Abstract

With nearly 3.5 billion people now using some form of social media, understanding its relationship with personality has become a crucial focus of psychological research. As such, research linking personality traits to social media behaviour has proliferated in recent years, resulting in a diverse and disparate set of literature that is rarely synthesised. To address this, we performed a systematic search that identified 182 studies relating extraversion to social media behaviour. Our findings highlight that extraversion and social media are studied across six main areas: 1) content creation, 2) content reaction, 3) user profile characteristics, 4) patterns of use, 5) perceptions of social media, and 6) aggression, trolling, and excessive use. We compare these findings to offline behaviour and identify parallels such as extraverts’ desire for social attention and their tendency to display positivity. Extraverts are also likely to use social media, spend more time using one or more social media platforms, and regularly create content. We discuss how this evidence will support the future development and design of social media platforms, and its applications across a variety of disciplines such as marketing, education, and human-computer interaction.

Keywords: Personality, Big Five, OCEAN, Social Media, Facebook, Extraversion
How is extraversion related to social media use? A literature review

1. Introduction

Whilst social media use is greater in economically developed regions such as Europe, Eastern Asia, Oceania, and the Americas (Kemp, 2019), the total number of social media users is now approaching half the global population. Facebook is the most popular social media platform, with more than 2 billion users and a long-term mission to help people ‘to discover what's going on in the world’ (Facebook, 2019). Although its global influence is still growing, in America the majority of adults already use Facebook as a source for news (Matsa and Shearer, 2018). The ubiquity of social media, and Facebook in particular, means that these platforms have become an important way for organisations to communicate externally: more than $55 billion was spent on Facebook advertising in 2018 alone (PR Newswire, 2019), in addition to the hours spent organically generating content and engaging with users. As well as having academic relevance, understanding how social media users behave has important practical importance for organisations and society. For instance, many businesses want to understand users in order to predict or even influence their future behaviour via targeted advertising or recommendation systems (see Buettner, 2017; Hirsch et al. 2012).

A number of reviews have identified social media usage patterns among different demographic groups (such as Hinds & Joinson, 2018) and have explored the prediction of personality traits from digital traces (see Azucar et al. 2018; Hinds & Joinson, 2019; Tskhay & Rule, 2014). Likewise, hundreds of studies have explored how personality and social media behaviour are related. However, to our knowledge, no research has synthesised these vast and disparate findings across psychology, communications, or other areas within the social sciences. Social media is often associated with extraversion, because social media platforms provide a
mechanism by which individuals can socialise and interact with many different groups and friends (see Correa et al. 2010; Seidman, 2013). The purpose of the present review therefore is to explore the varied ways extraversion is related to social media, by extracting the key trends across the current state-of-the-art. By systematically reviewing this work, we identify and synthesise the most prominent trends and discuss recommendations for future research. Further, by considering how social media compares to offline extraverted behaviour we consider whether typical aspects of extraversion, such as ‘enthusiasm’ and ‘assertiveness’ (DeYoung, Quilty, Peterson, 2007) are reflected in online social media behaviour.

1.1. The biological origins of trait extraversion

Descriptive language has long been used to identify different ‘types’ of person; however, the 20\textsuperscript{th} century saw a concerted effort to condense thousands of descriptors into the core components that identify human ‘personality’. The term ‘extraversion’ was used by Carl Jung as far back as 1912 (Jung, 2014); Eysenck later described extraversion as a trait (Eysenck, 1947; Eysenck, 1981), based on a ‘dimension’ previously identified as ‘changeability’ by Wundt and Judd (1897). Unlike Jung’s original conception of a person ‘type’, as a trait Eysenck (1992) later identified a continuum for extraversion against which all people can be rated.

More recent research has investigated the origin of these observable personality traits, and there are now known to be neurobiological differences between extraverts and introverts. Whereas arousal theory (Eysenck, 1967) originally \textit{speculated} that extraverts’ motivation for stimulation might be due to a difference in the ascending reticular activating system responsible for attention and consciousness, there is now \textit{evidence} to support a link between extraversion and the cortical arousal system (Mitchell & Kumari, 2016) as well as various further neurological differences. For example, extraverts have less grey matter volume in several areas of the brain.
(Lu et al., 2014), alongside increased grey matter in the left amygdala (Omura, Constable & Canli, 2005), right amygdala (Cremers et al., 2011), and in the orbitofrontal cortex area of the frontal lobes responsible for decision-making (Cremers et al., 2011; Rauch et al., 2005). As well as studies of grey matter volume, extraversion is associated with greater activity in the lateral pre-frontal cortex involved in decision-making, rostral anterior cingulate cortex which supports functions involving emotion and decision-making, and lateral posterior parietal cortex supporting controlled processing tasks (Eisenberger, Lieberman & Satpute, 2005). There is also evidence of a link between extraversion and the chemical responsible for motivation [dopamine] (Wacker & Smillie, 2015), as well as the hormone responsible for love [oxytocin] (Andari et al., 2014).

Finally, trait extraversion has been shown to be partially genetic (Bouchard Jr & Loehlin, 2001). For example, studies of monozygotic twins have demonstrated heritability through similarities in personality by a correlation of .45 compared to a correlation of only .20 for non-identical twins (Munafo, 2009). There is also evidence that the facets leading to five-factor model extraversion are genetic (Jang et al., 2002). However, Fleeson (2001) has demonstrated that although average personality trait tendencies are stable, there is a degree of variance according to context such as situational cues.

1.2. Extraversion measures

The identification of extraversion and other traits was initially reached through identification of the 4,500 descriptors of humans ‘personality’ in the English dictionary (Allport & Odbert, 1936). These descriptors have since been condensed through factor analysis. Extraversion is present in each of the frequently-used models of personality, either labelled as ‘surgency’ (Norman, 1963) or the more common term ‘extraversion’ (Fiske, 1949).
Goodness of fit testing supports a five-factor model of personality (Corr & Matthews, 2009), commonly referred to as the ‘Big Five’ (Goldberg, 1981) or OCEAN model. Some researchers have suggested that these five traits contribute to two higher order factors: plasticity [extraversion and openness] and stability [neuroticism (reversed), agreeableness and conscientiousness] (DeYoung, 2006; DeYoung, 2013). Others (such as Specht et al., 2014) have provided evidence of broader personality ‘types’ comprising combinations of traits. The combination of traits is a controversial area of research though with some disagreement on reliability and reproducibility (Donnellan & Robins, 2010; McCrae et al., 2006). As supporting research in this area is still limited, this literature review has focused on extraversion as an independent trait.

