Personality Analysis Through Behavior in Social Networks. Application to the Military Context

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ABSTRACT

Cyberspace is one of the current threat contexts that the Army must address. In particular, social networks have become a vital scenario of influence, in which users also reveals a large amount of psychological information. The aim of this paper is to determine whether the analysis of behavior in social networks can be established as a valid indirect measure of users' personality, as well as to find out if this can be a useful tool for the Army. To this end, a systematic review of the research present in 5 databases (PsycInfo, Web of Science, Scopus, Psicodoc and PubMed) was carried out, selecting those articles based on the Big Five model. Of the 194 articles found, a total of 36 papers, published in the last 10 years and corresponding to 20 countries, were analyzed in depth. The results reveal that the behavior presented in social networks corresponds to the self-reported personality of the users. In addition, certain patterns of online behavior associated with the factors of the Big Five Model can be identified. This analysis technique has demonstrated its reliability and validity, revealing itself capable of complementing and extending traditional self-report or acquaintance report measures. It may also constitute a tool of interest for the Army, aimed at improving the operability of the units.

1.0 INTRODUCTION

In 2014, Aleksandr Kogan, professor of psychology at the University of Cambridge, developed an application called "This Is Your Digital Life". Through Facebook, this application offered users the possibility to complete a series of questions with the aim of determining their personality. In total, it is estimated that the project initiated by Professor Kogan obtained personal information from more than 78 million users of the social network (Hindman, 2018).

This data was purchased by the company Cambridge Analytica, and as it has subsequently been learned, was used to influence voting intentions in the 2016 U.S. presidential election, (Sampedro, 2021). In terms of the then CEO of the company, Alexander Fix, knowing the personality of voters allowed them, in a way, to anticipate their behavior, and with this, to design a series of messages with which to manipulate attitudes and change voting behavior (Hindman, 2018).

Leaving aside the controversy arising from the misuse of these data, it is clear that we are at a time of change in the study of human behavior. The classic observation of traditional environments is now moving to the realm of the internet and new technologies, also offering new possibilities and, as seen in the case of Cambridge Analytica, with powerful consequences on social phenomena.

1.1 Social networks

In recent years we have witnessed the unstoppable expansion of these platforms. According to data provided

by the consulting firms We Are Social and HootSuite in their Digital 2021 report, it is estimated that the total number of active users of social networks as of January 2021 exceeds 4.2 billion (around 53.6% of the world's population). It is estimated that each of these users spends around two and a half hours a day using these networks, and has an average of 8.4 accounts across the different platforms.

These figures not only reflect a lucrative business, but also point to the penetration that these platforms have had in our society, with online activity becoming an important spectrum of a person's daily behavior. In this sense, research has been developed that relates certain online activity with certain psychological dimensions, such as, for example, personality analysis.

1.2   Theoretical background: the study of the personality

1.2.1   Preliminary research

The first objective questionnaire used in personality assessment was designed by Woodworth, in the context of World War I. The test aligned with the interest shown by the U.S. Army to assess the emotional stability of new recruits. (Gibby & Zickar, 2008). This early work in the military setting was soon refined and extended to civilian settings as well.

Among the most outstanding contributions are the trait theorists, headed by Allport and Cattell, who understand traits as general, relatively stable categories that predispose subjects to act in a certain way.

Cattell furthered the study of these traits using the statistical method and factor analysis, through the statistical relationships observed between factors. This technique allowed a screening of the information, so that the smallest possible number of variables would account for the greatest proportion of variability in the data (Torregrosa & López, 2016).

Eysenck added to his theory biological mechanisms that explained some basic processes, such as learning or motivation. This author reduced the proposed personality factors to three mutually independent dimensions: Psychoticism/Impulse Control, Neuroticism/Emotional Stability and Extraversion/Introversion. These major factors are in turn composed of other lower order traits, also establishing a continuum between normal and pathological personality (Bermúdez, J; Pérez A, ; Ruiz, J ; Sanjuán P ; Rueda, 2011).

1.2.2   Big Five Model

The theory that has reached a greater consensus among the scientific community is the Big Five Model (Sánchez-Marqueses & Sanz, 2018) highlighting the contributions of Costa and McCrae (1992). These authors designed the NEO-PI questionnaire (1985) and its revised version NEO-PI-R (1992), Its application to samples from different countries and longitudinal studies have accounted for the cross-cultural scope and temporal stability of the factors (Sánchez-Marqueses & Sanz, 2018).

For the development of this model, factor analysis was used as a starting point, following in the wake of previous trait theorists. After data cleaning, five traits were proposed as necessary and sufficient to explain personality: Extraversion, Agreeableness, Responsibility, Neuroticism and Openness to experience. Due to space limitations, the definitions of each of the personality factors have not been included in this paper. For further information, however, they can be consulted in Costa and McCrae (1992).

Although the Big Five Model has been the preponderant one during the last decades, personality research has not stopped, it is still alive and in constant dynamism. One hundred years have passed since Woodworth's Personal Fact Sheet and, as is obvious, the context we live in has changed. In the digital era, given the tremendous rise of connectivity and social networks, new areas of study are being explored.

1.2.3 Current state of research: social networks and personality

The advantages offered by these new tools are not only limited to the large sample size. The communication shared through these platforms takes place in a natural social environment, where the data collection process is performed in a non-intrusive manner and under natural conditions. Also, access to these data can be retrospective, avoiding the loss of subjects. In many cases, it is not even necessary to administer lengthy questionnaires, it is sufficient to analyze the behavior of the subjects, reducing cost, fatigue and maximizing efficiency in the evaluation (Park et al., 2014).

However, although promising, some of these studies reveal certain inconsistencies, or point to significant correlations but with poor effect sizes. For these reasons, it is necessary to conduct a more in-depth review of the literature and, with this, to firmly determine whether it is possible to perform personality profiling using only the data present in social networks, and, if so, to define which variables, as Cattell already suggested, are capable of explaining the greatest variability in the data.

1.3 Justification and objectives

Currently, one of the threat contexts that the Armed Forces must address is that of cyberspace (Nieves, 2021). In particular, given the expansion of social networks, the messages disseminated through these platforms are likely to reach a large part of society and, as we have seen, potentially modify its behavior (Sampedro, 2021).

Another threat to security, both in national territory and in the area of operations, is terrorism and the concept of asymmetric warfare. In such a scenario, the enemy is not a state or a recognizable and organized institution, but depends on the intervention of small groups or individual actions. To combat it, personality profiling of individuals susceptible to radicalization could be used, helping to anticipate certain behaviors, risks, as well as providing information about radicalization processes.

Likewise, the advance in the knowledge of these areas could also reach its application to other fields, such as personnel selection, helping to collect information on both the candidate and the specific position, or health prevention, through the detection of risks or as an advisory tool in the design of interventions.

