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Does Facebook activity reveal your dark side? Using online language features to understand an individual's dark triad and needs*

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ABSTRACT

Language is a powerful indicator of psychological processes. This study analysed the language features on online social networks to understand individuals' Dark Triad personality and need for power. Results based on data from 130 individuals using the Linguistic Inquiry and Word Count (LIWC) dictionary showed that language features such as I-words, negative emotion, and clout were positively related to Machiavellianism, which was positively associated with the need for power. We also found indirect effects of Analytic, I-words, and Social words on the need for power through Narcissism and indirect effects of Analytic and Authenticity on the need for power through Psychopathy. In addition, gender moderated the relationship between I-words and Machiavellianism, in that the relationship was stronger for men than for women. Finally, we built a regression model using language features to predict individuals' Dark Triad and the need for power. Based on the findings, we put forward some suggestions for managers to recruit and promote appropriate employees.

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KEYWORDS
Language features; LIWC; Dark Triad; need for power

1. Introduction

Language usage reflects essential social and psychological processes (Pennebaker and Stone 2003). Many sociolinguists and social psychologists suggest that word features in our daily life convey individuals' social, economic, and psychological worlds (Eckert 1999; Giles and Wiemann 1993; Lakoff 1987). For example, language features on social media are indicative of users' values, orientations, and motivation (Chen et al. 2014). Likewise, how individuals use words is a powerful indicator of their personality (Sanford 1942). In recent years, there has been a steady growth in research that examined the association between language use features and personality traits (e.g. Fast and Funder 2008; Pennebaker and King 1999). However, most of these studies focused on the Big Five model of personality. Less attention has been paid to the Dark Triad, or anti-social personality with malevolent behaviour (Paulhus and Williams 2002). From psychoanalytic theory to lexical method, language has always been the basis of personality theory and measurement. This is because language is the most effective way for individuals to describe themselves, others and the world (Tausczik and Pennebaker 2010). Given that the 'bright side' of personality can be accurately measured by the use of language, we would expect that the same will be true of the dark side.

Dark Triad traits consist of Machiavellianism, Narcissism, and Psychopathy, all of which pertain, to varying degrees, to social malevolence, self-promotion, emotional coldness, duplicity, and aggressiveness (Paulhus and Williams 2002). *Machiavellianism* refers to a duplicitous interpersonal style, a cynical disregard for morality, and a focus on self-interest and personal gain. *Narcissism* is the pursuit of gratification from vanity or egotistic admiration of one's own attributes. *Psychopathy* indicates enduring antisocial behaviour, diminished empathy and remorse, and disinhibited or bold behaviour (Muris et al. 2017). Although the Dark Triad was regarded as antisocial, it was correlated with various types of organisational behaviour, both negative and positive, such as counterproductive work behaviour (Cohen 2016; O'Boyle et al. 2012), effectiveness (Furnham, Trickey, and Hyde 2012), negative to organisational citizenship behaviour (Becker and Dan O'Hair 2007), and unethical behaviours (Amernic and Craig 2010). Therefore, it is vital to identify and understand

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the complexity of an individual's Dark Triad traits in organisational management.

Psychologists suggest that motivations are fundamental aspects of psychology and could be related to personality and other individual differences, such as Dark Triad traits (Bernard 2010; Elliot and Thrash 2001b; McHoskey 1999). We think of personality traits as descriptive traits that explain systematic biases in motivational, cognitive and affective systems (Jonason and Ferrell 2016). By studying the relationship between motivation and Dark Triad traits, we provide the motivational basis of these socially undesirable but potentially adaptive sets of individual differences. According to the definitions of Dark Triad, all three traits relate to the pursuit of power, although it may be obtained through different social means (Jonason, Slomski, and Partyka 2012; Jonason et al. 2012). A key motivation for Narcissists seeking leadership is the desire to gain the power they need to build a world that supports their egoistic needs and visions (Glad 2002). Similarly, Machiavellians and Psychopaths also like to manipulate power to pursue self-interest. Paradoxically, although Dark Triad traits have been considered as socially undesirable, employees with such personalities can obtain a higher salary, make better progress in their careers, and have more political skills in the organisation (Templer 2018). Related, the need for power is positively correlated with an employee's promotion and a leader's success (Hoch 2013; House, Spangler, and Woycke 1991). While the implicit need for power is inherently valence neutral (neither good nor bad), it can become problematic when coupled with a negative motive that is potentially embedded in the Dark Triad, such as the motive to aggress or to cause harm (James et al. 2013). Thus, in the study, we incorporate the need for power to explain and understand the implications of the Dark Triad.

Traditionally, questionnaires have been the primary means to assess an individual's psychological variables at work, such as personality and needs, which often fall short given the social desirability limitation (Morgeson et al. 2007). Nonetheless, online social networks have burgeoned in the past decades, producing a massive amount of data and a novel way for analysing users' psychological activities. For example, one early study employed machine learning methods to recognise the Big Five personality using 167 Facebook users' content (Golbeck, Robles, and Turner 2011). One study used Support Vector Machine, Bayesian Logistic Regression, and Multinomial Regression to predict users' personality based on the MyPersonality datasets (Alam, Stepanov, and Riccardi 2013). Another study built a regression model to predict user's values through Reddit data, a popular social news sharing community, and found that the word usage habit of individuals was impacted by their values (Chen et al. 2014). Research further demonstrated that writing features were useful for personality identification when suitable classifiers were adopted (Chen and Lin 2017). These precedents provide a new route for utilising social networking data to assess individual attributes that are important for organisations.

In this study, we attempt to examine how the language features on Facebook predict a user's Dark Triad and, subsequently, the need for power. In doing so, we aim to make several contributions to the literature. First, Dark Triad personality has a strong predictive validity for many socially important outcomes, often stronger than the widely used Big Five personality (Lee et al. 2013). Nonetheless, previous studies of social networking data have primarily focused on the correlation between individual language features and Big Five personality (e.g. Pennebaker and King 1999). Research on the relationship between language features and the Dark Triad personality, however, has been inadequate. This study will attempt to address this gap by using language features on Facebook to predict an individual's Dark Triad personality.

