Personality Traits and the Relationship with (Non-)Disclosure Behavior on Facebook

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ABSTRACT

Applications increasingly use personality traits to provide a personalized service to the user. To acquire personality, social media trails showed to be a reliable source. However, until now, analysis of social media trails have been focusing on *what* has been disclosed: content of disclosed items. These methods fail to acquire personality when there is a lack of content (non-disclosure). In this study we do not look at the disclosed content, but whether disclosure occurred or not. We extracted 40 items of different Facebook profile sections that users can disclose or not disclose. We asked participants to indicate to which extent they disclose the items in an online survey, and additionally asked them to fill in a personality questionnaire. Among 100 participants we found that users' personality can be predicted by solely looking at whether they disclose particular sections of their profiles. This allows for personality acquisition when content is missing.

General Terms

Experimentation; Measurement; Theory

Keywords

Facebook; Disclosure; Non-disclosure; Personality; Personality Prediction

1. INTRODUCTION

Social networking sites (SNSs) are becoming increasingly connected with applications, such as recommender systems. The interconnectedness with SNSs lets users automatically import their information to the application by making use of a single sign-on (SSO) mechanism to authenticate. This allows users to save a considerable amount of registration time, and makes them able to use the application right away.

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Before SNSs release users' profile information to an application, users need to accept a consent form that states which parts of the profile is going to be accessed by the application. Besides accessing users' basic profile information, applications often ask for additional permissions for accessing other parts of users' profile [2]. By granting access to other parts of the profile, applications are able to unobtrusively infer users' preferences and thereby able to provide the new user a more personalized experience.

User preferences can be inferred explicitly or implicitly. For example, Facebook user profiles consist of sections where users can explicitly disclose entertainment content (e.g., music, movies, books) they like, which makes inferring user's preferences straight forward. When explicit information is unavailable, an implicit approach can be adopted. Research has shown that it is possible to infer personality traits from content of social media trails (e.g., Facebook; [1, 9, 13, 16], and Twitter; [8, 14], Instagram [5, 6]). It has been shown that personality consist of reliable cues to create proxy measures about users' behavior, preference, and taste (e.g., [4, 15, 17]). However, both methods heavily rely on disclosed content. When sections are not disclosed, and thereby, content is missing, both methods fail to infer user preferences.

In this study we do not rely on the *content* of disclosed sections, but solely whether sections are disclosed, and especially *not* disclosed. To investigate the relationship between personality traits and (non-)disclosure behavior, we focus on Facebook. Facebook is one of the most popular and interconnected SNS, which in addition allows users to create an extensive user profile, with the ability to control for disclosure by assigning separate privacy settings to each section. This makes Facebook a suitable platform to study the relationship between personality traits and (non-)disclosure behavior of different user profile sections.

Our work makes several contributions. We provide insights into the relationship between (non-)disclosure behavior of profile sections and personality traits. Our findings could be used by applications to infer personality when content data is missing, hence allowing to exploit the benefits of personality to address, for example, cold start problems [18], adaptive user interfaces [7], or music recommendations [3].

We conducted an online survey where we extracted all the user's profile sections of Facebook, and asked participants to indicate for each section the items they disclose or not. Additionally, we asked them to fill in the Big Five Inventory (BFI) questionnaire in order to assess their personality.

Among 100 participants we found distinct relationships between disclosed and not disclosed user's pro le sections and personality traits. In the remainder of this paper we continue with the related work, materials, results, discussion, limitations and future work, and conclusion.

2. RELATED WORK

In this work, we focus speci cally on personality traits. Personality traits have shown to be an enduring factor with relationships to one's taste, preference, and interest (e.g., [4, 15, 17]). For example, a nding of Rawlings and Ciancarelli show that extraverts have a preference for pop music [15].

Several models have been developed to categorize personality, of which the ve-factor model (FFM) is the most well known and widely used. The FFM categorizes personality into ve general dimensions that describes personality in terms of: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism [12].

As personality is such an enduring factor, knowing one's personality provides information about a person's taste, preference, and interest without the need of directly related data. Hence, personality is a useful measurement for personalized systems, such as recommender systems to provide an improved user experience (e.g., [3, 7, 18]). For example, Tkalcic et al. propose a method to overcome the cold start problem of new users by incorporating personality data to enhance the nearest-neighbor measurement [18]. Similarly, Ferwerda et al. use personality traits to adjust the user interface in order to match di erent music browsing strategies [7]. Hu and Pu showed that personality-based recommender system create an advantage (e.g., higher system loyalty of users) over systems that do not incorporate personality [10].

In order to incorporate personality information into applications, research has given attention to the implicit acquisition of personality from social media trails (e.g., Facebook [9, 13, 16], Twitter [8, 14]). For example, personality has been linked to Facebook use, such as the number of friends [16]. Others have shown personality correlations with natural language features on Twitter [8, 14]. Although, prior research has been able to infer personality traits from social media, they relied on content analyses. When content data is missing (e.g., no information is disclosed), these methods fail to infer personality traits. However, as personality is related to human behavior, which sections users disclose or not may provide indicators about their personality. More speci cally, we believe that sections that users decide not to disclose is related to certain personality traits. This provides opportunities to infer personality when content data is missing.