1.3.1 Objectives

1.3.1.1 To examine whether social network behavior analysis can be established as a valid indirect measure of user personality

1.3.1.1 Establish whether personality profiling through social networks could be a useful tool for the Army.

1.3.2 Research questions

1.3.2.1 Does the personality projected in social networks correspond to the self-reported personality, or on the contrary, do users project an idealized image of their personality?
1.3.2.2 Is there any correlation between users' behavior in social networks and the personality traits proposed by the Big Five Model?
1.3.2.3 Can a valid measure of personality be established by observing network behavior?
1.3.2.4 Is personality profiling a useful tool in any sense for the military?

2 METHODOLOGY

It is proposed to carry out a systematic review to analyze the data and compare them with the proposed objectives. The main advantage of this methodology is the possibility of comparing different previous studies and drawing conclusions on the evidence found. In this sense, a method inspired by the six stages of Ganong (1987) was proposed:
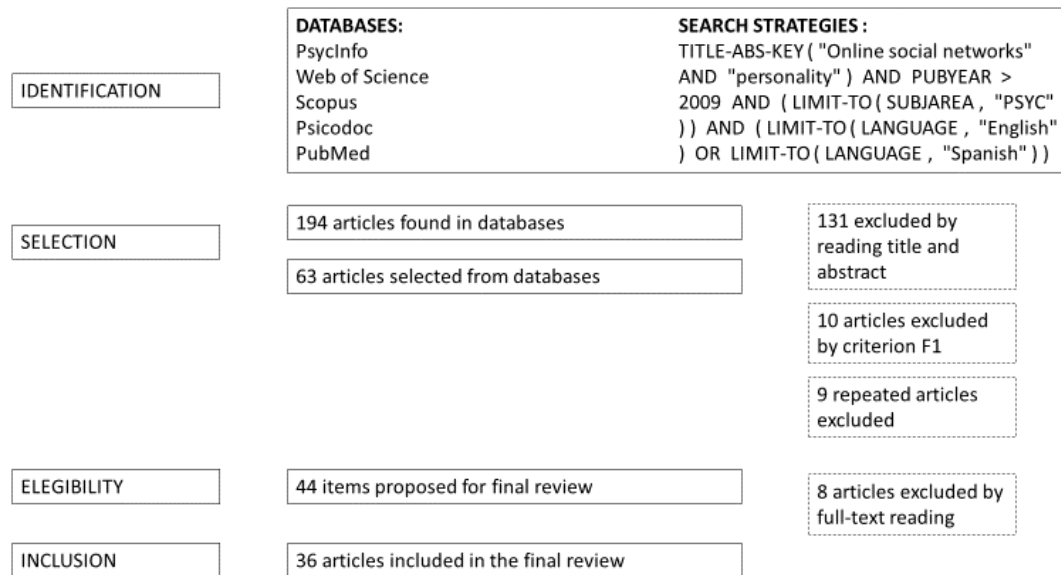
IDENTIFICATION	DATABASES: PsycInfo Web of Science Scopus Psicodoc PubMed	SEARCH STRATEGIES : TITLE-ABS-KEY ("Online social networks" AND "personality") AND PUBYEAR > 2009 AND (LIMIT-TO (SUBJAREA , "PSYC")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Spanish"))	
SELECTION	194 articles found in databases 63 articles selected from databases	131 excluded by reading title and abstract	
		10 articles excluded by criterion F1	
		9 repeated articles excluded	
ELEGIBILITY	44 items proposed for final review	8 articles excluded by full-text reading	
INCLUSION	36 articles included in the final review		

Figure 1

- First, to initiate the data collection, the key terms "online social networks" and "big five" were determined with the Boolean operator AND.

- Next, the inclusion criteria were established, which included publications related to behavior in social networks and personality analysis, available in English or Spanish, with access to the full text and integrated in the subarea of psychology. In addition, a restriction by year was applied, reviewing only papers published between 2010 and 2020, given that it was during this last decade when the use of smartphones became widespread globally, a key factor in the explosion of social networks as we know them.

- Five databases of recognized prestige were selected for the searches, with the aim of guaranteeing a good representative quality of the data. The databases chosen were the following: PsycInfo, Web of Science, Scopus, Psicodoc and PubMed. The key terms had to appear in the title, abstract, or in the list of Keywords. The searches were conducted between November 2020 and January 2021. A total of 194 publications were collected, choosing those that best fit the purposes of the research. The criteria proposed for eligibility were as follows:

  - Publications that focused on children were eliminated because of the difficulty in extrapolating conclusions to adult populations of interest to us. However, given that the military population also includes students and troops aged around 18 years, the elimination of the juvenile population was not considered.

  - Also were excluded those that included third modulating variables (such as academic performance or personal satisfaction), as well as works focused on the identification or understanding of psychological disorders (addictions, depression), risk factors or other variables related to clinical issues.

  - Research that used other models for the conceptualization of personality, different from the Big Five Model, were not included. This decision was made in order to homogenize the measures and data collected. Specifically, the Costa and McCrae (1992) model was used as the formulation that has the greatest consensus among the authors. (Torregrosa & López, 2016).

- Only research that used validated questionnaires to assess the personality traits of the participants was taken into account.

- In addition, it was decided to add a new criterion based on the Impact Factor of the journals in which the papers were published. This index is calculated taking into account the number of citations obtained by the articles published in these journals. The JCR (Journal Citation Reports) index was used as a classification instrument. Only those papers present in publications with an Impact Factor equal to or higher than 2 were chosen, following the line of previous works (Torregrosa & López, 2016). In this way, we tried to ensure the highest possible rigor and quality for our research.

- Once the aforementioned criteria were applied, from 194 papers found in the databases, 53 of them were selected for analysis (131 articles excluded by title and abstract reading, and 10 by Impact Factor criteria), which after leaving out the duplicates (9 eliminated) resulted in a total of 44 papers.

- Finally, a critical reading of the remaining 44 articles was carried out, in which the main purposes, research methodology, results and discussion were analyzed and extracted. In this process, it was decided to discard 8 of these papers, because after a complete reading of them, it was determined that they did not meet any of the above requirements. Therefore, 36 articles were finally included in our review.

3   RESULTS

In order to facilitate the understanding and analysis of the data, during the review a series of variables were identified on which to classify the results extracted. The studies were grouped according to the year of publication, the country of origin, the specific use of social networks under study, and the personality traits taken into account in each report. The findings of the research were then analyzed and presented according to the Big Five factors.