Second, to our knowledge, this study is also among the first to predict an individual's need for power based on online language features, although there have been many studies predicting personality, values (Chen et al. 2014), and life satisfaction (Kosinski, Stillwell, and Graepel 2013) etc. using this approach. Besides, employees with Dark Triad personality sometimes can achieve better career outcomes (Templer 2018). We posit that part of the reason could be that they also possess a stronger need for power, which is positively correlated to leader success and employee promotion (Hoch 2013; House, Spangler, and Woycke 1991). Thus, in the study, we intend to shed light on the puzzling relationship among language features, Dark Triad traits, and the need for power. We posit that Dark Triad traits mediate the relationship between language features and the need for power.

Third, previous studies have shown that at a young age, boys exhibit more conduct problems, delinquency, and violence than girls and such gender differences tend to persist into adulthood, in such a way that men are more likely to be diagnosed with antisocial personality disorder than women (Cale and Lilienfeld 2002). We suspect that there are also differences in language expression between boys and girls, corresponding to Dark Triad traits. Meanwhile, research also suggest that there are gender differences in relation to the Dark Triad and other personality traits, with most of these differences being found in the field of emotion

management (Czibor et al. 2017). Therefore, in the study, we examine gender as a moderator of the relationship between language features and the Dark Triad personality.

Finally, besides testing the hypothesised relationships using structural equation modelling, we further use language features on Facebook to predict users' Dark Triad traits and need for power through machine learning. Such modelling techniques will have practical implications for human resource managers to assess employees' personality and needs in a novel and cost-effective manner. Our theoretical model is summarised in Figure 1.

2. Theoretical foundations and hypothesis development

2.1. Language features and Dark Triad

Psychology and lexical research suggest that language is the most effective way for individuals to describe themselves, others, and the world (Tausczik and Pennebaker 2010). Previous studies in psychology have examined an individual's linguistics style as an independent and meaningful way of understanding personality (Pennebaker and King 1999). For example, research has used the Linguistic Inquiry and Word Count (LIWC) dictionary to analyse language use patterns and found that neuroticism was positively correlated with negative emotion words and positively correlated with first-person pronouns; extraversion was related to positive emotion words and social processes words; agreeableness was positively correlated with positive emotion words (Pennebaker and King 1999; Pentina and Zhang 2017). Whereas cumulated research has shown that language features, as specified in the LIWC dictionary, are useful in understanding Big Five personality, whether such prediction can be established for the Dark Triad personality remains less understood.

To our knowledge, only a handful of studies have used online social activity data to examine the relationship between language usage and the Dark Triad. Sumner and colleagues used the LIWC dictionary based on Twitter content and found that Machiavellianism was negatively correlated with positive emotion and the word 'we'. Narcissism was positively related to friends and sexual words, such as love and horny, and negatively related to cognitive processes, anxiety, and discrepancy words. Psychopathy was significantly and negatively correlated with first-person singular words, such as I, Me, and Mine. Psychopathy was also positively related to swear words (Sumner et al. 2012). Another study used Russian Facebook texts to identify the language features that were correlated with the Dark Triad and found that Machiavellian users were less likely to post tweets, and the length of the tweets was shorter than the users with low scores of Machiavellianism. On the contrary, narcissistic users tend to publish longer posts on Facebook. These language features suggest that perhaps narcissistic users are 'ego-promoting' and need to attract attention from others through online social behaviours (Panicheva, Ledovaya, and Bogolyubova 2016). Preoiuc-Pietro et al. explored the relationship between Twitter activities and Dark Triad traits using the 'bag-of-words' method and found that Machiavellianism was correlated with expression of gratitude; Narcissism was positively related to word topics that represented the banal, such as everyday activities and TV shows; and Psychopathy was correlated with topics that represented aggression and violence (Preoiuc-Pietro et al. 2016).

To summarise, the handful of studies about the Dark Triad and language features mostly used the LIWC dictionary, which contains dozens of word categories. Little has been done to use the new LIWC2015 dictionary (Pennebaker et al. 2015) to conduct the analysis, which contains the traditional LIWC dimensions as well as the summary variables, which are research-based composites with values converted into 100 points scales. Compared with previous dictionaries, the summary variables new to LIWC2015 could better discover language patterns as a whole and analyse them more comprehensively (Pennebaker et al. 2015). As such, we hypothesise that as follows.

> Hypothesis 1: The Facebook language features analyzed based on the LIWC2015 dictionary will be related to Dark Triad traits (Machiavellianism, Narcissism, and Psychopathy).

2.2. Language features, Dark Triad, and need for power

As discussed above, individuals high on Dark Triad traits tend to manipulate others to pursue selfish gains (Jones 2013; Lee et al. 2013). Individuals with high Machiavellianism lack empathy and affect, and possess an unconventional view of morality – a willingness to manipulate, lie, and exploit others – to focus exclusively on their own goals (Christie and Geis 1970; Wu and LeBreton 2011). Narcissistic individuals have high grandiosity, entitlement,

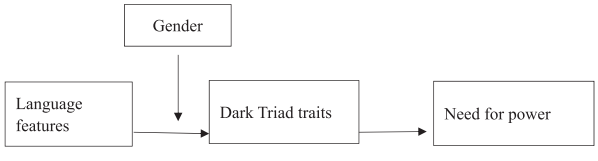

Figure 1. Proposed moderated mediation model.

dominance, and superiority, and are more likely to self-enhance (Raskin, Novacek, and Hogan 1991). Psychopaths are antagonistic and believe in their own superiority. They are impulsive and seek immediate gratification of their needs (Cleckley 1976; Hare 1999).

Dark Triad traits have been associated with motivational processes (Elliot and Thrash 2001a; McHoskey 2001b) and have wide applications in organisational psychology, social psychology, health diagnosis, and so on (Spain, Harms, and Leberton 2014). It is meaningful to link individual motivation to Dark Triad traits because both approaches postulate motivational explanations for social behaviours, be it in its pathological form or not (McClelland 1985; McClelland, Koestner, and Weinberger 1989). Specifically, McClelland's motivation theory posits that the most important aspects of human motivation include the need for achievement, the need for power, and the need for affiliation (McClelland et al. 1976). In particular, the need for power stands for a desire to influence and control others, which is largely in line with the Dark Triad traits of manipulating others and focusing on self-interest, as exemplified in Machiavellianism and Narcissism. Psychopathy is also positively correlated with the need for power, given its dominance-striving nature (Semenya and Honey 2015).