Observable behaviour is known to relate to personality traits. The ‘three-tiered’ level of abstraction suggested by Norman (1967) provides a helpful explanation of how behaviour (or situational ‘responses’) might first lead to habits. Such habits contribute to behavioural ‘facets’ (McCrae and Costa, 2003) which then support the identification of a corresponding trait. Within the five-factor model (Costa & McCrae, 1992a; McCrae & Costa, 1997), the facets of extraversion are warmth, gregariousness, assertiveness, activity, excitement seeking, and positive emotion.

There is much research to support the identification of extraversion within a five-factor model (Costa & McCrae, 1992b; Digman, 1990; Eysenck, 1947; Goldberg, 1990; Norman, 1963), with various multi-item questionnaires to test the presence of each facet and score participants against five overall factors, including extraversion. These include the 44-item Big Five Inventory [BFI] (John, Hampson & Goldberg, 1991), 50-item questionnaire (with 10 bipolar adjective scales per factor) (Goldberg, 1992), 60-item neuroticism, extraversion, openness
five-factor inventory [NEO-FFI] (Costa & McCrae, 1992b), 100-item questionnaire (unipolar) (Goldberg, 1992), and the 240-item neuroticism, extraversion, openness [NEO] personality inventory (Costa & McCrae, 1992b). More recently, shorter 10-item versions have also been proposed (Gosling, Rentfrow & Swann, 2003; Rammstedt, 2007).

Using these scales, many behaviours have been correlated with high scores for extraversion, including social activities (Eaton & Funder, 2003; Wilt & Revelle, 2019), as well as other behaviours that are intuitively linked to sociability, such as alcohol consumption (Martsh & Miller, 1997) and leadership (Spark, Stansmore & O'Connor, 2018). See Wilt and Revelle (2009 and 2017) for reviews.

1.3. Extraversion and social media

Although personality studies have revealed a wide variety of behaviours that extraversion predicts, online behaviour is a relatively new environment. Not only does continually-developing technology offer new functionality, but behaviour on social media is often visible to a greater number of peers (and sometimes beyond) than equivalent offline behaviour. As described previously, this might naturally appeal to individuals scoring highly for trait extraversion, who tend to desire social attention (Ashton, Lee, & Paunonen, 2002).

Using a variety of the personality questionnaires described above, there is plenty of evidence suggesting that behaviour on social media is linked to the OCEAN personality traits (see Amichai-Hamburger & Vinitzky, 2010; Pornsakulvanich, 2017; Ryan & Xenos, 2011; Tsai et al., 2017). The present review employs a systematic search to identify relevant papers in order to discuss the key trends between extraversion and social media behaviour. This is an important and topical area of study, particularly given the recent increased public awareness of personality data use and collection through social media. For example, some news coverage of the
Cambridge Analytica ‘scandal’ (BBC News, 2019) gave the impression that personality is a reliable predictor of interaction with social media content (Cadwalladr & Graham-Harrison, 2018). Similarly, academic research has highlighted the potential to effectively tailor advertisements that match individuals’ personality traits (see Hirsh et al. 2012; Matz et al. 2017). An investigation of the consistency and replicability of such evidence relating personality to social media behaviour is therefore crucial to support meaningful public discussion about the ethics of collecting such data. That is, if personality is not a strong predictor of social media behaviour, then data-mining tactics to determine personality could potentially be less intrusive or effective than many typical headlines suggest.

2. Method

The present review has taken a traits-based approach to the identification of extraversion, presenting research that is based on self-reported personality as identified through one of several commonly-used questionnaire-based tests. The methods are presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009).

2.1. Eligibility criteria

To be included in this literature review, studies were required to: a) quantitatively examine the relationship between social media use and extraversion as defined through the five-factor model; b) measure extraversion using a published scale associated with the five-factor model (see measures below); c) be published on or before 5 July 2019, inclusive; d) be published in a peer-reviewed journal or in peer-reviewed conference proceedings. Studies were required to
include a quantifiable measure of social media use, although the scale and measurement tool varied depending on the type of social media use.

Papers are not included where the Big Five traits are mediating variables. Where papers identify correlations between traits and behaviour in order to contribute ground truth for a machine-learning algorithm, these are also removed. This literature review therefore reports on the 182 papers where relationships were identified between extraversion and social media use.

### 2.2. Search strategy and information sources

The following databases were searched up to and including 5 July 2019: Scopus, Web of Science, ACM digital library, PsychInfo and Pubmed. The search strategy involved identifying papers that combine personality as defined through the five factor model, and social media use. Therefore, a search string relating to personality or each personality trait, was combined with a search string relating to social media or a social media platform. The search included both titles and abstracts.

The Boolean search performed in each database was: ["social media" OR "social network*" OR instagram OR facebook OR twitter OR youtube AND personality OR extravert* OR neurotic* OR agreeable OR conscientious* OR open* OR ocean OR "big five"].

### 2.3. Study selection

The search was firstly performed within the Scopus database, with all 16,502 citations downloaded into a single Mendeley library. The results of additional databases were then added, with automated removal of duplicates. This resulted in 25,209 papers to be reviewed.
The abstracts and titles were then screened by a researcher (first author), who examined the titles and abstracts of the papers and removed those that were not specifically researching five-factor personality and social media behaviour. This left 494 papers to be reviewed. Figure 1 displays the PRISMA flowchart with full detail of this process.

The remaining papers were then reviewed by two researchers (first and second authors) independently to select those where personality predicts behaviour (rather than identifying personality from behaviour). In order to be eligible for this literature review, participants must have undertaken a self-report personality test and then provided evidence of their social media behaviour either through answering a questionnaire (n=153), some form of observation (n=35), or experiment (n=1). However, articles that reported personality scores as the basis for ‘ground truth’ (typically reported in machine learning studies) were removed because they are out of the remit of this review. Further, any papers that did not appear in peer-reviewed journals or conference proceedings were also removed. In some cases (see Bachrach et al., 2012; Tadesse et al., 2018) the work presented reported both personality predicting social media use and how patterns of use could predict personality. In these cases, the papers were included in the review, but only the results from the former analyses integrated rather than the latter. Finally, Cohen’s Kappa was used to assess interrater agreement, and demonstrated high levels of consensus, $k = 0.82$.