3.1   Year of publication

The articles are distributed according to the following table, with 2020 being the year with the highest number of articles, with a total of 6 research studies.
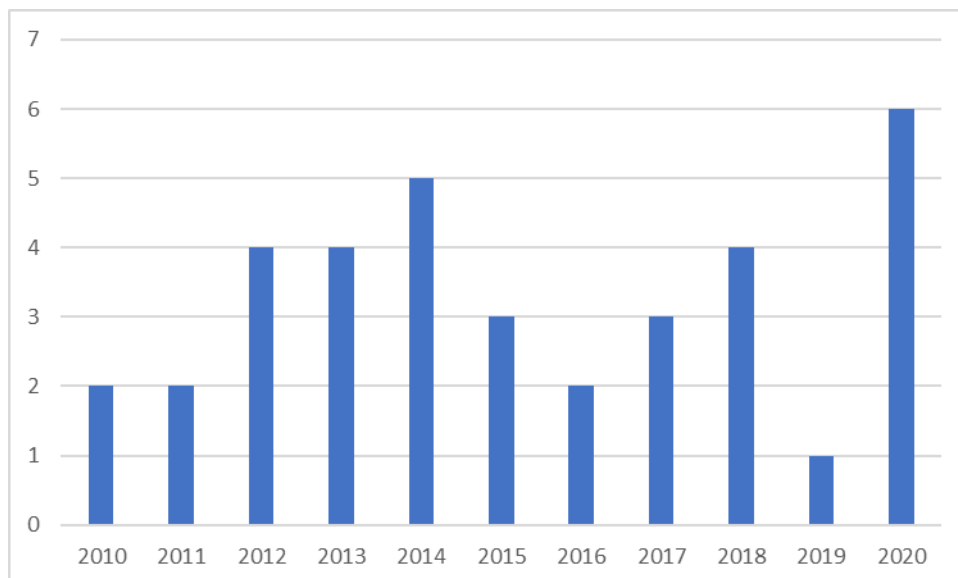

Figure 2

Note: number of investigations collected according to year. Own elaboration.

3.2   Analyzed traits

Likewise, it was taken into account which personality traits were analyzed in each of the articles, based on the Big Five Model. The results showed that 88.9% of the papers dealt with all the traits proposed in the model. The remaining 11.1% analyzed the Extroversion factor specifically or in combination with Neuroticism or Conscientiousness. No studies were collected that analyzed the Openness or Agreeableness factors individually.

3.3   Country of origin

In reference to the country of origin, as the table shows, most of the articles reviewed come from the USA (34.28%), followed by China (14.28%), the United Kingdom (14.28%) and Germany (11.42%). However, it should be noted that the data collected includes research from a total of 20 countries, spread all over the world and from different cultures. The wide distribution of the papers is an advantage when interpreting the results, as they are not restricted to a locally limited environment. Therefore, being able to study it in a comprehensive manner increases the validity of the conclusions.
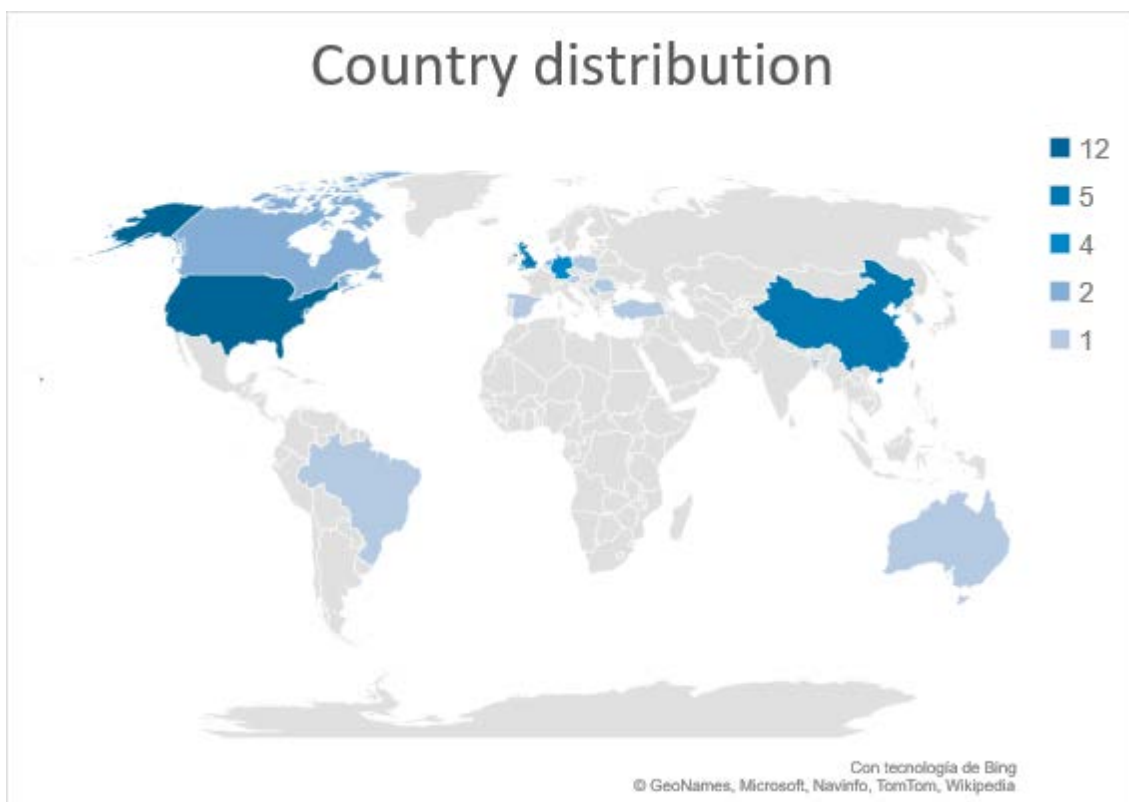

Figure 3

Note: number of articles included in the review according to their country of origin. Own elaboration.

3.4 Variables studied

On the other hand, the behavioral variables in social networks that were analyzed in each of the investigations were studied. These variables were grouped into different categories, according to the elements of online behavior that were taken into account.

- Status updates: personal content through short messages. They can be evaluated through the content of the messages (more or less intimate, for example), but also through their update frequency or style.

- Language content: patterns and individual differences in language use, which are also characterized by their stability and their relationship to personality traits.

- Activity related to photographs and images: creation of albums, selfies, frequency and quantity of images uploaded to the network, comments and likes received on photographs, number of people tagged, aesthetics or composition. Content indicators can also be analyzed, such as what or who appears in the photograph, in what situation, what is happening. These elements are objectifiable and can be analyzed through artificial algorithms (Cooper et al., 2020), but there are also other aspects of psychological significance such as the positive or negative charge of the image, its social character.

- Profile information: personal descriptions, Facebook updates, profile picture, favorite posts, shared interests, external indicators such as number of friends, interactions with friends, etc.

- General behavior: joint analysis of different variables. Processes of self-disclosure, self-presentation, formation and development of friendships, self-identification with Facebook profile, interactions, information search, updates, use of social network functions.

- Frequency and purposes of use: frequency with which users connect to social networks, time spent on them. This section also includes the main interests and motivations for which users connect.