Several previous studies have investigated the relationship between the Dark Triad and individual motivation. Jonason and Ferrell (2016) analysed participants' Facebook posts and found that psychopathy was negatively related to the need for achievement, Machiavellianism was negatively related to the need for achievement but positively related to the need for power, and Narcissism was significantly and positively related to the need for power. In addition, the authors replicated these findings by using a dataset collected from the social psychology organisation platform and found that Machiavellianism and Psychopathy were positively related to the need for power, while Narcissism was positively related to the need for achievement and power (Jonason and Ferrell 2016). Another study analysed the relationship between the Dark Triad and the universal values and found that self-enhancing values were best explained by Dark Triad traits (around 20% variance). Among these, Machiavellianism was positively associated with power but negatively related to universalism and benevolence. Narcissism was also associated with power. Psychopathy was associated with power and hedonism (Kajonius, Persson, and Jonason 2015).

Given the aforementioned theoretical characteristics of the Dark Triad, we focus on the relationship between the Dark Triad and the need for power in this study. Based on prior theorising and research, we hypothesise that Psychopathy is positively related to the need for power because power enables superior self-gratification. Narcissism is positively correlated with the need for power because narcissistic individuals appreciate leadership, dominance, and autonomy. We expect that Machiavellianism is also positively associated with power because of the benefits that power can generate. Hence, we put forward the following hypothesis.

> Hypothesis 2: Dark Triad traits (Machiavellianism, Narcissism, and Psychopathy) are positively related to the need for power.

Integrating Hypotheses 1 and 2, we further posit that language features on Facebook can be indicative of an individuals' need for power via the mediation of the Dark Triad. Language, as an essential medium for communication with the outside world, represents the external expressions of an individual's thoughts, attitudes, and characteristics. The Dark Triad personality and the need for power, on the other hand, are an individual's inner attributes and motivation. On one hand, computer-based personality evaluation presented both significant opportunities for psychological assessment, marketing, and privacy (Youyou, Kosinski, and Stillwell 2015). Research has suggested that online social network data can predict an individual's attributes and values, such as personality, satisfaction with life, sexual orientation (Kosinski, Stillwell, and Graepel 2013), and moral values (Kajonius, Persson, and Jonason 2015).

On the other hand, Dark Triad traits are related to motivational factors (e.g. Jonason and Ferrell 2016; Palmer et al. 2017). Motivational process and motivation-related constructs can further shed light on the understanding of personality traits (e.g. Roberts and Robins 2000). Given that motivation delineates what an individual wants, personality traits may describe how an individual satisfies his or her motivation (e.g. McAdams 1995). The fundamental factor that determines an individual's needs is the personality traits. As such, we believe that the various language features map into different personalities. Personality is correlated with needs, and the language features reflect an individual's needs indirectly. As such, we hypothesise that language features on Facebook are indirectly related to an individual's need for power via the mediation of the Dark Triad personality.

> Hypothesis 3: Dark Triad traits (Machiavellianism, Narcissism, and Psychopathy) mediate the relationship between Language features and the need for power.

2.3. The moderating role of gender in language features and Dark Triad

Based on previous findings that men tend to score higher than women on the Dark Triad traits (Jonason and

Ferrell 2016), we further suggest that gender moderates the relationship between language features and Dark Triad traits. On the one hand, men were more often diagnosed with antisocial personality disorder than women (Cale and Lilienfeld 2002). Moreover, gender difference has been revealed for each of the Dark Triad traits. A study indicated that men were more narcissistic than women, although the effect size of this gender difference was in the medium range (Grijalva et al. 2015). Psychopathy was also found to be more prevalent in men than in women (Nicholls et al. 2005). On the other hand, men tend to use words such as insults, anger, swear, and radicalism more frequently in their daily language (Güvendir 2015). To some extent, these words are consistent with the characteristics of dark personality, suggesting that boys may be more expressive and visualised in language expression than girls. Given the wider range of the Dark Triad as well as the lack of inhibition in language expression among men, the correlation between language features and Dark Triad traits will be stronger. By contrast, women may use words relatively more conservatively and plain. Thus, the correlation between language features and dark personality among women will be weaker.

From a neurobiological perspective, men's brains have a potential to create more aggressive behaviour and swear words than women's brains (McDonald, Navarrete, and van Vugt 2012; Navarrete et al. 2010). When anger and aggression are stimulated, women are more prepared neurologically to hit the brakes than men. The neurobiology perspective also suggests that the correlations between Dark Triad traits and language are more likely to be inhibited in women relative to men. Taken together, because the bandwidth or range of language features and personality vary between genders, the relationship between language features and Dark Triad traits are more likely to be stronger among men than women.

> Hypothesis 4: Gender moderates the relationship between Facebook language features and Dark Triad traits in such a way that the relationship is stronger among men than among women.

3. Method

3.1. Participants and procedure

We collected data in two sources with undergraduate students from a business school in the United States. First, we conducted a survey using the Qualtrics platform, which is a web-based survey tool designed for academic and business research. Before launching the study, we obtained university Institutional Review Board (IRB) approval for conducting research involving human subjects. Both faculty sponsor and research team members completed the online CITI training. An informed consent was provided to the participants, which explained the purpose and procedure of the study, and assured participants of the voluntary nature of the study, the confidentiality of their responses, and their right to withdraw from the study at any time. All participants came to the lab to complete a survey in November 2018. Each session lasted for 30 min; students who finished the questionnaire early were not allowed to leave the lab until time ran out. This ensures participants enough time to deliberate the questionnaire fully and provides a quiet and undisturbed environment. The online survey contained measures of gender, grade, Facebook nickname, Dark Triad, and need for power. Then, we crawled and collected the participant's Facebook posts online through the Facebook Application Programming Interface (API) according to the corresponding Facebook nickname (those who authorised).

