubt, don't code it as emotion). Two research assistants under the training and supervision of the first author performed the coding operation. Both coders were blind to the study hypotheses and the international nature of the data they were coding (groups of images were simply numbered 1 to 6). To establish a measure of inter-coder reliability, the first coder completed coding all images before the second coder, independently, performed the coding operation again covering the first 200 drawings for each nation. Reliability was high for eyes ($r = 0.97$) and mouths ($r = 0.94$) and was also acceptable for context ($r = 0.86$) and emotion ($r = 0.87$).

2.4. Data analysis

Based on the dichotomous coding schema, all group differences were assessed for statistical significance using the Pearson chi-square test of independence. The analysis was undertaken using SPSS version 25.

3. Results

3.1. Emotion

There were differences between nations regarding the frequency with which fish were deemed to be expressing emotion. Compared to KSA, UAE and JAP, the English speaking nations, AUS, USA and UK, all produced a greater number of emotionally expressive fish drawings (see Fig. 2).

We combined the USA, UK and AUS into a single group representing individualist nations (IND), and combined JAP, KSA and UAE into a collectivist nations (COL) group. A chi-square test of independence was conducted to examine the relation between culture and emotional expression. Displays of emotion were detected in 13.2% of the IND fish and 6.9% of the COL fish. This difference was statistically significant $\chi 2$

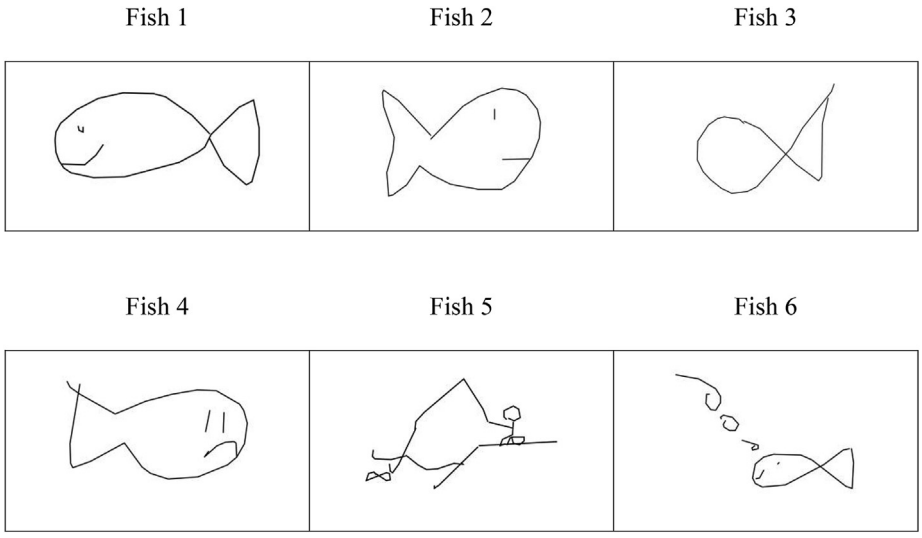

Fig. 1. Examples of the fish drawings produced on Google Quick Draw.

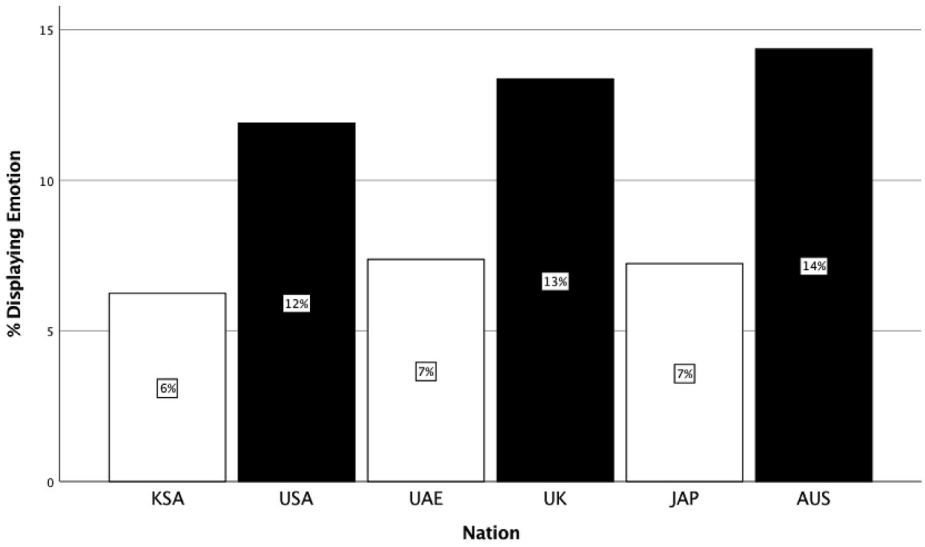

Fig. 2. The percentage of fish deemed to be displaying emotion by nation.