Thus, 27.78% of the papers focused on general user behavior, 22.22% analyzed profile information, the same number of articles looked at frequency and purposes of use, 16.67% studied language content, the same proportion analyzed activity related to images and photographs, and finally 13.89% analyzed status updates (the raw sum of the percentages indicates a number greater than 100% since some articles analyzed more than one variable).
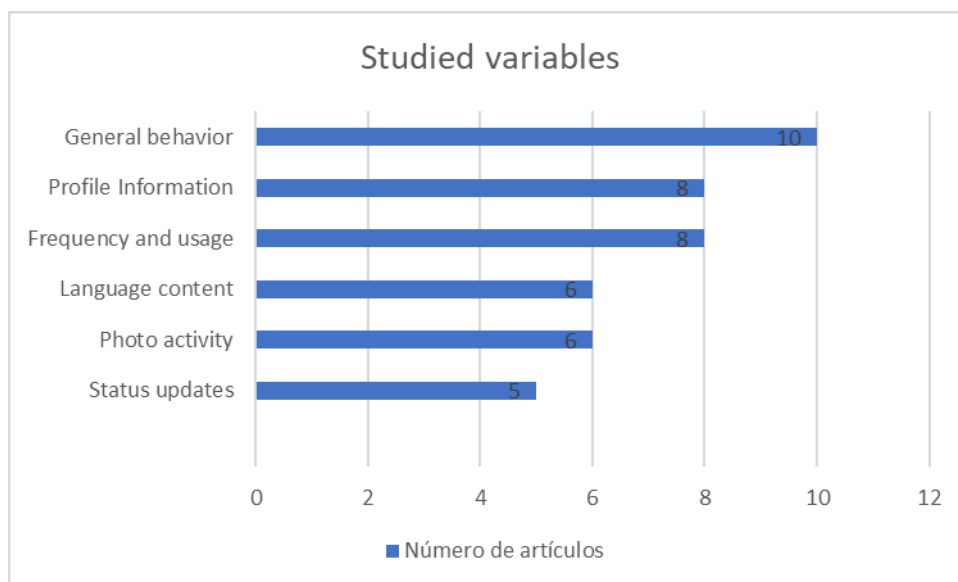

Figure 4

Note: explored aspects of network behavior according to the number of articles included in the review that study them. Own elaboration.

3.5   Online behavior associated with personality factors

3.5.1   Extraversion

Firstly, the studies revealed that the profiles of these networks convey reliable information about users' personalities, rejecting the idea that they only reflect idealized views of users. Specifically, the factors that were most accurately reflected in online behavior were Extraversion and Openness (Back et al., 2010).

Most studies point to extraversion being consistently and positively related to the number of friends maintained by the user in the social network (Hall & Pennington, 2013; Li et al., 2013; Winter et al., 2014; Hall et al., 2014). In the same vein, a positive association is also seen between this factor and the use of these platforms, manifested both in the activity on the network, the time invested or the frequency of connection (Brailovskaia & Margraf, 2018). For some authors, only Extraversion and Neuroticism correlated significantly with the overall use of social networks, with Extraversion being the factor presenting the strongest positive association with network activity (Liu & Campbell, 2017). Some of the indicators reflecting such activity are, for example, greater willingness to comment or like (Choi et al., 2017), greater likelihood to post pictures and share them with others (Gosling et al., 2011; Muscanell & Guadagno, 2012; Eftekhar et al., 2014), the use of emoticons on Facebook (Oleszkiewicz et al., 2017), the tendency to interact with others across networks, the use of communication features on Facebook (Ryan & Xenos, 2011), or having a greater number of people tagged in photographs uploaded to the network (Hall et al., 2014).

Regarding contact social networks, such as Tinder, it was observed that extroverted users repeated the pattern of greater activity in these networks (Burtăverde et al., 2019). Moreover, in this type of platforms, they showed, along with those with high openness, a greater tendency towards short-term intimate relationships, even in cases where they were already in some type of relationship (Timmermans et al., 2018).

Likewise, attending to the purposes of use, extroverts use Facebook more often with the interest of meeting new people and sharing social information (Horzum, 2016). These users have been observed to post more often details about their social activities (Gvili et al., 2020) and daily life (Marshall et al., 2015) and disclose more personal information on their profiles (Chen et al., 2016). However, Extraversion was not related to the degree of concern about others' responses to their selfies (Choi et al., 2017).

Statistically significant differences can also be seen in language use. Extraversion turned out to correlate positively with words of positive emotional tone and social character, as well as being related to words of assent; whereas it correlated negatively with words of functional type (Qiu et al., 2012). Aspects of language reflecting high extraversion would show positive emotionality (love), enthusiasm (the best, excited), and sociability (party, meeting, dining with). At the other extreme, low extraversion scores (introverts) suggested language with a more internal focus (e.g., have, must not, should), relatively greater interest in things versus people (computer, book, chemistry), and words expressing doubt (probably, guess, apparently) (Park et al., 2014).

For images, it has been observed that participants with lower scores on Extraversion were more likely to choose an image of themselves for the Twitter profile, compared to participants who scored higher (Whitty et al., 2018). In addition, on Instagram high scores were related to images of many people, while introversion was related to images of cats, books, and images of objects or clothing (Rodriguez et al., 2020).

3.5.2   Agreeableness

Meanwhile, the Agreeableness factor is also positively related to the frequency of interaction and

communication in the network (Huang et al., 2018) and to making more comments on other people's profiles (Wang et al., 2012). From the scores on this factor, the average number of "likes" and comments received on profile pictures was predicted (Choi et al., 2017).

However, this factor correlates with non-overuse of Facebook (Hall et al., 2014). Subjects who scored higher on Agreeableness used less network features (Amichai-Hamburger & Vinitzky, 2010) and in particular, a negative correlation was found with the use of network games (Liu & Campbell, 2017).

According to studies, the main purpose for Facebook use of users with high Agreeableness was to maintain their existing relationships (Seidman, 2013; Horzum, 2016), followed by informational and educational purposes. Those with low scores on this trait use this social network more with the intention of becoming more well-known and popular, as well as for entertainment (Horzum, 2016). Likewise, compensation seeking (of insecurities and feelings of inadequacy) is related to Introversion and lower Agreeableness (Bodroža & Jovanović, 2016). This factor also maintains a negative relationship with attention seeking (Seidman, 2013).

Men with low Agreeableness posted blog entries more often than those with high Agreeableness (Muscanell & Guadagno, 2012), and the content of the posts correlated negatively with words of denial and sexual content (Qiu et al., 2012). People who scored high on Kindness showed a tendency not to include content that was controversial or could upset their network (Hall et al., 2014). Similarly, users who scored higher on Agreeableness and Neuroticism also used more emoticons than users who scored lower (Oleszkiewicz et al., 2017).

In the networking domain, Tinder users who also had a partner scored significantly lower on Agreeableness (Timmermans et al., 2018). Furthermore, this factor was related to a decrease in the use of dating apps (Burtăverde et al., 2019).