The remaining 190 papers included findings for any (or all) of the five personality traits, as results for extraversion were sometimes reported despite not reporting this specifically in a title or abstract. However, for this literature review only the 182 papers including results for extraversion were taken through to the analysis stage.
2.4. Analysis

The analysis consisted of five stages during which data was extracted from each of the articles that met our inclusion criteria. First, a researcher (first author) independently read through the manuscripts and developed a comprehensive codebook to record key features from each study. This included reference information (title, authors, publication year), sample sizes, platform (such as Facebook or Twitter), measures used (such as Costa & McCrae [1992] or John et al. [1991]), and outcome behaviour (such as frequency of use, addiction, or commenting).

Second, the outcome behaviours extracted were refined into a series of distinct codes. After, the behaviours (i.e. dependent variables) were recorded, two researchers (first author – a PhD candidate researching personality and systematic reviews, and second author – a postdoctoral researcher experienced in performing systematic reviews) read through the behaviours and identified variables that were conceptually similar or equivalent. Such behaviours were merged into a series of independent categories, for example “addiction” and “excessive use” were grouped into an overall “excessive use” code, and “follower quantity” and “network size” were grouped into an overall “network size” code.

Third, 25 per cent of randomly selected studies were second coded (by the second author) to assess reliability. In other words, after developing the set of categories for each outcome behaviour, a subset of articles was independently read and the behavioural outcome was coded in line with these pre-defined categories. Cohen’s $k$ was used to assess interrater agreement, and demonstrated moderate levels of consensus, $k =0.58$. All discrepancies that occurred in data extraction were resolved through discussion\(^1\). Fourth, the outcome behavioural codes were

\(^1\) The discussion revealed that differences in coding resulted when the researchers interpreted behavioural outcomes in slightly different ways (such as coding a behaviour reported as ‘mild use’ in one
reviewed again in order to assess similarities/differences, and were grouped into a series of themes according to their commonalities. For example, “trolling”, “excessive use”, and “aggression” were grouped into an “anti-social” theme. Finally, these themes were reviewed once more to generate a series of higher-level, overarching, themes which are used to organise our findings and discussion. An outline of each of these themes can be found in Section 3.2. Further, an overview of the themes is provided in Table 2, and all studies included in the analysis are provided in the Supplementary Materials.

3. Results

3.1. Study characteristics

Overall, Facebook was the most studied social media platform \((n=101)\), in comparison to other platforms, which were substantially fewer, such as Twitter \((n=12)\), and Instagram \((n=6)\). The full range of platforms studied is outlined in Table 1. Further, questionnaires were the most common method used to collect information about participants’ social media use \((n=134)\). Where reported, the majority of the samples in the research we reviewed included ‘students’ \((n=98)\) and/or participants recruited through Facebook \((n=32)\).

The studies reviewed focused on a variety of dependent variables (see Table 2), with easily-measurable outcomes the most common, such as network size \((n=34)\), followed by time spent on social media \((n=20)\), update frequency \((n=18)\), and more general frequency of use \((n=16)\).

paper as ‘frequency of use’ by one researcher, and ‘time spent’ by another), or when studies that reported many behaviours (which caused the researchers to code a different number of behaviours). Thus, such differences were mostly due to subtle differences in assigning behaviours to categories, rather than actual ‘disagreements’
There are a variety of scales used to measure extraversion as part of the five-factor model. Where reported, the most popular (n=18) was Costa and McCrae (1992), followed by Goldberg et al (2006) and John and Srivastava (1999) (both n=17). The full range of measures and their frequency of use is shown in Figure 2.

3.2. Major findings

We identified six overarching themes within the papers reviewed. These themes encapsulated the main trends and commonalities amongst the behavioural outcomes identified, and are outlined as follows:

1. Content creation. As Goffman (1978) first observed (later applied to social media by Kaplan & Haenlein [2010]), in interactional situations people ‘manage’ their actions in order to create a specific impression on others. These are studies therefore which find that extraverts consciously create content in order to manage the image presented to others through social media.

2. Content reaction. As described above, social media users are known to manage their self-presentation. Whereas the first theme identifies studies relating to content creation though, this theme instead presents research showing how extraverts visibly choose to react through social media to content produced by others.
3. User profile characteristics. These are studies that relate extraversion to the factual information revealed within a user’s profile information. For example, this would include the number of other users a Twitter user ‘follows’.

4. Patterns of use. Gosling et al (2002) explain that people unintentionally leave observable ‘residue’ through their day-to-day behaviour, which relates to their personality traits. For this review therefore, these are studies of unconscious patterns of behaviour on social media that are likely to be driven by extraversion.

5. Perceptions of social media. These are studies which investigate the motivations and attitudes of extraverts towards the value and usefulness of social media. Joinson (2008) has previously demonstrated that motives for using social media differ according to demographics, but this section instead presents research linking motivation to a personality trait.

6. Aggression, trolling and excessive use. The studies within this theme investigate negative or anti-social aspects of social media, with extraverts behaving in a way that might be described as ‘problematic’. Baccarella et al (2018) refer to these behaviours as representing the ‘dark side’ of social media. Whilst ‘trolling’ (Thacker and Griffiths, 2012) and ‘addiction’ (Kirik et al, 2015) are sometimes attributed to demographics, for this literature review the theme instead relates the findings to a personality trait.

We also identified a number of methodological insights, as outlined for each outcome behaviour (code) within Table 2. First, the breadth of papers demonstrates a variety of approaches, with self-report the most popular means of understanding the behavioural outcome (for example the frequency of updating one’s status), including data collection through surveys.
(n=133), self-reported content analysis (n=6), and self-reported observation (n=3). Examples of studies where the outcome did not rely on self-report include word use (n=9) and a number of studies of network size (n=10).

The disclosure of non-significant results is a topic of much wider debate within academia (see Franco, Malhotra, Simonovits, 2014). In the studies reviewed here, where non-significant results are not reported (n=47), it is unclear in most cases whether this is because there were no further results to report beyond those presented, or because the authors chose only to report the significant results. This ‘choice’ to report only those findings deemed statistically significant is often referred to as a ‘file drawer’ problem (Franco, Malhotra & Simonovits, 2014). A related, although slightly different, explanation for this lack of non-significant findings could be the tendency to ‘p-hack’ the results (Nuzzo, 2014), meaning that these significant results could have been reached following various previous, although unreported, attempts.