(2, $N = 4869$) = 52.42, $p < .001$.

3.2. Context

The rate of inclusion of contextual elements was also relatively greater for the IND (low context) nations, with AUS, USA and UK all producing relatively more context in their drawings compared to KSA, UAE and JAP (see Fig. 3).

Using the previously mentioned IND (low context) and COL (high context) groupings, a chi-square test of independence was conducted to examine the relation between culture and the inclusion of contextual elements. Typical examples of contextual elements included, plants, rocks and bubbles (see Fig. 1: fish 5 and 6). The IND group produced more drawings inclusive of context (5.7%) than the COL group (2%), these differences were statistically significant, $\chi 2$ (2, $N = 4869$) = 46.79, $p < .001$.

3.3. Facial features

Chi-square tests of independence were performed to examine the relation between culture and the inclusion of facial features (eyes and mouths). The IND (27.6%) COL (29%) groups did not differ significantly on the inclusion of mouths. They did, however, differ (IND = 51% and COL 59.1%) significantly on the inclusion of eyes $\chi 2$ (2, N = 4869) = 32.38, p < .001 (see Fig. 4).

4. Discussion

There were several significant differences between the IND and COL nations. Firstly, drawings from IND nations more frequently depicted emotionally expressive fish. This finding supports the study's emotional expressivity hypothesis and is in line with previous cross-cultural studies exploring the expression of emotion across cultures (Matsumoto, 1991; Keltner, 1995; Stephan et al., 1998; Tsai, Louie, et al., 2007; Tsai, Miao, et al., 2007; Cordaro et al., 2017). These findings also fit well with the "affective preference hypothesis", which suggests that Western (IND) and Eastern(COL) nations differ in their preferences for high (exited, happy) and low (content, calm) arousal positive emotions, respectively (Tsai, Miao, et al., 2007). It is arguably easier to draw and detect high arousal emotions relative to low arousal ones, and this might also explain the apparent preponderance of IND fish deemed to be expressing emotion. This finding is further supported by the observation that IND and COL

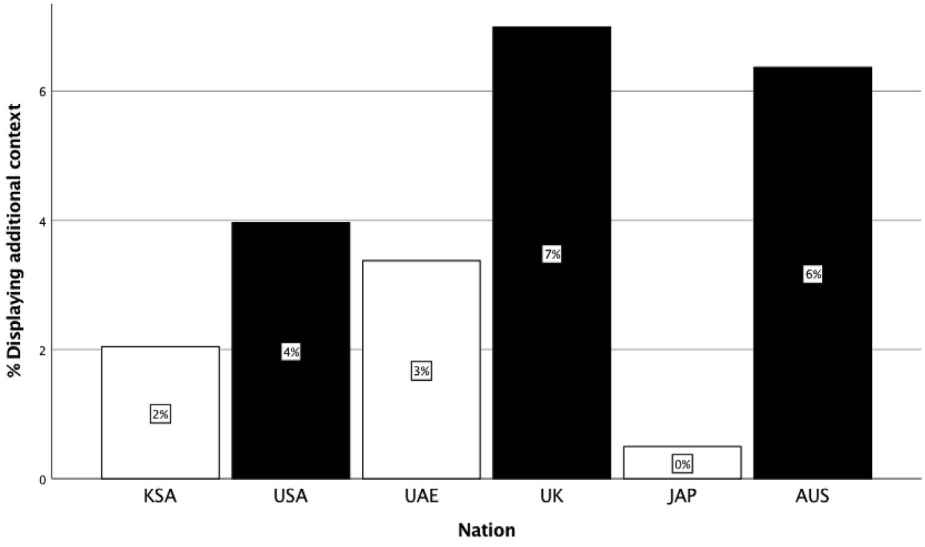

Fig. 3. The percentage of fish drawings deemed to be displaying additional context (e.g. plants, rocks, bubbles) by nation.