Putting the focus on the use of images, some authors point to a positive relationship between Agreeableness and the publication of photographs (Liu & Campbell, 2017), although others qualify that this association could be represented in a U-shape, as is also the case with the publication of contact information (Amichai-Hamburger & Vinitzky, 2010). Likewise, in users with high scores in this factor, positive associations have been found with images of flowers and negative ones with images of texts and naked torsos (Rodríguez et al., 2020). On the other hand, users with high Agreeableness and low Openness showed a strong tendency to observe the selfies of others (Choi et al., 2017).

3.5.3   Consciousness

Results indicate that non-users of social networks scored higher on the Conscientiousness trait than active users (Ryan & Xenos, 2011). Indicators of subjects low in conscientiousness can also be detected through procrastination of activities (Gosling et al., 2011). A negative relationship was also observed with the use of games and the search for information in social networks. These subjects valued information in terms of its contribution to the achievement of their goals, but also information of a psychological or personal nature (Gvili et al., 2020). It also stands out that it was the only factor that correlated negatively with the use of these platforms (Liu & Campbell, 2017).

The conscientiousness factor would be negatively related to the frequency of interaction on the network (Huang et al., 2018). This factor proved to be a significant predictor of sending private messages (Muscanell & Guadagno, 2012). On the other hand, Conscientiousness estimates were related to three types of indicators: expressing positive affect, talking more about family in status updates, and having Facebook friends who expressed support in response to status updates (Hall & Pennington, 2013).

In contrast to some previous findings, Conscientiousness correlated positively with the location sharing

function of social networks (Chorley et al., 2015). Also, people who scored higher on this trait demonstrate having a higher number of friends on the platform than those who scored low, and used less often the option to upload photos to the network (Amichai-Hamburger & Vinitzky, 2010).

Participants who scored higher on Conscientiousness and lower on Extraversion were more likely to change or update their profile picture (Whitty et al., 2018). In the case of uploaded audiovisual content, for subjects with high scores most of the images were pictures of food, especially healthy food, while for low scores we see more images of alcohol, weapons, and people (Rodriguez et al., 2020).

As expected, Conscientiousness was associated with decreased use of dating apps. However, of those users who used them, a positive correlation was observed between Conscientiousness and average daily use (Burtăverde et al., 2019). For its part, as was the case with Kindness, Conscientiousness also correlated negatively with short-term relationships in this type of apps (Timmermans et al., 2018).

In terms of purpose, as was the case with Agreeableness, users high on the Conscientiousness trait tend to use Facebook for the purpose of maintaining their existing relationships, in addition to informational and educational purposes. This trait correlates with sharing less content about oneself or others and the lowest number of comments (Horzum, 2016). The Conscientiousness trait correlated negatively with seeking acceptance or relationships (Seidman, 2013).

3.5.4 Neuroticism

As pointed out by several studies, the accuracy for the detection of neuroticism through social networks was low, compared to the other factors (Hall et al., 2014).

This factor was also associated with dependence on social network use (spending a lot of time on the network and failure when trying to control it) and social anxiety (Bodroža & Jovanović, 2016). Individuals with high trait neuroticism seemed to prefer joining more platforms than other subjects (Brailovskaia & Margraf, 2018). Commensurate with this, such a factor predicted more photo uploads to the network (Eftekhar et al., 2014) (Amichai-Hamburger & Vinitzky, 2010). Regarding location sharing social networks, some negative correlations were found associated with this factor (number of places visited, number of sociable places visited) (Chorley et al., 2015).

It was further observed that high scores on this factor were related to images of pets, while for low scores we see images of landscapes and sunsets (Rodriguez et al., 2020).

A U-shaped correlation was also revealed between neurotic personality and the amount of basic information shared on Facebook. This result indicates that people with low or high levels of neuroticism are more inclined to share basic information on their profiles than those with medium scores on this trait (Amichai-Hamburger & Vinitzky, 2010).

As research indicates, these users use networks for information seeking, giving special importance to social information, for self-presentation and acceptance purposes (Gvili et al., 2020). Neuroticism was associated with general self-disclosure and emotional disclosure, with high Agreeableness and Neuroticism being the best predictors of belonging behavior. In addition, individuals with high Neuroticism showed behaviors aimed at ideal and hidden presentation of the self, i.e., they use networks for self-presentation and may include false or idealized aspects of self (Seidman, 2013).

Neuroticism was negatively related to interaction frequency (Huang et al., 2018) but did correlate with some aspects of communication (Seidman, 2013), such as status updating (Liu & Campbell, 2017). They are more likely to use the status update function as a form of self-expression, controlling the information they wish to share and using profile data as a self-affirmation (Wang et al., 2012). Likewise, communication through

posts was also related to neuroticism, as a preference over live communication offered by chat (Ryan & Xenos, 2011). On the other hand, participants with low levels of neuroticism were more likely to post about romantic partners (Marshall et al., 2015).

Finally, in the realm of dating apps, emotional stability would be more associated with seeking long-term relationships over short-term relationships. In addition, a negative relationship was found between emotional stability and average daily use of this type of social networks (Burtăverde et al., 2019)

3.5.5 Openness

The clues for the prediction of the Openness factor were based on the personal information section, which contained the user's personal and artistic interests, so Facebook could be a good tool to identify this trait (Hall et al., 2014). Those who scored higher filled in more options in the personal information section. It seems that people with higher Openness are more expressive in their Facebook profile (Amichai-Hamburger & Vinitzky, 2010). The variation of this effect when correct OPSEC measures are applied has not been studied.

Users with low Openness to experience use Facebook more often to express themselves, introduce themselves or become more popular (Horzum, 2016). The value placed on psychological or personal information was found to be negatively related to Openness to experience, although it does orient more toward hedonism (Gvili et al., 2020).

Openness also correlated with social networking activity, especially game playing (Wang et al., 2012). Men with low Openness reported playing games on social networks more often than those with a high score on this trait, ignoring the many other functions present on these websites (Muscanell & Guadagno, 2012). This trait was also related to information seeking, photo posting, and status updating (Liu & Campbell, 2017). People with high Openness to Experience were more likely to update on intellectual topics (Marshall et al., 2015). This trait is also expressed through the tendency to explore new activities, experiment with new people, or changing profile pictures, for example (Gosling et al., 2011). Regarding the choice of images in the profile, associated with high scores in Openness we can see images of books, the moon and the sky, while for low scores we find images related to love (Rodriguez et al., 2020).

Likewise, in location-based social networks, a correlation has been observed between this factor and some variables such as the average distance between places visited, popularity of the place and number of records in social places (Chorley et al., 2015).

In reference to the language used, this factor correlated negatively with the use of second person pronouns, assent words and emotionally positive words, as well as with the use of adverbs, swear words and affective words (Qiu et al., 2012).

Finally, both Extraversion and Openness are associated with short-term intimate relationships, as well as greater use of dating social networks (Timmermans et al., 2018).

4 CONCLUSIONS

4.1 Does the personality projected in social networks correspond to the self-reported personality, or on the contrary, do users project an idealized image of their personality?