A total of 300 students were invited to participate in the survey. Among them, 181 students provided their Facebook nickname voluntarily, of which 140 nicknames were identified on Facebook. After removing the invalid questionnaires, such as when there was no variation in responses across questions, the response time was less than 180 s, or reverse items were obviously in the wrong directions after transposition, we received 130 valid responses with matching questionnaires and Facebook data. The majority of participants were sophomores (114), account for 87.7%; the others were juniors (16). There was a fair representation of both genders: 55.4% were male (72) and 44.6% were female (58).

3.2. Measure

3.2.1. Dark Triad

Dark triad traits were measured with 12 items from the Dirty Dozen Triad scale ($a = .84$), including Machiavellianism ($a = .78$), Narcissism ($a = .75$), and Psychopathy ($a = .80$) (Jonason and Webster 2010). A sample item was 'I tend to manipulate others to get my way'. Participants choose the most appropriate descriptive option for themselves on a 5-point Likert scale (from 1 = very inaccurate to 5 = very accurate).

3.2.2. Need for power

We adopt McClelland's needs assessment scale to measure the need for power (Steers and Braunstein 1976) ($a = .71$). Participants responded to the five items with a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree). Sample items include 'I enjoy

being a manager', 'I like being in charge of things and people'.

3.2.3. Language on Facebook

The Facebook posts of the participants from January 2016 to December 2018 were crawled through API. We obtained 2,497 posts, which consist of a total of 10,364 words. As our interest was to analyse the language usage of the participants, we exclusively documented the contents that were published by the participants originally. The Linguistic Inquiry and Word Count (LIWC) (Pennebaker et al. 2007) is the most used dictionary to analyse the language features in the field of social psychology. It can recognise and calculate the percentage of words in a given content, which can reflect the different emotions, ways of thinking, social concerns, and even parts of speech. In the study, we used the LIWC 2015 online dictionary to extract the word's frequency. Nine LIWC variables were calculated, which were divided into two categories, the traditional LIWC dimensions and the summary variables. The traditional LIWC dimensions capture the percentage of certain words in a text, such as I-words (I, ME, MY), social words, positive emotions, negative emotions, and cognitive processes. The summary variables include four variables: *Analytic* refers to analytical thinking, which describes the extent of using words that imply formal, logical, and hierarchical thinking patterns (Pennebaker et al. 2014); *Clout* refers to influence, which relates to social status, self-confidence, and leadership expressed through the writing (Kacewicz et al. 2014); *Authenticity* pertains to whether people present themselves truly or deceptively (Newman et al. 2003); *Emotional tone* ranges between positive emotion and negative emotion, the higher the number, the more positive the tone (Cohn, Mehl, and Pennebaker 2004). As mentioned above, the summary variables are new to LIWC2015 and belong to generalised word categories, which we use to discover the language features correlated with Dark Triad traits.

4. Results

Table 1 presents the descriptive statistics, bivariate correlations, and Cronbach's alphas for all variables. All variables have acceptable internal consistency of above .70. Grade was used as a control variable. All predictor variables were standardised before analysis.

4.1. Tests of hypotheses

We tested the correlational hypotheses using path analytic procedures (Lim and Tai 2014; Preacher, Rucker,

Table 1. Mean, standard deviations, and correlations between variables.

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender	1.45	.49	–														
2. Grade	2.12	.33	.18*	–													
3. I-words	1.19	2.71	.12	.02	1												
4. Social words	4.28	10.87	−.03	.05	.37**	1											
5. Positive emotions	1.61	2.98	.06	−.12	.65**	.31**	1										
6. Negative emotions	.27	.80	−.06	−.04	.41**	.20*	.39**	1									
7. Cognitive processes	2.32	4.34	.03	−.00	.68**	.29**	.51**	.45**	1								
8. Analytic	82.65	22.25	−.05	−.06	−.68**	−.66**	−.37**	−.29**	−.58**	1							
9. Clout	58.33	15.01	.04	.14	.41**	.65**	.47**	.35**	.38**	−.42**	1						
10. Authenticity	20.18	30.87	−.01	.03	.39**	.10	.22*	.25**	.49**	−.18*	.14	1					
11. Emotional tone	41.81	27.41	.00	−.11	.47**	.28**	.90**	.25**	.56**	−.26**	.51**	.25**	1				
12. Machiavellianism	2.43	.91	−.20*	.05	.20*	.13	.13	.21*	.07	−.10	.24*	−.20*	.05	(.77)			
13. Narcissim	3.31	.81	.10	.10	.12	.11	.04	.07	.08	−.19*	.12	.10	.10	.42**	(.75)		
14. Psychopathy	1.98	.92	−.19*	.01	.21*	.12	−.01	.17	.10	−.17	−.00	−.19*	.01	.55**	.25**	(.81)	
15. Need for power	3.81	.56	−.16	−.14	.21*	.10	.09	.17	.16	−.19*	.17	−.16	−.14	.51**	.41**	.33**	(.71)

Note: $N = 130$ undergraduate students. Reliability estimate appear in parentheses across the diagonal. Due to the language features are extracted by LIWC dictionary with percentage for each variable, there is no reliability estimate.
*$p < .05$; **$p < .01$ (two-tailed).

Table 2. Mediation, direct and indirect effect on need for power through Machiavellianism.