Sampling is another important area of consideration when comparing studies. Although a sample size of at least 384 is advised to reliably represent populations of 100,000 or more with 95 per cent confidence (Krejcie & Morgan, 1970), many studies (n=36) had a sample size below this. We give the overall sample size for each outcome behaviour in Table 2. Furthermore, few studies (n=7) explicitly stated that they had randomly selected a sample, or deliberately intended to represent a wider population (n=2). With these caveats in place, in the remainder of this section we outline the main findings and key trends derived from the review, in accordance with each of the six themes.
3.2.1. Extraversion and content creation

The studies we reviewed consistently found a link between extraversion and the regularity of posting new content on social media. This is unsurprising given that ‘sociability’ and ‘activeness’ are facets of extraversion (Eysenck et al., 1992). Extraverts are not only sociable and gregarious, but are often energetic and engaged, as reflected in their social media content posting behaviour. Offline, trait extraversion is also known to predict conversing and spending time with people (Mehl et al., 2006), which are two of the primary functions of social media.

Extraverts update their status or tweet frequently (Bachrach et al., 2012; Casado-Riera and Carbonell, 2018; Cheevasuntorn et al., 2018; Lee, Anh, & Kim, 2014; Mo et al., 2018; Ong et al., 2011; Seidman, 2019; Shena, Brdiczka, & Liu, 2015; Wang et al., 2012; Yoong, Ngatirin & Zainol, 2017), and update their profile frequently (Bogg, 2017; Hwang, 2017; Shi, Yue & He, 2013) [but see Große Deters, Mehl & Eid (2016) for a study that did not report this association]. These patterns occur regardless of age, across platforms, and are seen cross-culturally. One study (Rollero, Daniele & Tartaglia, 2019) reported a significant association between the frequency of ‘active use’ (profile updating or posting new content) and extraversion for females, but not for males.

There is also a clear relationship between extraversion and the quantity of images posted (Eftekhar, Fullwood & Morris, 2014; Gosling et al., 2011; Hwang, 2017; Lee et al., 2014; Moore & McElroy, 2012; Muscanell & Guadagno, 2012; Ong et al., 2011; Shena, Brdiczka & Liu, 2015). Extraverts tend to post pictures of: (1) people and objects (Kim & Kim, 2018); (2) faces showing all emotions except neutral and surprised (Kim & Kim, 2018); and (3) animals (Ferwerda et al., 2018) such as pets Yang (2019). Extraverts take personal (Guo et al., 2018; Kim & Chock, 2017; Sorokowska et al., 2016; Wang et al., 2012) and group selfies (Kim &
Chock, 2017), supporting the ‘gregariousness’ facet (Costa & McCrae, 1992b). They also frequently edit selfies (Wang, 2019). Qiu et al (2015) did not find any association between the type of selfie (such as duckface, or amount of body shown) and extraversion, a result they explain is due to the preponderance of positive images shared by all social media users in the form of selfies.

Positive emotions are generally known to be a facet of extraversion (Costa & McCrae, 1992b), and many studies do reflect the positivity previously shown offline (Rothbart, Ahadi & Evans, 2000); for example, our review has identified a number of studies linking extraversion to the use of positive words (Hall, Pennington & Lueders, 2014; Kern et al., 2014; Qiu et al., 2012; Schwartz et al., 2013; Tadesse et al., 2018; Yuan et al., 2018).

Several other studies in our findings associated extraversion with social words or processes (Kern et al., 2014; Qiu et al., 2012; Qiu et al., 2017; Schwartz et al., 2013; Yuan et al., 2018). Although Bai, Gao & Zhu (2012) suggested that extraverts use the second person singular infrequently to refer to others on social media, other studies (Schwartz et al., 2013; Tadesse et al., 2018) found the opposite, supporting the trait characteristics previously-identified offline such as socialising (Olson & Weber, 2004) and encouraging conversation (Mehl, Gosling & Pennebaker, 2006). In return, Shen, Brdiczka and Liu (2015) found that extraverts do receive more comments and likes on social media, specifically from friends. Extraverts are also more likely to use sexual words (Kern et al., 2014; Schwartz et al., 2013) or refer to other biological processes (Qiu et al., 2017; Schwartz et al., 2013). Park et al (2017) also relate extraversion positively to use of future tense and negatively to use of the past tense.

The findings above show clear evidence of extraversion associated with specific word usage on social media. There is likewise evidence that extraversion is related to the overall topic
that people post content about. For example, Marshall, Lefringhausen and Ferenczi (2015) showed that extraversion is related to an increased frequency of updates about social activities, achievement, diet and exercise. On the service ‘Weibo’, Zhou, Xu and Zhao (2018) identified a greater likelihood of sharing music amongst extraverts. On Instagram, Ferwerda et al (2018) reported an association between extraversion and content around electronics. Lastly, Roulin (2014) reported that extraversion predicts the likelihood of posting inappropriate content and with posts about alcohol or drugs in particular (Stoughton, Thompson & Meade, 2013).

For those high in extraversion, social media provides an opportunity to present themselves to others. This is unsurprising, given that previous offline research has found extraverts to be motivated by social power and status (Olson & Weber, 2004). Adolescents with higher levels of extraversion engage in more self-presentation activities on Facebook (such as adding profile pictures and status updates, [Ong et al., 2011]), although the impact of extraversion on these activities is reduced when narcissism is added to the statistical model. Extraverts are also more likely to engage in broadcasting [one-to-many] behaviour (Kabadayi & Price, 2014) and exhibitionism on WeChat (Wang, 2017), supporting the gregariousness facet (Costa & McCrae, 1992b). Extraversion is also related to the likelihood of sharing videos (Zhou et al., 2018), including longer videos on Facebook and Weibo (Shena. Brdiczka & Liu, 2015). Furthermore, there is some limited evidence to suggest that the self-presentation of introverts creates a ‘false’ self on social media (Michikyan, Subrahmanyam & Dennis, 2014).