In relation to the studies reviewed, online behavior seems to be offering a close reflection of the self-reported personality of individuals in the questionnaires; however, this statement has certain nuances. There is a

stronger association between certain personality traits and the realistic presentation of oneself through networks, as is the case of the factors Extraversion and Openness (Back et al., 2010). This could be due to the willingness of these users to use networks as an extension of their usual behavior and interests, while the idealized image that subjects with high scores in Neuroticism tend to offer (Seidman, 2013) could be explained by their tendency towards low self-esteem and negative emotionality. Dissatisfied with their own self-concept, the networks would be a vehicle to try to modify it.

There may also be other biases that modulate the idealization of the image, such as the cultural particularities of the sample, the self-awareness of self-presentation or the specific motivation to reflect certain information (we must not forget the social exposure to which the user is subjected with each publication). These interferences are also present, in one way or another, in traditional evaluation measures, with the particularity that, in the case of online behavior, these pernicious effects may be mitigated by some of its characteristics.

For example, firstly, the use of the social network over time tends to reduce the user's self-consciousness bias, progressively bringing their online activity closer to their usual repertoire of behavior. Moreover, given that the user does not have direct contact with the experimenter and does not know at what exact moment the data collection will take place, he/she is less vigilant and the bias inherent to the evaluation situation is reduced. Finally, given that under this paradigm a measurement of the user's continuous activity is made, and not a one-off measurement, the behavioral sample is not so subject to the influence of certain external variables, such as the vital circumstances that the person is going through at that particular moment.

4.2   Is there any correlation between users' behavior in social networks and the personality traits proposed by the Big Five Model?

As mentioned, there is a clear continuity between the offline and online behavior of the subjects according to their personality traits. For example, the Openness factor is associated with the use of networks to cover intellectual or artistic interests, the search for experiences or differentiation. For its part, the Friendliness factor is characterized by a tendency towards interaction and avoidance of conflict, also in networks, which is evident in the language and content posted (Qiu et al., 2012; Hall et al., 2014).

Regarding the Conscientiousness factor, the type of interaction and shared contents are in line with the values of discipline, duty and commitment common in these subjects, and have less relationship with personal or emotional aspects, with the exception of family contents, in line with the aforementioned values. Likewise, the negative relationship found between this trait and activity on networks (Liu & Campbell, 2017) stands out, probably associated with the conception of these as irresponsible entertainment and little linked to their objectives.

However, the most systematically detected factor that offers the best predictive guarantees is Extraversion. These users have been associated with a more active use of networks (Brailovskaia & Margraf, 2016; Chen et al., 2016; Winter et al., 2014; Hall et al., 2014), a fact that could be due to the social function that these platforms exert, being used as a complement to the relationships they already maintain in person. However, a more active use is not always oriented towards high Extraversion, since such exposure may also be mediated by compensation mechanisms, as in the case of introverts or neurotics, revealing more personal information in their profiles to compensate for certain deficits in interpersonal relationships.

In this sense, some authors refer that the Neuroticism factor is less accurately detected (Hall et al., 2014).

4.3   Can a valid measure of personality be established by observing network behavior?

The development of algorithms and the analysis of social networks open a door to the collection of objective behavioral data, in a natural situation and through standardized procedures, collecting and processing large volumes of information in a matter of seconds (Park et al., 2014). However, this method is still in a period of

development, especially if we compare them with traditional measures, such as tests, which accumulate a century of refinement behind them. Some of the associations found, although significant, present a variable effect size, between small and moderate, which, on the other hand, is similar or slightly higher than the correlation with reports of acquaintances.

Probably, the works that are obtaining better results in predicting personality through behavior in social networks are those that focus on the analysis of language (Park et al., 2014). One of the possible reasons regarding the accuracy of these algorithms may be due to the systematization of their design. Within this perspective, there are several lines of research, focusing either on the content of the message, the words used, grammatical structures or a combination of these factors.

The study of images and photographs uploaded to networks also has a promising future (Rodriguez et al., 2020; Cooper et al., 2020). From the choice of profile pictures, the frequency of change, the content of the same, the situational characteristics it describes and/or its composition, among other factors, direct the research in an increasingly structured and reliable way.

Fortunately, the different systems of analysis are not mutually exclusive, but can be combined and complement each other. One of the axioms shared by several of the researches in this field is that, when several of these procedures are applied in parallel, better results are obtained (Gayathridevi & Pattabiraman, 2019), so starting from different approaches, adding the information provided by language, photographs, or likes, among others, can lead to greater reliability of the analysis..

4.4   Is personality profiling an useful tool for the Armed Forces?

It could be concluded that in all military processes in which some type of personality study is applied, this assessment could be complemented, improved or even replaced (if necessary) by network analysis, in order to improve the operability of the unit in which it is applied. The following table details those specific areas where this technique could be particularly appropriate.

Table 2

AREA	APPLICATION
PSYOPS (Psychological operations)	The target audience must be known and precisely defined, identifying those characteristics shared by or differing from a certain population, or the personality traits of a specific individual. This helps to build the type of message, its style, as well as the media through which it will be disseminated, so that the intended persuasion ends up being more powerful.
Intelligence operations	Operations that require some type of infiltration or contact with the enemy. A prior analysis of the subjects involved and their possible reaction tendencies should be carried out. Such data are not usually provided voluntarily, but are collected through informants or covert observations, which in turn may contain biases, errors or involve risks for the observers. Profiling through social networks is proposed as an alternative, safer and more objective way of acquiring and interpreting this information.

Terrorism and threat detection	They allow reliable profiling of a large number of subjects in conditions where little or no collaboration is expected. Massive data tracking could be a tool for the prevention of this type of attacks, since, if these data can be oriented to the investigation of the personality of terrorists, risk profiles can also be investigated. By identifying similarities and differences, it is possible to gain a better understanding of the radicalization process and open a way to its prevention.
Selection of specific positions	It can be a valid and reliable measure of personality, complementary to other tests. It is developed in natural contexts for the subject and presents the additional virtue of being carried out through objective standards, easy to compare, informing of the subject's predisposition to respond to certain situations, allows to dispense with inadequate profiles and is a good predictor of the fit between the needs of the position, the culture of the organization and the characteristics of the candidate. It can be applied to sensitive positions, but also to those where personality and the human factor are fundamental elements for performance, such as pilots, heavy machinery operators, communications or external personnel, to prevent green on blue attacks.

Note: possible areas of application of personality analysis through behavior in social networks. Own elaboration.

In conclusion, it can be affirmed that the research objectives have been met, since the validity of the indirect analysis of personality through social networks has been determined, and therefore, its corresponding usefulness as a tool for the Armed Forces.

4.5   Limitations and proposals for the future

Firstly, the works analyzed have used different methodologies and instruments for evaluation. A lack of standardization of measurement could lead to certain problems in the validity of the conclusions.