		Stage			Effect		
Independent variable	Mediation variable	First (Pmx)	Second (Pym)	Direct	95%Clof direct effect	Indirect (Pmx *Pym)	95%Clof indirect effect
I-words	Machiavellianism	.20*(.09)	.50**(.08)	.12(.09)	[−.05, .28]	.10*(.06)	[.01, .23]
Social words		.13(.09)	.51**(.08)	.51**(.08)	[.34, .67]	.00(.02)	[−.01, .06]
Positive emotions		.13(.09)	.51**(.08)	.51**(.08)	[.35, .67]	.00(.01)	[−.02, .04]
Negative emotion		.21*(.09)	.53**(.08)	.06(.08)	[−.10, .22]	.11*(.06)	[.02, .24]
Cognitive processes		.07(.09)	.51**(.08)	.12(.08)	[−.04, .28]	.04(.05)	[−.05, .14]
Analytic		−.10(.09)	.50**(.08)	−.14(.08)	[−.29, .02]	−.05(.05)	[−.17, .02]
Clout		.23*(.09)	.51**(.08)	.05(.08)	[−.11, .22]	.12*(.06)	[.01, .25]
Authenticity		.18(.09)	.51**(.08)	.04(.08)	[−.12, .21]	.09(.05)	[−.00, .21]
Emotional tone		.08(.09)	.51**(.08)	.05(.08)	[−.12, .20]	.05(.05)	[−.05, .16]

Note: $N = 130$. Grade was control variable. Significance tests for the indirect effects were based on bias-corrected confidence intervals derived from 5,000 bootstrapped samples. The 95% bias corrected bootstrapped confidence interval does not include zero.
*$p < .05$; **$p < .01$ (two-tailed).

and Hayes 2007). For the moderation hypothesis, we conducted bootstrapping analysis to assess the significance of indirect effects (Shrout and Bolger 2002). We used an SPSS macro (Hayes 2012; Preacher, Rucker, and Hayes 2007) to estimate both mediation and moderated mediation model. Tables 2–4 show the results of each dimension of Dark Triad traits as the mediated variable in the model, respectively. From Table 2, we can see that three of nine language features are related to the need for power via the mediation of Machiavellianism, including I-words, negative emotion, and clout. Specifically, I-Words was positively related to Machiavellianism ($\beta = .20$, $SE = .09$, $P < .05$), and Machiavellianism was, in turn, positively related to the need for power ($\beta = .50$, $SE = .08$, $P < .001$). The indirect effect was significant at $p < .05$ (effect = .10, $CI_{95\%} = [.01, .23]$). Negative emotion was positively related to Machiavellianism ($\beta = .21$, $SE = .09$, $P < .05$), which was, in turn, positively related to the need for power ($\beta = .53$, $SE = .08$, $P < .001$), and the indirect effect was significant (effect = .11, $CI_{95\%} = [.02, .24]$). Similarly, clout was positively related to Machiavellianism ($\beta = .23$, $SE = .09$, $P < .05$), which was positively related to the need for power ($\beta = .51$, $SE = .08$, $P < .05$). The indirect effect was also significant (effect = .12, $CI_{95\%} = [.01, .25]$). Although not all the indirect effects of language features on the need for power were significant, Machiavellianism was related to the need for power significantly in the mediation model ($\beta = .51$, $SE = .08$, $P < .001$).

Narcissism mediated the relationship between analytic, I-words, and social words and need for power. Table 3 showed that the indirect effects of these were all significant (the corresponding effect and confidence interval are: analytic effect = −.07, $CI_{95\%} = [-.14, -.02]$; I-words effect = .05, $CI_{95\%} = [.00, .12]$; social words effect = .04, $CI_{95\%} = [.01, .19]$), although they were not significantly related to narcissism in the first stage. In all mediation models, Narcissism was positively related to the need for power in the second stage ($\beta = .38$, $SE = .09$, $P < .001$).

Table 4 showed the result of psychopathy as the mediation variable. Analytic was not related to psychopathy significantly ($\beta = -.17$, $SE = .09$, $P > .05$), and psychopathy was positively related to the need for power ($\beta = .36$, $SE = .09$, $P < .001$). However, the indirect effect of analytic on the need for power was significant (effect = −.06, $CI_{95\%} = [-.15, -.00]$). Authenticity was positively related to psychopathy ($\beta = .31$, $SE = .09$, $P < .001$), which was then positively related to the need for power ($\beta = .37$, $SE = .09$, $P < .001$). The indirect effect was also significant (effect = .12, $CI_{95\%} = [.03, .23]$). Other language features in the mediation model were not

Table 3. Mediation, direct, and indirect effect on need for power through narcissism.

		Stage		Effect			
Independent variable	Mediation variable	First (Pmx)	Second (Pym)	Direct	95% CI of direct effect	Indirect (Pmx *Pym)	95%CI of indirect effect
I-words	Narcissism	.12(.09)	.36**(.08)	.17(.08)	[−.00, .34]	.05*(.03)	[.00, .12]
Social words		.11(.09)	.38**(.09)	.06(.08)	[−.12, .23]	.04*(.05)	[.01, .19]
Positive emotions		.04(.09)	.38**(.08)	.08(.09)	[−.10, .25]	.01(.04)	[−.07, .09]
Negative emotion		.07(.09)	.38**(.09)	.14(.09)	[−.03, .32]	.03(.04)	[−.04, .10]
Cognitive processes		.08(.09)	.38**(.09)	.13(.09)	[−.05, .30]	.03(.03)	[−.02, .10]
Analytic		−.18(.09)	.36**(.09)	−.12(.09)	[−.30, .06]	−.07*(.03)	[−.14, −.02]
Clout		.12(.09)	.37**(.09)	.13(.09)	[−.05, .30]	.05(.03)	[−.01, .11]
Authenticity		.08(.09)	.38**(.09)	.10(.09)	[−.07, .28]	.03(.03)	[−.03, .10]
Emotional tone		.01(.09)	.38**(.09)	.08(.09)	[−.09, .26]	.00(.04)	[−.08, .09]

Note: $N = 130$. Grade was control variable. Significance tests for the indirect effects were based on bias-corrected confidence intervals derived from 5,000 bootstrapped samples. The 95% bias corrected bootstrapped confidence interval does not include zero.
*$p < .05$; **$p < .01$ (two-tailed).

Table 4. Mediation, direct, and indirect effect on need for power through psychopathy.