On Facebook, extraversion is significantly correlated with the expression of emotion, although openness to experience showed a stronger relationship (Farnadi et al., 2014), suggesting that a personality type combining extraversion and openness (described as ‘plasticity’ in a two-factor model proposed by DeYoung [2006, 2013]) would be associated with high
expression of emotions on social media. McCann (2014) identified a correlation between neuroticism and the expression of negative emotions on Twitter, but no other correlations between emotion expression and personality, including extraversion.

### 3.2.2. Extraversion and reaction to content

Offline studies have shown that extraverts are likely to experience positive affect (Costa and McCrae, 1980; Lucas & Baird, 2004; Watson & Clark, 1992), both in moments (Lucas & Baird, 2004; Uziel, 2006) and over time (Costa & McCrae, 1992a; Spain, Eaton & Funder, 2000). Extraverts even judge neutral events more positively than introverts (Uziel, 2006). Given that their experience of the world is likely to be positive, a positive reaction to content posted online is to be expected. There is some, although limited, supporting evidence for this, connecting the use of the ‘liking’ function and extraversion, (Bachrach et al., 2012; Lee, Ahn & Kim, 2014; Marshall, Lefringhausen & Ferenczi, 2015; Shchebetenko, 2019).

Shi, Yue and He (2013) and Hwang (2017) have demonstrated that extraverts tend to give feedback on social media. However, the research we identify shows more specific evidence of extraverts commenting on posted content, rather than simply ‘liking’. Again, the evidence reveals a link between extraversion and the volume of comments posted (Gosling et al, 2011; Lee, Ahn & Kim, 2014; Marshall, Lefringhausen & Ferenczi, 2015; and Wang, Lv & Zhang, 2018b). This link is also reflected in China on Renren (Wang et al., 2012), and for commenting on selfies specifically (Choi et al., 2017). Große Deters, Mehl and Eid (2016) also identified a correlation between extraversion and positive valence of comments given; however, they report a series of non-significant relations between extraversion and responses to content online (such as ‘liking’ and giving feedback).
Sharing is a slightly different mechanism to reacting through a comment, ‘like’, or an equivalent show of praise. Sharing involves identifying a piece of content that is then posted within a user’s own update. Dupre et al (2018) suggested that the link between extraversion and willingness to share information on social media is weak. Yet several studies do relate extraversion positively to public sharing on social media (Jain, Gera & Ilavarasan, 2016; Lee, Ahn & Kim, 2014; Lynn et al., 2017), although negatively to rumour sharing (Lynn et al., 2017). Hwang (2017) found that extraversion predicts sharing of photos and images in particular. As sharing is clearly a social behaviour that encourages engagement with peers, this evidently supports the social behaviour trait characteristic previously identified offline (Argyle & Lu, 1990). Supporting this, Hodas, Butner and Corley (2016) showed that extraverts are particularly likely to retweet Twitter messages deemed to be of a ‘social’ nature.

We have found little specific research on the relationship between personality and reaction to marketing content on social media. The limited research in this area to date shows a relationship between extraversion and both sharing of sponsored stories and liking adverts (Clark & Calli, 2014), the effectiveness of producing advertising content specifically for extraverts (Matz et al, 2017), and a general positive link between extraversion and consumer engagement online (Islam, Rahman & Hollebeek, 2017). This supports previous links identified offline between extraversion and so-called ‘market mavenism’ (Mooradian, 1996; Steenkamp & Maydeu-Olivares, 2015) whereby trusted experts (mavens) monitor brands in order to advise others on new products and services. Mavens collect this market information to use in ‘social exchanges’ (Feick & Price, 1987), supporting extraverts’ desire to behave sociably (Eysenck et al., 1992).
3.2.3. Extraversion and user profile characteristics

A social media user’s profile is the part of their ‘page’ or ‘account’ that displays factual information about their social media usage. For example, on Twitter information is displayed relating to a user’s number of followers, number of followed users, their home location, and the date on which they began using Twitter. User profile characteristics are distinct though from users’ ‘patterns of use’ (see Section 3.2.4), which relate to research that examines users’ behavioural patterns, such as the number of times the account has actually been used since the creation date.

Extraversion is found to positively correlate with social media users’ friend quantity (see Amichai-Hamburger & Vinitzky, 2010; Gosling et al, 2011; Ong et al, 2011). Furthermore, for extraverts many of these friends seem to consist of other extraverts on social media (Noë, Whitaker and Allen, 2016). Similarly, introverts are found to connect with other introverts (Lönnqvist & Itkonen, 2016). Together, such findings exhibit a phenomenon known as ‘homophily’ – the notion that people who are similar tend to socialise or be attracted to one another (in some form or another) (McPherson et al., 2001). Thus, this can be explained through the known tendency for extraverts to both display (Rothbart et al., 2000) and be attracted to positivity (Derryberry & Reed, 1994). In other words, extraverts display positivity, and therefore attract people who are also express positive characteristics.

Finally, Noë, Whitaker and Allen (2018) also showed that pairs of extraverts using social media tend to be geographically closer together, suggesting that offline and online social contact are mirrored, although Zhou, Xu and Zhao (2018) identified a higher likelihood that extraverts move location.
3.2.4. Extraversion and patterns of use

In contrast to the way individuals attempt to make themselves appear online, or the factual information shown within a user’s profile, extraversion is also related to individuals’ behavioural patterns on social media. The process of managing one’s identity, as well as interacting with others (or content) more broadly, means that individuals create patterns of behaviour (such as number of logins, photos) - a form of ‘residue’ (Gosling, 2002) that relates to their personalities. Our search highlights that extraversion is related to a number of social media usage patterns including membership of a platform (Bogg, 2017; Brailovskaia & Margraf, 2016; Brailovskaia & Margraf, 2018; Ryan & Xenos, 2011), frequency of use (see Caci et al., 2014; Correa, Hinsley & de Zúñiga, 2010; Gosling et al., 2011), duration of each use (Caci et al., 2014), time spent using social media (see Annisette & Lafreniere, 2017; Moore & McElroy, 2012; Wilson, Fornasier & White, 2010), and both group membership (Kosinski et al., 2014; Mo et al., 2018; Ross et al., 2009) and group interaction (Bachrach et al., 2012; Kelsen & Flowers, 2018).