Regarding personality assessment, the different questionnaires used share a good convergent validity, however, it is not perfect. With a view to future research, it would be advisable to aim for a homogenization of the measurement instruments.

As for the analysis of online behavior, multiple methods have been proposed. This may be the reason for some discrepancies found between studies. However, in general terms, the conclusions of the researches are in the same direction, which shows the rigor of the methods and the effort of the authors to replicate or differentiate themselves from previous studies, providing new data. In this sense, a line of research for the future could be the comparison of various sources of information (photographs, text content, profile activity, etc.) when predicting personality traits, within the context of social networks. Such work could lead to a more complete understanding of the use of these channels.

Likewise, this review was not intended to focus on one or several social networks in particular, but rather to analyze the general behavior of users on these platforms. However, some studies point out that such behavior may vary depending on the website being operated. Therefore, it would be particularly useful to compare this possible variation in behavior between different networks.

Likewise, publications from different countries have been included in the present work; however, some studies suggest that there may be certain cultural differences in users' social network behavior, so this would be a relevant variable to consider.

Finally, perhaps one of the most promising research perspectives in the analysis of networks is the construction of standardized evaluation instruments. Some proposals have been reviewed in this paper; however, it is necessary to continue the research, pursue their improvement and ensure their reliability and validity, without losing sight of the ultimate goal, which is their effective application in the military context.

5   REFERENCES

[1] Amichai-Hamburger, Y., & Vinitzky, G. (2010). Social network use and personality. *Computers in Human Behavior*, *26*(6), 1289–1295. https://doi.org/10.1016/j.chb.2010.03.018

[2] Back, M. D., Stopfer, J. M., Vazire, S., Gaddis, S., Schmukle, S. C., Egloff, B., & Gosling, S. D. (2010). Facebook profiles reflect actual personality, not self-idealization. *Psychological Science*, *21*(3), 372–374. https://doi.org/10.1177/0956797609360756

[3] Bermúdez, J; Pérez A, ; Ruiz, J ; Sanjuán P ; Rueda, B. (2011). *Psicología de la Personalidad*. Madrid: UNED.

[4] Bodroža, B., & Jovanović, T. (2016). Validation of the new scale for measuring behaviors of Facebook users: Psycho-Social Aspects of Facebook Use (PSAFU). *Computers in Human Behavior*, *54*, 425–435. https://doi.org/10.1016/j.chb.2015.07.032

[5] Brailovskaia, J., & Margraf, J. (2016). Comparing Facebook users and Facebook non-users: Relationship between personality traits and mental health variables. *PLOS ONE 11*(12), e0166999. https://doi.org/10.1371/journal.pone.0166999

[6] Brailovskaia, J., & Margraf, J. (2018). What does media use reveal about personality and mental health? An exploratory investigation among German students. *PLOS ONE*, *13*(1), 1–16. https://doi.org/10.1371/journal.pone.0191810

[7] Casado, C. (2017). Personalidad y preferencias de uso en las redes sociales en línea. [Tesis de Doctorado, Universidad Ramon LLul]. *TDX (Tesis Doctorals en Xarxa)*. http://www.tdx.cat/handle/10803/409670

[8] Chen, X., Pan, Y., & Guo, B. (2016). The influence of personality traits and social networks on the self-disclosure behavior of social network site users. *Internet Research*, *26*(3), 566–586. https://doi.org/10.1108/IntR-05-2014-0145

[9] Choi, T. R., Sung, Y., Lee, J. A., & Choi, S. M. (2017). Get behind my selfies: The Big Five traits and social networking behaviors through selfies. *Personality and Individual Differences*, *109*, 98–101. https://doi.org/10.1016/j.paid.2016.12.057

[10] Chorley, M. J., Whitaker, R. M., & Allen, S. M. (2015). Personality and location-based social networks. *Computers in Human Behavior*, *46*, 45–56. https://doi.org/10.1016/j.chb.2014.12.038

[11] Costa, P.T., Jr. y McCrae, R.R. (1992). The Revised NEO Personality Inventory (NEO-PI-R) and NEO-Five-Factor Inventory (NEO-FFI) professional manual. Odessa, FL: Psychological Assessment Resources.

[12] Cooper, A. B., Blake, A. B., Pauletti, R. E., Cooper, P. J., Sherman, R. A., & Lee, D. I. (2020). Personality Assessment through the Situational and Behavioral Features of Instagram Photos. *European Journal of Psychological Assessment*, *36*(6), 959–972. https://doi.org/10.1027/1015-5759/a000596

[13] Eftekhar, A., Fullwood, C., & Morris, N. (2014). Capturing personality from Facebook photos and photo-related activities: How much exposure do you need? *Computers in Human Behavior*, *37*, 162–170. https://doi.org/10.1016/j.chb.2014.04.048

[14] Ganong, L.H. (1987) Integrative Review of Nursing Research. *Research in Nursing & Health*, 10, 1-11. http://dx.doi.org/10.1002/nur.4770100103

[15] Gayathridevi, B., & Pattabiraman, V. (2019). Towards User Profiling from Multiple Online Social Networks. *Procedia Computer Science*, *165*(4), 456–461. https://doi.org/10.1016/j.procs.2020.01.006

[16] Gibby, R. E., & Zickar, M. J. (2008). A history of the early days of personality testing in american industry: An Obsession With Adjustment. *History of Psychology*, *11*(3), 164–184. https://doi.org/10.1037/a0013041

[17] Gosling, S. D., Augustine, A. A., Vazire, S., Holtzman, N., & Gaddis, S. (2011). Manifestations of personality in online social networks: Self-reported facebook-related behaviors and observable profile information. *Cyberpsychology, Behavior, and Social Networking*, *14*(9), 483–488. https://doi.org/10.1089/cyber.2010.0087

[18] Gvili, Y., Kol, O., & Levy, S. (2020). The value(s) of information on social network sites: The role of user personality traits. *Revue Europeenne de Psychologie Appliquee*, *70*(2), 100511. https://doi.org/10.1016/j.erap.2019.100511

[19] Hall, J. A., & Pennington, N. (2013). Self-monitoring, honesty, and cue use on Facebook: The relationship with user extraversion and conscientiousness. *Computers in Human Behavior*, *29*(4), 1556–1564. https://doi.org/10.1016/j.chb.2013.01.001

[20] Hall, J. A., Pennington, N., & Lueders, A. (2014). Impression management and formation on Facebook: A lens model approach. *New Media and Society*, *16*(6), 958–982. https://doi.org/10.1177/1461444813495166

[21] Hindman, M. (28 de marzo de 2018). How Cambridge Analytica's Facebook targeting model really worked. The conversation. https://theconversation.com/how-cambridge-analyticas-facebook-targeting-model-really-worked-according-to-the-person-who-built-it-94078

[22] Horzum, M. B. (2016). Examining the relationship to gender and personality on the purpose of Facebook usage of Turkish university students. *Computers in Human Behavior*, *64*, 319–328. https://doi.org/10.1016/j.chb.2016.06.010