3. MATERIALS

To investigate the relationship between (non-)disclosure of Facebook's user pro le sections and personality traits, we extracted all the items available in a user's pro le. We closely observed an average Facebook pro le, and extracted in total 40 items of three di erent sections of a Facebook pro le (i.e., about, interest, and like sections; see Table 1).

In the survey, participants were asked to indicate to which extent they disclosed the information of the respective item (*To everybody, To friends only, Custom setting, Don't know the setting,* or *Don't disclose*), by answering the following question of the corresponding section: "In the `{section},' I disclose my {item}..." After all the disclosure questions were answered, participants were asked to ll in the 44-item BFI personality questionnaire (5-point Likert scale; Disagree strongly - Agree strongly [11]) to identify the FFM factors.

We recruited 126 participants through Amazon Mechanical Turk. Participation was restricted to those located in the United States with a very good reputation ($\geq$95% HIT approval rate and $\geq$1000 HITs approved). Additional comprehension testing questions were used to lter out fake and careless entries. The Mahalanobis distance was calculated to check for outliers. This left us with 100 completed and valid responses. Age (18-64, median 30) and gender (49 male, 51 female) information indicated an adequate distribution.

About section:	
1	Work
2	Education
3	Professional skills
4	Current city
5	Hometown
6	Places lived
7	Mobile phone
8	Website
9	Email
10	Address
11	Birth date
12	Gender
13	Interested in
14	Religious views
15	Language
16	Political views
17	Relationship
18	Family members
19	About you (e.g., short description about yourself)
20	Other names (e.g., nickname)

Interest section:	
21	Music (i.e., listen later)
22	Movies (i.e., watched and want to watch)
23	TV-shows (i.e., watched and want to watch)
24	Books (i.e., read and want to read)

Like section:	
25	Movies
26	Television
27	Music
28	Books
29	Sports teams
30	Athletes
31	Inspirational People
32	Restaurants
33	Games
34	Activities
35	Interests
36	Sports
37	Foods
38	Clothing
39	Websites
40	Other

Table 1: Facebook's disclosure items with the corresponding section of occurrence.

4. RESULTS

To find the relationship between personality traits and disclosure behavior, we dichotomized the responses of the disclosure scale (To everybody, To friends only, Custom setting, Don't know the setting, or Don't disclose). Although we asked participants for their disclosure setting, providing a third-party application access to one's profile disregards that. An application will have access to the sections that a user granted access to, regardless of the disclosure setting in the profile. Hence, we recoded the responses "To everybody," "To friends only," "Custom setting," "Don't know the setting," to 1, as this means that participants had something filled in. The "Don't disclose" responses were recoded as 0.

A correlation analysis was performed to indicate the relationship between personality traits and disclosure behavior (Table 2). Point-biserial correlation (r ϵ [-1,1]) is reported as the correlation coefficient. [1] Below the results related to each personality trait. A positive correlation indicates that participants scoring high in the personality trait show a higher tendency to engage in disclosure behavior of the respective item in their user profile, while a negative correlation indicates the opposite effect.

Openness to experience. The openness to experience factor correlates with several items in the "About" section. We found negative correlations with the "Current city" (r=-.24, p=.02), "Hometown" (r=-.25, p=.01), "Mobile phone" (r=-.22, p=.03), "Website" (r=-.22, p=.03), and "Address" (r=-.24, p=.02). Additionally, we found a relationship of openness to experience with "Birth date" (r=-.018, p=.08). Negative correlations indicate a decreased tendency to engage in disclosing these items.

Conscientiousness. For the conscientiousness personality trait we found some relationships with items in the "About" section. We found correlations with "Current city" (r=-.20, p=.05), "Hometown" (r=-.18, p=.07), and "Birth date" (r=-.018, p=.07). Additionally, we found a correlation with the "Other" item in the "Like" section (r=-.19, p=.06). Results show a negative correlation meaning that conscientiousness participants indicated to be less likely to disclose these items.

Extraversion. Significant correlations were found in the "About" section and extraversion. We found correlations with "Email" (r=.23, p=.02), and "Birth date" (r=-.22, p=.03). Additionally, we found several positive correlations with items in the "Like" section and extraversion: "Restaurant" (r=.22, p=.03), "Games" (r=.18, p=.08), "Activities" (r=.21, p=.04), "Interests" (r=.17, p=.09), "Food" (r=.24, p=.02), and "Clothing" (r=.19, p=.06). Except for email and birth date, the items show a positive relationship with extraversion; indicating a higher tendency to disclose.

Agreeableness. The only correlation we found with the agreeableness personality factor is with "Places lived" in the "About" section (r=-.20, p=.04). The negative correlation indicates that agreeable participantes are less likely to engage in disclosing this item.

[1] The magnitude of the reported correlations are commonly seen in personality related research [5, 8, 9, 13, 14, 16].