These findings therefore reflect many facets of extraversion that manifest in offline relationships and interactions. That is, extraverts are sociable (Eysenck et al., 1992), they have many friends (Watson & Clark, 1997), they are ‘bold’ (Cattell, Eber & Tatsuoka, 1980) and they enjoy meeting new people. Social media therefore appears to facilitate such interactions, enabling individuals to maintain existing/develop new relationships. Further, these behavioural patterns are evident across numerous platforms (including Facebook, Twitter, Instagram, and Snapchat) suggesting that these affordances are not exclusive to one particular form of media.
Other research examines how more specific behavioural patterns relate to extraversion. For example, studies have highlighted that extraverts engage more in ‘real time social interaction’ on Facebook (Ryan & Xenos, 2011), they frequently use social search services (Uesugi, 2011), play games (Wang et al., 2012), and use entertainment services (Deng et al., 2013). These patterns furthermore reflect the classic tendencies of extraverts in offline settings to seek out stimulation and social activities with other people (Argyle & Lu, 1990; Paunonen, 2003). Extraverts are also likely to display on Facebook that they are attending events (Kosinski et al., 2014), again supporting this tendency.

Although the majority of these studies focus on student and WEIRD samples (Henrich et al. 2010), there is some evidence to suggest that these extraverted behavioural patterns exist across other demographics including teenagers (Cheevasuntorn et al., 2018), elderly individuals (Mo et al., 2018) and Asian populations (Min & Yuan, 2013; Shi et al., 2013; Wang et al., 2012; Wang, Qu & Sun, 2013). These trends suggest that the general sociability aspects and behavioural patterns of extraversion extend beyond those typically studied. Further, while the majority of studies in our set find significant relationships between extraversion and various behavioural patterns of engagement, numerous studies find evidence that counter these effects. For instance, McCreery and Krach (2018) found no significant relationship between extraversion and Facebook membership, and Pettijohn et al. (2012) found that extraversion was not related to frequency of use.

3.2.5. Extraversion and perceptions of social media

As extraverts are known to be motivated by social contact (Olson & Weber, 2004), social media platforms are, unsurprisingly, generally perceived positively by those scoring highly for trait extraversion. Those scoring higher on extraversion perceive Facebook to be more useful
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(Mouakket, 2016; Mouakket & Sun, 2019; Rosen & Kluemper, 2008), while more extraverted users of the Chinese service Weibo perceive it to be more valuable than lower extraversion users (Zou & Wu, 2018). Deng et al (2013) identified a relationship between extraversion and perceived satisfaction with an online social network, and Rosen & Kluemper (2008) reported an association between extraversion and between the perceived ‘ease of use’ of Facebook.

Motivation to use social media is another area of study where there are interesting nuances in the findings. Offline research has demonstrated that extraverts set social goals (Roberts & Robins, 2004) and are motivated by social contact, power and status (Olson & Weber, 2004), and findings on social media support this. Several studies identified in our research found a relationship between extraversion and the need to connect with peers and new friends using social media (Bhattacharya, Sinha & Sheorey, 2014; Orchard et al., 2014; Scherr and Brunet, 2017) or communicate with others via social media (Horzum, 2016; Marshall, Lefringhausen & Ferenczi, 2015). Extraversion also relates to use of Facebook for social interaction (Eşkisu, Hoşoğlu & Rasmussen, 2017) or socialisation (Lin et al., 2017).

Unsurprisingly then, extraversion relates to messaging on Facebook (Tsai et al., 2017), and use of the ‘@’ function on Sina Weibo, which addresses a message to a specific recipient rather than all followers (Wang, Qu & Sun, 2013). These findings again lend support for the ‘sociability’ facet of extraversion (Eysenck et al., 1992).

Krishnan and Atkin (2014) demonstrated that infotainment is likely to be a motive for extraverts using online social networks, similar to ‘entertainment’ (Lin et al., 2017; Scherr & Brunet, 2017) or ‘recreation’ as described by Orchard et al (2014). In addition, use of Facebook for informational purposes correlates with extraversion (Hughes et al., 2012). This is partially
supported by Eşkisu, Hoşoğlu, and Rasmussen (2017), who link extraversion to use of Facebook for education.

Extraverts also state that they are driven to use social media to share information about themselves (Mishra & Ayatham, 2017) or even develop a personal brand (Chou & Chiu, 2015). This supports the findings above relating to public sharing on social media (Jain, Gera & Ilavarasan, 2016; Lee, Ahn & Kim, 2014; Lynn et al., 2017), and sharing of photos and images in particular (Hwang, 2017).

In their known desire to make social contact (Olson & Weber, 2004) and converse (Mehl, Gosling & Pennebaker, 2006), extraverts seem generally unconcerned about disclosing personal data on social media (Quercia et al., 2012). Extraversion relates to the increased disclosure of personal information (Loiacono et al., 2012; Wang, 2013), including the honesty of such information (Chen & Marcus, 2012) accuracy of such information (Chen, Pan & Guo, 2016), willingness to disclose a private address and political view (Valdez, Schaar & Ziefle, 2013), or even post intimate content (Hollenbaugh & Ferris, 2014). Peluchette et al (2015) also found a significant link between extraversion and posting indiscreet information on Facebook, although findings by Aharony (2016) suggest that specific disclosure of demographic details and pictures is not significantly associated with extraversion. On Renren however (Yu & Wu, 2010), and Twitter (Jin, 2013), extraversion scores negatively predicted self-disclosure, a finding repeated by Amichai-Hamburger and Vinitzky (2010) for social media in general. Yu and Wu (2010) related this to the social compensation hypothesis (Valkenburg, Schouten, & Peter, 2005), with introverts ‘compensating’ for the ‘inadequate’ satisfaction of their offline social needs by making the most of their online experience.
There is an additional strand of research presenting a link between extraversion and being privacy-conscious on social media, in particular protecting birthdays, political views, religious views, and family and relationships (Kuo & Tang, 2013). Extraverts use ‘protection strategies’ such as deleting content and/or friends (Gerber, Gerber & Hernando, 2017) and amending the privacy settings for viewing and adding to a timeline (Tsai et al., 2017). There is also a relationship between extraversion and concern for other’s privacy when disclosing information (Kooohikamali, Peak & Prybutok, 2017). Riera, Oberst and Carbonell (2015) identified a small but non-significant correlation between extraversion and privacy among men, although negative among women, but Osatuyi (2015) identified that the relationship between extraversion and concern for privacy is not significant.