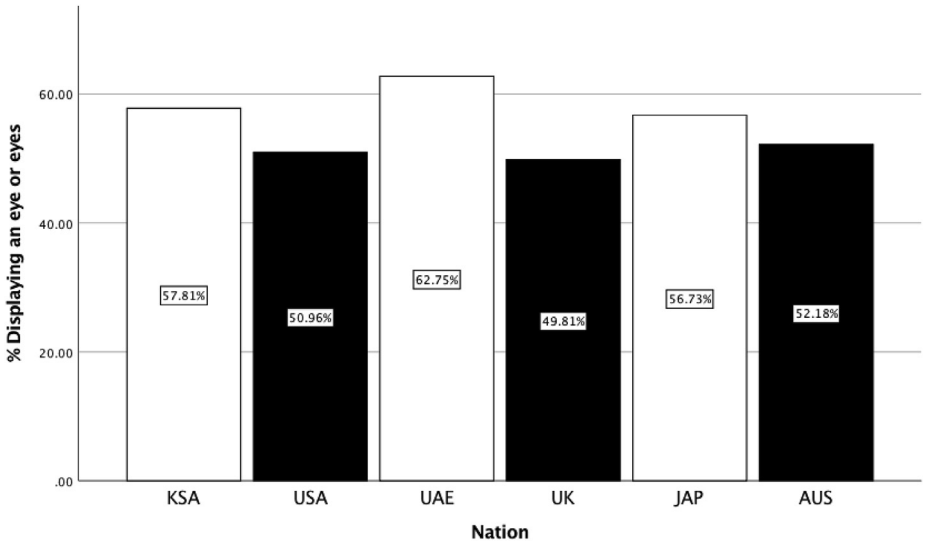

Fig. 4. The percentage of fish drawings displaying an eye or eyes.

nations did not differ regarding the frequency with which they drew mouths. Mouths curving up (happy) or down (sad) are commonly used to depict the expression of emotion in drawings (see Fig. 1: Fishes 1 and 4). Interestingly, participants from COL nations were more likely to include the fish's eye in their depictions. This emphasis on eyes may reflect the importance of eyes in societies (KSA and UAE) where female veiling (burka, lithma, hijab) has been and remains a relatively common practice. In a study of face recognition, comparing the US and Emirati citizens, the Arab/Emirati participants were far superior in recognising faces based on eyes. The authors attribute this finding to the "Hijab effect", that is the widespread use of veiling and head covering results in better non-peripheral facial recognition(Wang et al., 2015). Eyes are also often used to provide non-verbal cues during communication, and the higher frequency of their inclusion may reflect the HC communication style of collectivist nations (Hall, 1976; Okabe, 1983).

The IND and COL national groupings also differed significantly regarding the depiction of context. IND nations provided more context than COL nations. This finding is in line with Hall's high and low context communication (Hall, 1976), where low context communicators provide more explicit contextual detail than their high context counterparts. The inclusion of seaweed or bubbles, for example, allows the viewer to know that this is a living fish swimming in water rather than, say, a fish on a slab in a fishmonger's shop window. The provision of specific details to explicitly communicate context is viewed as a hallmark of low context cultures (Gudykunst, 1997; Okabe, 1983), with the present data supporting this model. This finding is also in line with the work of Würtz (2005) who observed that websites targeting low context cultures tended to provide more explicit written details than their high context (COL) counterparts.

4.1. Limitations and future studies

The present study has several important limitations. Firstly, the use of only one image type (Fish) precludes ruling out the specificity of the present findings. For example, would images of cats or houses show similar cross-national patterns of affective expressivity and context inclusion? A similar limitation is our reliance on a relatively small number of nations, the observed findings could be an artefact of other national idiosyncrasies beyond the hypothesized cultural factors. Future studies should include a more varied range of pictures and expand the number of nations included. However, the present study was a preliminary attempt at exploring a novel data source and drawing medium. As such, including multiple categories of images (cat, dog, camel) was beyond the study's scope and resources. Furthermore, given that previous studies have supported the "ideal affect" and "affective expressivity" hypotheses in drawings of humans (Tsai, Louie, et al., 2007; Gernhardt et al., 2013, 2015) it seems highly unlikely that the present findings are restricted to fish. Future studies could indeed greatly increase the sample size, target image type and the international scope of the analysis. Beyond that, training computer algorithms to detect emotional expression in images (deep learning) would then permit automated analyses, allowing large amounts of data to be processed quickly.

4.2. Conclusions & implications

The present study demonstrated one way that psychologists can use "big data", in this case, Google's Quick Draw, to explore existing models of culture and cross-cultural behaviour. This area of research has implications for how we communicate, graphically/pictorially, across cultures. Ideas of ideal affect and high and low context communication appear to manifest in our drawings spontaneously, and this may have significant implications for online marketing, website design and other forms of communication typically relying on images. A greater understanding of the cross-cultural affective preferences can potentially help us craft more culturally resonant communications, in both digital and offline contexts.

Declaration of competing interest

None.

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