		O	C	E	A	N
4	Current city	**-.24***	**-.20^**	-.08	-.08	.01
5	Hometown	**-.25***	**-.18^**	-.08	-.13	-.05
6	Places lived	-.12	-.12	-.08	**-.20***	-.01
7	Mobile phone	**-.22***	-.12	-.01	-.05	.10
8	Website	**-.22***	.01	.16	.02	-.16
9	Email	-.16	.09	**-.23***	.13	-.13
10	Address	**-.24***	-.02	.14	-.04	-.15
11	Birth date	**-.18^**	**-.18^**	**-.22***	-.12	**.17^**
32	Restaurant	.03	-.06	**.22***	-.06	.09
33	Games	.10	.01	**.18^**	.02	-.13
34	Activities	.05	.03	**.21***	.06	-.08
35	Interests	.09	-.04	**.17^**	-.06	-.05
37	Foods	.01	-.18	**.24***	.01	-.11
38	Clothing	-.05	-.06	**.19^**	.01	-.09
40	Other	-.05	**-.19^**	.08	-.09	.02

Note. ^p<0.1, *p<0.05

Table 2: Correlation Matrix of the profile items disclosure against the personality traits: (O)penness, (C)onscientiousness, (E)xtraversion, (A)greeableness, (N)euroticism. Only items that show significant levels of p<0.1 are reported.

Neuroticism. A correlation was found between "Birth date" and neuroticism (r=.17, p=.09). The positive coefficient indicate a positive relationship with disclosing birth date and the neuroticism trait.

5. PERSONALITY PREDICTION

As we found significant correlations between personality traits and disclosure behavior, we explored personality prediction based on disclosure behavior. We trained a 10-fold cross-validation regression model with 10 iterations by using the *Radial Basis Function*. To indicate the differences between the predicted and observed values, we report the *root-mean-square error* (RMSE; see Table 3). The RMSE of each personality trait relates to a [1,5] scale.

Personality	RMSE	1	2	3
Openness to experience	0.73	0.73	0.68	0.69
Conscientiousness	0.73	0.69	0.66	0.76
Extraversion	0.99	0.95	0.90	0.88
Agreeableness	0.73	0.74	0.69	0.79
Neuroticism	0.83	0.95	0.95	0.85

Table 3: Personality prediction with the root-mean-square error (RMSE). Left RMSE column shows the results of the current study. Columns numbered 1, 2, and 3 show RSME scores of Ferwerda et al. [5, 6] and Quercia et al. [14] respectively.

To see how well our prediction performs, we compared our results with prior work of Ferwerda et al. [5, 6], and Quercia et al. [14], as they used a similar approach for their analyses. Ferwerda et al. [5, 6] extracted personality using characteristics of Instagram images, and Quercia et al. [14] uses Twitter users' characteristics (e.g., popularity, highly read; see Table 3). By disregarding content and only looking at whether sections are disclosed or not, we show that we can approach similar RSME scores as prior research analyzing social media content. Similarly, we found the most difficult traits to predict are extraversion and neuroticism.

6. DISCUSSION

We found that personality traits are correlated with disclosing or not disclosing different parts of the user profile on Facebook. Most significant correlations are found for openness to experience, extraversion, and agreeableness. Our results indicate a relation between openness to experience and *non-disclosure* behavior in the about section of a profile, while for extraversion it is mainly *disclosure* behavior in the like section of a profile. A non-disclosure relationship was found between the places lived and agreeableness.

Additionally, we were able to identify some correlations with conscientiousness and neuroticism. The conscientiousness trait shows overlapping disclosure behavior with the openness to experience trait, whereas the neuroticism trait shows a more distinct pattern; a positive relationship was found of neuroticism on disclosing the birth date.

Furthermore, we show that the extracted Facebook items can be used to predict personality traits. Comparing with prior work (i.e., [5, 6, 14]), we found similar patterns in personality prediction; prediction is most successful for openness to experience, conscientiousness, and agreeableness, but more difficult traits are conscientiousness and neuroticism.

7. LIMITATIONS AND FUTURE WORK

Although our results indicate correlations with disclosing behavior and personality traits, there are also several limitations to our study. Due to constraints of the Facebook API, we decided to use self-report measurements to capture disclosure behavior. There is a possibility that this self-report measure did not accurately capture all the disclosure behavior of participants. Additionally, our sample size is relatively small (n=100). We, therefore, adopted a more lenient significance level to reveal correlations with all personality traits. Reported findings would benefit from a larger sample size.

By using Amazon Mechanical Turk we focused only on participants based in the United States. However, what people disclose may be influenced by culture [19]. Future work should take cultural differences into account. Finally, we focused specifically on Facebook user profile disclosures. Interesting would be to see how and whether (non-)disclosure behavior on other platforms (e.g., Twitter, Instagram, Pinterest) are able to indicate personality traits as well.

8. CONCLUSION

Our results suggest that personality traits can be inferred by analyzing whether users disclose or not disclose sections in their profile. Being able to infer personality traits without content information, enables the creation of measurements to estimate personality traits even when there is no content data available. This makes it possible to facilitate personality based applications (e.g., [7, 18]) with personality approximations to create a personalized experience.

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