While the initial findings, supporting both self-disclosure and a concern for privacy, may appear to be contradictory, candid self-disclosure usually requires a *degree* of privacy. In any case Masur (2019) presented evidence that attitudes to self-disclosure and privacy in online environments tend to be situational rather than personality-based, therefore allowing extraverts to self-disclose or protect private information in different situations.

### 3.2.6. Extraversion and aggression, trolling and excessive use

Offline, Derryberry and Reed (1994) identified that extraverts find it difficult to shift away from positive stimuli. Given that extraverts associate social media with positive affect therefore, it follows that extraversion is related to excessive use of Facebook (Atroszko *et al.*, 2018; Biolcati *et al.*, 2018; Hasan & Yasir, 2016; Wilson, Fornasier & White, 2010) and to social media in general (Jaradat & Atyeh, 2017; Wang *et al.*, 2015). However, non-significant relationships are identified on YouTube (Klobas *et al.*, 2018) and WeChat (Hou *et al.*, 2018).
Looking at social apps on mobile specifically, Hsiao et al. (2016) identified a relationship between compulsive usage and extraversion.

On the other hand, there is evidence that low levels of extraversion are linked to ‘problematic’ (Marino et al., 2016) or ‘addictive’ (Blachnio et al., 2017) Facebook use. Several further studies though suggested that this relationship between low extraversion and excessive use is not significant on social media in general (Lee, 2019; Hawi & Samaha, 2019), on Instagram (Kircaburun & Griffiths, 2018), on Tinder (Orosz et al., 2018) or on Facebook (Blachnio & Przepiorka, 2016; Blachnio et al., 2017). The results generally in this area are therefore inconclusive. Observing a difference though between their findings on Facebook ‘addiction’ and internet ‘addiction’, Blachnio and Przepiorka (2016) noted that Facebook ‘addiction’ is clearly a separate area for research, providing a different experience than ‘the internet’ in general.

Perhaps surprisingly, extraversion appears to relate to proactive aggression online (McCreery & Krach, 2018), supporting previous offline findings that extraverts like to be ‘socially dominant’ (Olson & Weber, 2004). This finding seems at odds with the ‘sociability’ facet of extraversion (Eysenck et al., 1992), and at odds with other studies which found that extraverts generally do not bully (Kokkinos, Baltzidis & Xynogala, 2016), give ‘uncivil’ comments (Koban et al., 2018), or troll (Seigfried-Sellar & Lankford, 2018) on social media. This suggests a subtle difference between ‘socially dominant’ or even ‘aggressive’ behaviour, and behaviour that is perceived to be ‘bullying’ or ‘uncivil’.
4. Discussion

4.1. Major findings and implications

Our survey of the literature to date has provided consistent evidence that extraverts are more likely to use social media, use it frequently, and spend more of their time using one or more social media platforms. Further, extraverts create content regularly and the content they post uses social words and refers to social processes. Extraverts also comment frequently, provide feedback to others, and share content publicly. The attitudes expressed by extraverts towards social media indicate that they value social media and view social media platforms as being useful to them. Extraverts also state that they are motivated to use social media in order to achieve their ‘social goals’; their conscious behaviour indicates a desire to interact, which is evidenced by their use of social language, status updates, sharing, and content generation (as a means of presenting themselves to others). The studies reviewed certainly appear to demonstrate that the ability to socialise through social media appeals to extraverts. In turn, the ‘residue’ (Gosling et al, 2002) left by extraverts indicates that they tend to have a larger network, are likely to search for contacts, and are likely to join groups, demonstrating a willingness to socialise that also typify extraversion offline.

The review has further demonstrated consistent findings that, as offline, extraverts tend to display positivity through their social media use, using positive words in their updates and ‘liking’ content generated by others. The affect-threshold model (Rosenberg, 1998) explains this tendency by suggesting that extraverts have a lower threshold for experiencing positive affect, either due to a higher baseline positivity (Gross, Sutton & Ketelaar, 1998) or because extraverts react more strongly to positive stimuli and are therefore conditioned more quickly by reward stimuli [Reinforcement Sensitivity Theory] (Corr, 2008; Gray, 1970; Gray, 1981; Gray, 1982).
These findings have important implications for organisations or individuals wanting to communicate with social media users, including educators, marketers, and communication professionals across a range of industries. For example, the findings suggest that a marketing campaign intending to reach a large audience, is likely to engage extraverts. In addition, knowing that extraverts are likely to be connected to other extraverts means that a message that appeals to one person, may also appeal to many others within their network. Similarly, as extraverts spend more time on social media, and engage with others frequently, they are more likely to see adverts or other forms of marketing content. The psychographic profile of an audience is therefore an important consideration, alongside commonly-used profiling techniques such as demographics and geographics, in order to target communications effectively and efficiently.

The findings also pose a larger question for designers of social media platforms in respect of the development of tools that appeal primarily to extraverted users. In particular, we question whether the current designs of social media platforms adequately cater for a range of personality types, or whether the function and purpose of social media inherently appeals to extraverts. Would it be possible to design a Facebook for introverts? In fact, do introverts fit the economic model supported by social media? Given the increasing desire by businesses to engage an audience, especially online, perhaps this ‘engagement economy’ (Lucas, 2018) where everyone and everything is expected to be connected, and the associated ‘surveillance capitalism’ (Zuboff, 2019) where transactions have been replaced by private companies monetising consumer data, requires and encourages extraversion.

Beyond the headline findings, we do also draw readers’ attention to some of the issues we have identified regarding methodology. Much of the work we reviewed uses student or social
media recruited samples, typically fulfilling the WEIRD sample criteria (Henrich et al. 2010). Social media use is almost always based on self-report, despite evidence of the unreliability of such measures when people estimate their technology use (Ellis, Davidson, Shaw & Geyer, 2019; Hinds & Joinson, 2019). In many cases, non-significant findings are not presented or discussed at any length. Is there a possibility that the weight placed on the behaviour of extraverts is the result of publication bias, with the results of non-significant correlations remaining undiscussed? Where non-significant results are found, sometimes ostensibly similar papers produce significant findings elsewhere. This casts doubt on the replicability of some findings, encouraging further investigation of potential moderators or mediators. In these studies, it also appears that other traits are not controlled for, meaning that the results do not consider the effect of other traits in combination with extraversion. Similarly, these studies do not appear to control for social media use itself. This means that the high rate of a specific observed behavioural outcome may actually be intrinsically linked to social media use itself as a mediating variable.