Independent variable	Mediation variable	Stage		Effect			
		First (Pmx)	Second (Pym)	Direct	95% CI of direct effect	Indirect (Pmx *Pym)	95% CI of indirect effect
I-words	Psychopathy	.21(.09)	.35**(.09)	.14(.09)	[−.04, .32]	.07(.05)	[−.01, .20]
Social words		.12(.09)	.37**(.09)	.06(.09)	[−.12, .23]	.04(.05)	[−.01, .21]
Positive emotions		−.01(.09)	.38**(.09)	.10(.09)	[−.08, .27]	−.01(.05)	[−.10, .09]
Negative emotion		.17(.09)	.36**(.09)	.11(.09)	[−.07, .28]	.06(.05)	[−.03, .18]
Cognitive processes		.10(.09)	.37**(.09)	.12(.09)	[−.05, .30]	.04(.04)	[−.04, .13]
Analytic		−.17(.09)	.36**(.09)	−.13(.09)	[−.30, .05]	−.06*(.04)	[−.15, −.00]
Clout		−.00(.09)	.38**(.09)	.17*(.09)	[.00, .34]	−.00(.04)	[−.07, .08]
Authenticity		.31**(.09)	.37**(.09)	.02(.09)	[−.17, .20]	.12*(.05)	[.03, .23]
Emotional tone		−.11(.09)	.39**(.09)	.13(.09)	[−.04, .30]	−.04(.04)	[−.13, .04]

Note: $N = 130$. Grade was control variable. Significance tests for the indirect effects were based on bias-corrected confidence intervals derived from 5,000 bootstrapped samples. The 95% bias corrected bootstrapped confidence interval does not include zero.
*$p < .05$; **$p < .01$ (two-tailed).

related to Dark Triad traits significantly in the first stage, and the indirect effect of the model was not significant, but all Dark Triad dimensions were related to the need for power significantly in the second stage (average $\beta = .38$, $SE = .09$, $P < .001$).

Based on the results of path analysis, we find that language features such as I-words, negative emotion, clout, and authenticity are correlated with Dark Triad traits, including Machiavellianism and Psychopathy. When Narcissism was entered, however, the coefficient of the first stage between language features and Narcissism was not significant. Thus, Hypotheses 1, which predicts that language features are related to Dark Triad traits, was partially supported for Machiavellianism and Psychopathy. As Tables 2–4 showed, in the second stage, each Dark Triad trait was positively related to the need for power. Together, these results supported Hypothesis 2, which predicts that Dark Triad traits are positively related to the need for power. Furthermore, the bootstrapping analysis shows that the 95% bias corrected confidence interval did not include zero. The direct effects were not significant, while the conditional indirect effect was significant for some language features. Therefore, Hypothesis 3 was partially supported. Dark Triad traits mediated the relationship between language features and the need for power.

Finally, Table 5 showed the moderating effect of gender on the relationship between language features and Dark Triad traits. In the moderated mediation model, we used 5,000 bootstrapped samples to test the moderated indirect effect of language features on the need for power through Dark Triad traits. As shown in Table 5, the interaction of gender with I-words was significant at predicting Machiavellianism ($\beta = -.37$, $SE = .18$, $P < .05$). Moreover, the indirect effect of I-words on the need for power through Machiavellianism was significant for men ($\text{effect}_{\text{men}} = .217$, $\text{CI}_{95\%} = [.081, .471]$), but not for women ($\text{effect}_{\text{women}} = .039$, $\text{CI}_{95\%} = [-.055, .167]$), and the difference between the conditional indirect effects of men and women was also significant (diff = −.178, $\text{CI}_{95\%} = [-.432, -.016]$). Therefore, we found some support for Hypothesis 4 – gender moderates the relationship between Facebook language features and Dark Triad traits in such a way that the relationship is stronger among men than among women.

Figure 2 illustrated the moderating effect of gender on the relationship between I-words and the need for power.

Table 5. Mixed-effect modelling results: moderated mediation analyses (Hypothesis 4).

Predictors	Machiavellianism		Need for Power	
	B	SE	B	SE
Intercept	−.01	.60	1.11*	.53
Grade	.37	.28	−.45	.25
I-words	.83**	.31	.49	.28
Gender	−.51**	.18	−.10	.17
I-words*Gender	−.37*	.18		
Machiavellianism			.47**	.08
Direct, indirect, and total effect		Effect	Lower limit	Upper limit
Direct effect of I-words on power		.485	[−.085]	[1.057]
Conditional indirect effect of I-words on power at:				
Male		.217*	[.081]	[.471]
Female		.039	[−.055]	[.167]
Difference		−.178*	[−.432]	[−.016]

Note: $N = 130$. Significance tests for the indirect effects were based on bias-corrected confidence intervals derived from 5,000 bootstrapped samples. The 95% bias corrected bootstrapped confidence interval does not include zero.
*$p < .05$; **$p < .01$ (two-tailed).

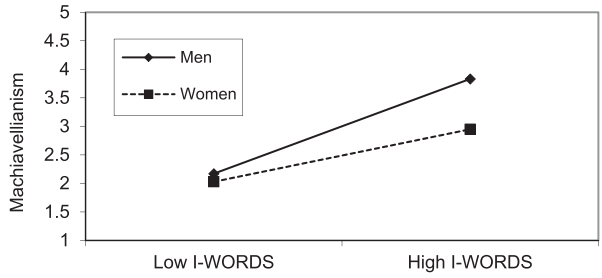

Figure 2. Gender Moderating the Relationship between I-words and Machiavellianism.

In particular, the indirect effect was significant for men (simple slope = .22, $t = 3.16$, $p = .002$). There was no moderating effect of gender on the relationship between the other language features and the need for power. The specific results of other significant indirect relationships for men are in the Appendix.

4.2. Predicting an individual's Dark Triad and need for power

Recent research has increasingly utilised machine learning methods to make Big Five personality prediction (e.g. Kalghatgi, Ramannavar, and Sidnal 2015; Ling et al. 2015; Skowron, Ferwerda, and Schedl 2016). Research predicting the Dark Triad and other psychological variables, however, has been insufficient. Given that our results showed that language features are related to an individual's Dark Triad and needs, we built a prediction model of the Dark Triad personality using the language features on Facebook. Based on the algorithm in a prior study (Youyou, Kosinski, and Stillwell 2015), which used the Likes list on Facebook to predict one's personality, we construct four LASSO regression models predicting each of the three Dark Triad dimensions and need for power. The language features contain the nine variables extracted by the LIWC dictionary. We used a split-sample approach to separate the training sample (90%) and the testing sample (10%). We calculated the Root Mean Square Error (RMSE) to compare the predicted scores and true scores for Dark Triad traits and needs. Table 6 showed the prediction results.