[23] Huang, H. C., Cheng, T. C. E., Huang, W. F., & Teng, C. I. (2018). Who are likely to build strong online social networks? The perspectives of relational cohesion theory and personality theory. *Computers in Human Behavior*, *82*, 111–123. https://doi.org/10.1016/j.chb.2018.01.004

[24] Ivcevic, Z., & Ambady, N. (2012). Personality impressions from identity claims on Facebook. *Psychology of Popular Media Culture*, *1*(1), 38–45. https://doi.org/10.1037/a0027329

[25] Li, A., Yan, Z., & Zhu, T. (2013). Self-report versus web-log: Which one is better to predict personality

of website users? *International Journal of Cyber Behavior, Psychology and Learning*, *3*(4), 44–54. https://doi.org/10.4018/ijcbpl.2013100103

[26] Liu, D., & Campbell, W. K. (2017). The Big Five personality traits, Big Two metatraits and social media: A meta-analysis. *Journal of Research in Personality*, *70*, 229–240. https://doi.org/10.1016/j.jrp.2017.08.004

[27] Liu, L., Preoţiuc-Pietro, D., Samani, Z. R., Moghaddam, M. E., & Ungar, L. (2016). Analyzing personality through social media profile picture choice. *Proceedings of the 10th International Conference on Web and Social Media, ICWSM 2016*, 211–220.

[28] Marshall, T. C., Lefringhausen, K., & Ferenczi, N. (2015). The Big Five, self-esteem, and narcissism as predictors of the topics people write about in Facebook status updates. *Personality and Individual Differences*, *85*, 35–40. https://doi.org/10.1016/j.paid.2015.04.039

[29] Muscanell, N. L., & Guadagno, R. E. (2012). Make new friends or keep the old: Gender and personality differences in social networking use. *Computers in Human Behavior*, *28*(1), 107–112. https://doi.org/10.1016/j.chb.2011.08.016

[30] Nieto, M. D., Abad, F. J., Hernández-Camacho, A., Garrido, L. E., Barrada, J. R., Aguado, D., & Olea, J. (2017). Calibrating a new item pool to adaptively assess the Big Five. *Psicothema*, *29*(3), 390–395. https://doi.org/10.7334/psicothema2016.391

[31] Nieves, G. (2021). Mando conjunto del ciberespacio. *Revista Española de La Defensa*, *382*, 34–39.

[32] Oleszkiewicz, A., Karwowski, M., Pisanski, K., Sorokowski, P., Sobrado, B., & Sorokowska, A. (2017). Who uses emoticons? Data from 86 702 Facebook users. *Personality and Individual Differences*, *119*, 289–295. https://doi.org/10.1016/j.paid.2017.07.034

[33] Park, G., Andrew Schwartz, H., Eichstaedt, J. C., Kern, M. L., Kosinski, M., Stillwell, D. J., Ungar, L. H., & Seligman, M. E. P. (2014). Automatic personality assessment through social media language. *Journal of Personality and Social Psychology*, *108*(6), 934–952. https://doi.org/10.1037/pspp0000020

[34] Qiu, L., Lin, H., Ramsay, J., & Yang, F. (2012). You are what you tweet: Personality expression and perception on Twitter. *Journal of Research in Personality*, *46*(6), 710–718. https://doi.org/10.1016/j.jrp.2012.08.008

[35] Rodríguez, P., Velazquez, D., Cucurull, G., Gonfaus, J. M., Roca, F. X., Ozawa, S., & Gonzàlez, J. (2020). Personality trait analysis in social networks based on weakly supervised learning of shared images. *Applied Sciences (Switzerland)*, *10*(22), 1–15. https://doi.org/10.3390/app10228170

[36] Ryan, T., & Xenos, S. (2011). Who uses Facebook? An investigation into the relationship between the Big Five, shyness, narcissism, loneliness, and Facebook usage. *Computers in Human Behavior*, *27*(5), 1658–1664. https://doi.org/10.1016/j.chb.2011.02.004

[37] Sampedro, R. (2021). *Redes sociales: desinformación y seguridad.* Documento de Opinión IEEE 30/ 2021.http://www.ieee.es/Galerias/fichero/docs_opinion/2021/DIEEEO30_2021_RAUSAM_RedesSociales.pdf

[38] Sánchez-Marqueses, J. M., & Sanz, J. (2018). La relación entre los síntomas del trastorno de estrés postraumático y las dimensiones de personalidad del modelo de los cinco grandes: una revisión sistemática. *Psicopatología Clínica, Legal y Forense*, *18*, 75–93.

[39] Seidman, G. (2013). Self-presentation and belonging on Facebook: How personality influences social media use and motivations. *Personality and Individual Differences*, *54*(3), 402–407. https://doi.org/10.1016/j.paid.2012.10.009

[40] Timmermans, E., De Caluwé, E., & Alexopoulos, C. (2018). Why are you cheating on tinder? Exploring users' motives and (dark) personality traits. *Computers in Human Behavior*, *89*(3), 129–139. https://doi.org/10.1016/j.chb.2018.07.040

[41] Torreblanca, L. (2017). Desarrollo de un nuevo instrumento de evaluación : El Cuestionario Breve de Personalidad (CBP). [Tesis de doctorado, Universidad de Málaga]. Repositorio Institucional de la Universidad de Málaga (RIUMA): riuma.uma.es .

[42] Torregrosa López, F. J., & López Pérez, R. M. (2016). *Personality and Social Networks : a Systematic Review*. *2*, 11–41.

[43] Trapnell, P. D., & Wiggins, J. S. (1990). Extension of the Interpersonal Adjective Scales to include the Big Five dimensions of personality. *Journal of Personality and Social Psychology*, 59(4), 781.

[44] Wang, J. L., Jackson, L. A., Zhang, D. J., & Su, Z. Q. (2012). The relationships among the Big Five Personality factors, self-esteem, narcissism, and sensation-seeking to Chinese University students' uses of social networking sites (SNSs). *Computers in Human Behavior*, *28*(6), 2313–2319. https://doi.org/10.1016/j.chb.2012.07.001

[45] We Are Social, & HootSuite. (2021). *Digital 2021*.Recuperado de https://www.hootsuite.com/es/recursos/tendencias-digitales-2021

[46] Whitty, M. T., Doodson, J., Creese, S., & Hodges, D. (2018). A picture tells a thousand words: What Facebook and Twitter images convey about our personality. *Personality and Individual Differences*, *133*, 109–114. https://doi.org/10.1016/j.paid.2016.12.050

[47] Winter, S., Neubaum, G., Eimler, S. C., Gordon, V., Theil, J., Herrmann, J., Meinert, J., & Krämer, N. C. (2014). Another brick in the Facebook wall - How personality traits relate to the content of status updates. *Computers in Human Behavior*, *34*, 194–202. https://doi.org/10.1016/j.chb.2014.01.048