4.2. Limitations and future directions

Although our systematic approach to reviewing these articles has enabled us to explore the key trends and nuances across these studies to date, this research offers no quantifiable means of assessing the strength of effect sizes. Future research could explore such opportunities via meta-analyses. A meta-analysis may also highlight statistical differences in outcomes between studies employing different data collection techniques, or differences when studies use a random, representative, or larger sample.
This is also largely a review of findings related to social media users, whereas more than half of the world’s population does not use social media (Kemp, 2019). Even in North America and Eastern Asia, where 70% of the population uses social media, 30% of the population does not (Kemp, 2019). Further research might investigate why this is. Is personality responsible for this lack of use – even in part? Moreover, not only is this a review of social media users, but the vast majority of literature (n=101) focuses on Facebook. Just 12 studies investigate Twitter use, six investigate Instagram use and five Weibo. Given the constant evolution of social media, for example with the recent rise of TikTok, there is a need to review the applicability of these findings to a broader range of social media platforms, including how personality is associated with the adoption of different or new platforms. In addition, there is an opportunity for studies employing consistent sampling approaches and methodologies to investigate nuances in extravert behaviour between platforms and to assess the replicability of results across social media.

In relation to the many papers (n=47) where non-significant results are not reported, for reasons that could include either a ‘file drawer’ problem (Franco, Malhotra & Simonovits, 2014) or ‘p-hacking’ (Nuzzo, 2014), it is important that future researchers make efforts to demonstrate transparency. One solution attracting attention among researchers of psychology is the concept of ‘preregistration’ (Nosek et al, 2018) whereby exploratory studies are then followed by replication. We have not identified any evidence of preregistration currently being applied within this body of literature.

Aside from methodological considerations however, within the existing literature discussed there are some clear topics requiring greater investigation. There is an opportunity for further research into the drivers of social online behaviour among extraverts, testing for example whether the positive affect felt by those who socialise is caused by a higher baseline positivity or
conditioning through reward stimuli. There could also be a connection between the evidence of social interaction and exhibitions of positivity. For example, the findings could indicate support for the notion that extraverts feel happier because they are social (Fleeson et al., 2002; Watson, 1988; Watson et al., 1992) with a desire for positive affect driving social activity. Both the affect-threshold model as an underlying cause of positivity, as well as positivity driving of social behaviour require further research though, with a specific focus on their relevance to online behaviour.

Yet, there are also areas where the findings to date generally do not seem to obviously support the preference for displaying positive emotion that has been demonstrated through offline behaviour. For example, there is scope for more research relating to the choice of images posted. Choice of topic is also an area for further research, to understand why extraverts might be more likely to post content relating to music, or electronics for example among other topics. Similarly, why do extraverts use sexual words?

Given that extraverts are clearly keen to socialise, the apparent predisposition to post inappropriate content is also counterintuitive and needs further investigation. Another contradictory finding indicates that extraverts appear to be both willing to disclose information (such as Loiacono et al., 2012), yet also concerned about certain privacy settings (such as Kuo & Tang, 2013). As discussed above, the situational nature of privacy and self-disclosure decisions may also play a role in this difference in attitudes, but further research is required to clarify this. Future research might also seek to understand the inconsistent findings that extraverts are proactively aggressive online (McCreery & Krach, 2018), yet do not bully (Kokkinos, Baltzidis & Xynogala, 2016), or give ‘uncivil’ comments (Koban et al., 2018). It could also explore whether there is a subtle difference in the meaning of these words.
Given the commercial drivers of social media use by organisations, there is also only a small number of studies investigating marketing content and reactions among an audience according to personality traits. This is particularly surprising, given the vast sums of money being spent on advertising (PR Newswire, 2019). Coupled with the opportunity to investigate the potential interaction between personality theory and other presentational theories from the behavioural sciences, this is a potentially rich area of research.

Lastly, this literature review is the presentation of findings relating to just one trait. This was intentional, given the volume of literature in this field, but there is clearly an opportunity to present the literature on the other four traits within the five-factor model. Moreover, the findings have been presented in a way that assumes that the traits predict behaviour independently. In fact, some of the findings presented may be amplified when a person scores highly for two or more of the five traits. Further research could explore such possibilities.

4.3. Conclusions

To our knowledge, this is the first literature review to systematically review the relationship between extraversion (according to the five-factor model of personality) and social media use. Whilst it has generally found that some of the trait characteristics relating to extraversion are also present in online behaviour, such as a tendency to display positivity and a desire to socially interact, there are also areas for further research, and at times contradictory results. These include the effect of combining traits and researching models that might amplify the relationship between traits and behaviour. The applications of this work have implications for numerous disciplines including psychology, marketing, healthcare, human computer interaction, and communications. For example, clinical practice may benefit from areas of this
review such as the contradictory evidence on addiction. Given the apparent general high level of use among extraverts though, future research may want to particularly focus on how social media could be better designed to support users who are low in extraversion (introverts), (as well as explore these aspects across other personality traits).
References


Allport, G.W. and Odbert, H.S. (1936) *Trait-Names; a Psycho-Lexical Study. A Study from the Harvard Psychological Laboratory*. Harvard Psychological Laboratory


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Personality, Gender, and Age in the Language of Social Media: The Open-Vocabulary Approach. *PLoS ONE*. 8 (9), pp.e73791.


Tables

Focus, method, and sample of studies. Please note that the sample of some studies included more than one group of people.

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<th>Data collection method</th>
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## Table 2

*Codes and themes identified*

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STAGE 1
Records identified through Scopus database searching (n = 16,502)
Additional records identified through other databases (n = 8,794)
Records after duplicates automatically removed (n = 25,209)
Abstracts and titles screened (n = 25,209)
Records excluded if not researching social media and five-factor personality (n = 24,715)
STAGE 2
Full-text articles assessed for eligibility based on personality predicting behaviour (n = 494)
Full-text articles excluded, with reasons [including 16 removed by a moderator] (n = 304)
STAGE 2
Full-text articles assessed for inclusion of all five traits (n = 190)
Full-text articles excluded where extraversion not tested (n = 8)
STAGE 3
Studies included in qualitative synthesis of extraversion trait (n = 182)

Figure 1. PRISMA flow diagram
Figure 1. Frequency of scale use for Big 5 measures