As shown in Table 6, we found that the RMSEs of Dark Triad traits were 1.01 (Machiavellianism), .82 (Narcissism), and .68 (Psychopathy), respectively. The prediction RMSE of the need for power was .56. RMSEs range from 0 to ∞ with smaller values signifying better models. On account that there was limited research on the prediction of Dark Triad personality and motivation through machine learning algorithms, we compared our results to a similar study about Big Five personality prediction using language features on Facebook. The average RMSEs across five personality dimensions were .75 (Extraversion = .807, Agreeableness = .699, Conscientiousness = .735, Neuroticism = .786, Openness = .661) (Farnadi et al. 2016). As such, our prediction models obtained comparable performance as the prior study. These results indicate that language features on Facebook are a powerful indicator of an individual's personality and motivation.

Table 6. Prediction results by Lasso regression model using language features.

Variables	Machiavellianism	Narcissism	Psychopathy	Power
RMSE	1.01	.82	.68	.56

Note: $N = 130$, RMSE = Root Mean Square Error.

5. Discussion

This study examined the relationship between language features on Facebook and the need for power via an individual's Dark Triad personality. We found that multiple language features reflect an individual's need for power via the mediation of the Dark Triad. We also found that the relationship between language features and Machiavellianism differed between men and women. Lastly, we effectively predicted Dark Triad traits and the need for power based on the language features using machine learning method. Results suggest that language features on Facebook are a powerful indicator of important variables such as Dark Triad and the need for power. This study sheds new light on how to measure and predict an individual's inner personality and needs through the content posted on social media.

5.1. Theoretical implications

Although previous research has garnered a considerable understanding of the need for power (e.g. Spangler 1992; Stahl and Harrell 1982), researchers have yet to explore how to associate an individual's need for power with language features on social media. Corroborating earlier research, which suggested that language was a dominant indicator of individual psychological characteristics (Holtgraves 2002), our results show that language features on Facebook reflect an individual's need for power via Dark Triad traits. Specifically, language features such as I-words, negative emotion, and clout are positively related to Machiavellianism. Those who use the first-person pronoun to express themselves online tend to have high Machiavellianism. This finding is consistent with a previous study (Ickes, Reidhead, and Patterson 1986), which suggested that Machiavellianism was associated with self-oriented impression

management – Machiavellian individuals tend to use first-person singular pronouns at the expense of second- and third-person pronouns. In addition, the fact that these individuals also tend to use more negative emotions speaks to the dark side of Machiavellianism, which is consistent with a previous study which found that Machiavellianism was positively associated with emotional instability ($r = .38$), as well as with aggression and delinquent behaviour among samples of youths in non-clinical adolescents (Muris, Meesters, and Timmermans 2013). Clout language manifests people's attention to or awareness of relative status in a social setting, which is in line with the characteristic of Machiavellianism. Meanwhile, Machiavellianism was positively related to the need for power, which is consistent with the previous research (Kajonius, Persson, and Jonason 2015) which also showed that Machiavellianism was positively correlated with power. These demonstrate the conditional indirect effects of online language features on an individual's need for power via Machiavellianism.

The language features such as analytic, I-words, and social words were indirectly associated with the need for power via Narcissism. Analytic language relates to words expressing thinking patterns. Individuals low in analytical language tend to write in more narrative ways, focusing on the here-and-now of personal experiences. We infer from this result that perhaps one of the reasons that individuals who use low analytic language/high narrative language tend to have a high need for power is because of their inherent Narcissism. In addition, social words was positively related to Narcissism, which echoes the previous finding that narcissistic individuals like to attract social attention and show off themselves (Ong et al. 2011). Similarly, the use of I-words shows that narcissistic individuals tend to be self-centred, which is also consistent with earlier research (Raskin and Shaw 1988). Narcissism was, in turn, positively related to the need for power. Taken together, people who use analytic, I-words, and social words more frequently in their online language tend to manifest a higher need for power through their Narcissism.

When Psychopathy was the mediator, the authenticity of language was indirectly related to the need for power. This indicates that individuals who tend to express themselves truthfully online possess a higher need for power via Psychopathy. This is consistent with results obtained in a previous study (Jonason and Ferrell 2016), which found that Psychopathy was positively related to power. Meanwhile, Rogers (1961) noted that, for some, the advocacy for being true to oneself might imply 'releasing the beast within'. From a human perspective, there are those who have not received the proper nutriments of self-development and may have impulses that are twisted accordingly (Womick, Foltz, and King 2019). For these individuals, true authenticity may be a complicated matter, involving first the uncovering of long suppressed impulses (Kernis and Heppner 2008). As such, impulsivity was questioned as a key feature of Psychopathy (Poythress and Hall 2011). This may explain our result that Psychopathy was positively related to authenticity. In addition, analytic language was negatively related to Psychopathy and, subsequently, the need for power, suggesting that one of the reasons why lack of analytic language, or the use of more narrative language, is predictive of the need for power is because of the link through Psychopathy. This illustrates that high Psychopathy individuals tend to use less formal or logical language and focus on the here-and-now and personal experiences.

In addition, we found that gender moderates the relationship between I-words and Machiavellianism. Specifically, the use of I-words was more strongly related to Machiavellianism for men than women. This extended prior research suggesting that sex difference existed in dark personality (Furnham and Trickey 2011). We found gender moderation only for Machiavellianism, perhaps because Machiavellianism is developmentally more sensitive to environmental cues than the other two traits (Vernon et al. 2008). Empirical investigations found that individuals high on Machiavellianism have difficulty or a decreased motivation to process the emotional states of themselves and others (Pilch 2008). As such, Machiavellian individuals may be less sensitive or hesitant in their language expression. Their I-Words language features indicated that these individuals tend to use the first-person pronoun, such as 'I' and 'Me', frequently. Meanwhile, gender differences affected the emotion management features expressed by those high in Machiavellianism (Rauthmann 2012). In general, most studies have found that men tend to score higher on Machiavellianism self-report scales than women (e.g. Jones and Paulhus 2009a; McHoskey 2001a). Our study further suggests that the chance that the Machiavellianism mapped into language features was higher for men than for women.

In conclusion, the results show that online social media is a window to understand an individual's Dark Triad traits and, subsequently, the need for power. According to the four components of the Neo-Socioanalytic Model (Roberts and Wood 2006), which consists of motivation, personality, ability, and narration, personality manifests hierarchically, with the highest level being broad and decontextualised, and the lowest level being specific and contextualised. As to motivation, the higher levels correspond to general tendencies (e.g. a tendency to achieve over time and across different situations),

while the lower levels show more specific desires and goals (e.g. a desire to succeed at a specific task in a specific situation). Our finding that the Dark Triad plays a mediating role between language features and the need for power corroborates with this framework in that the Dark Triad as a general personality tendency is indicative of an individual's general need for power, both of which can manifest through context-specific language patterns on online social media.

The finding that individuals with high Dark Triad personality tend to have a high need for power has profound theoretical implications. Previous research suggested that individuals with Dark Triad personalities do value power (Kajonius, Persson, and Jonason 2015). These individuals became successful because they obtained what they want by applying an agentic social style (Jonason, Li, and Teicher 2010). Likewise, Ferris et al. (2007) argued that individuals with a high need for power were motivated to use political skills. Although political skills have been described as a tool to advance personal and organisational goals, they can also be used in a self-serving manner to mask hidden ulterior motives (Ferris, Davidson, and Perrewé 2005). Dark personality, in combination with a need for power, then, can pose threats to others' and organisation's interests. As many previous studies have shown, individuals high in Dark Triad personality were more likely to engage in unethical and fraudulent behaviour (Harrison, Summers, and Mennecke 2018), counterproductive work behaviour, and less likely to be high performers (O'Boyle et al. 2012). The dangerous combination explains the reason why some individuals with dark personality can receive higher salaries and progress in their careers is because at critical junctures when resources or advancement opportunities are limited, dark personality individuals who desperately want to obtain power will maximise their own interests at the expense of others or the organisation. Our study provides some preliminary steps to help organisations predict the occurrence of such situations. Future research can further look into the consequences of the interaction between the Dark Triad and the need for power on individual and organisational outcomes.

5.2. Managerial and organisational implications

Personality and motivation are essential variables of interest in organisation management. Individuals not only have a bright side of personality but also have a dark side. As mentioned above, dark personality can have a better predictor than Big Five. Our findings on the assessment of the Dark Triad via online social media have important practical significance. Traditionally, organisations use self-report questionnaires to measure an individual's inner characteristics, needs, or motivation. Our findings point to a new and reliable way to assess and predict an individual's personality and need for power. Specifically, the HR managers can understand the individual's Dark Triad personality and need for power through scanning their posts online to identify their language features. This provides a novel and cost-effective way for organisations to make personnel decisions.

According to previous research, although the Dark Triad was usually regarded as undesirable in society, employees high in Dark Triad personality can actually manoeuver their career quite effectively – they tend to get promoted or become a leader in the organisation quickly (Hoch 2013; House, Spangler, and Woycke 1991). Our result further showed that the three dimensions of the Dark Triad, namely Machiavellianism, Narcissism, and Psychopathy, were all positively and significantly related to the need for power, which may help partially explain why these individuals tend to advance more quickly in organisations. This makes it all the more important for organisations to accurately assess and predict the potentially dangerous combination of the Dark Triad with a need for power to understand and manage the power dynamics in organisations. Given that the face meaning of Dark Triad personality can be self-evident, if we measure the Dark Triad by using the traditional self-report method, it will be subject to severe social desirability bias. We presented a novel and more effective way of predicting the Dark Triad and the need for power by analysing the language features on Facebook directly. The RMSE values of the prediction models were very small, showing the accuracy of language as the predictor of these interested outcomes.

5.3. Limitations and future research

In this study, we used the LIWC 2015 online programme, instead of the traditional LIWC dictionary, because the nine categories of language features summarise the social activities in our study well. In addition, given that our study makes a first attempt to analyse the need for power through online language, we chose the simple language analysis tool. Future research may use the traditional LIWC dictionary to replicate this study and compare the results with the current analysis. What is more, we focused on the language features of online social networking activities, while there are many other features on social media, such as the number of friends, comments, followers, and photos, which can be important indicators of an individual's personality and motivation. We thus encourage future research to

further examine the rich data of online social media activities and their potential value in management. Besides, we recognised that the small sample size in this study may limit the generalizability of the study results to the general population. Our sample is from only one university and not from a nationally representative sample. It would have been desirable to have a broader and more representative age distribution. Future research can replicate this study using a larger sample size to reduce the probability of random error. Nonetheless, we performed a post hoc power analysis using the G*Power software (Denis 2018) to determine the statistical power of the tests based on the sample size. Power was estimated given α (.05) – the significance level, sample size (130), and effect size (correlation coefficients of all variables in the mediation model ranged from .20 to .53, specifics can be seen in Tables 2–4) based on correlation bivariate normal model. The power to detect a correlation coefficient of .20 in the population was 63.05%, 67.42% for a correlation coefficient of .21, and 75.47% for a correlation coefficient of .23. These were the only three correlation coefficients less than .30 in our results. The others were over .30, with a power of 93.83%. If the correlation coefficient was up to .51, the power was estimated to 99.99%. The rule was that large effects can be spotted with fewer subjects than small effects (Denis 2018). Usually, investigators estimate a study sample size to achieve a power of greater than or equal to 80% (Levine and Ensom 2012). Therefore, based on our sample size, with the exception of the only three power values below 80%, all others were above 90%, thus the results were acceptable as a whole. Lastly, although the need for power is the most relevant to our model of the Dark Triad personality, we call for more research to understand other types of needs and motivation through social activities online. This will expand and provide new research insight for the social psychology science.

6. Conclusion

Our study used language features on Facebook to understand individuals' Dark Triad personality and need for power. We found that the Dark Triad mediates the relationship between multiple language features and the need for power, and that gender moderates the relationship between I-words and Machiavellianism. In addition, we also built a regression model to predict an individual's Dark Triad personality and need for power through the language features on Facebook. These results provide some implications for the organisations for managing the recruitment and promotion processes.

Disclosure statement

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