Pseudo Names Are More Than Hollow Words: Sex Differences in the Choice of Pseudonyms

Benjamin P. Lange[1], Eugen Zaretsky[2], and Harald A. Euler[3]

Abstract

Many studies demonstrate sex differences in communication. We investigated whether also pseudonyms used in anonymity revealed the sex of the pseudonym user and whether male and female pseudonyms were perceived differently regarding sex-typical attributes (partially taken from the Bem Sex-Role Inventory), the Big Five, and creativity. Pseudonyms chosen by 19 men and 19 women were randomly selected from a list of 2,096 pseudonyms used in written university tests and then rated by a total number of 346 participants (41% men) on the above-mentioned attributes. Results showed that the pseudonym users' sex was guessed correctly above chance. Male more than female pseudonyms were perceived as showy, aggressive, self-reliant, extrovert, and creative. Female pseudonyms were rated higher on the attributes cute, peaceful, romantic, and agreeable. We further found sex differences with respect to linguistic patterns (e.g., pseudonym length) that were, however, able to explain neither guessed sex, nor the higher creativity ratings for male pseudonyms. We conclude that even single words are used by individuals to infer significant information (e.g., sex) about their users.

[1]Julius-Maximilians-University of Wuerzburg, Wuerzburg, Germany
[2]Goethe University of Frankfurt/Main, Frankfurt, Germany
[3]University of Vienna, Vienna, Austria

Corresponding Author:
Benjamin P. Lange, Department of Media Psychology, Institute for Human-Computer-Media, Julius-Maximilians-University of Wuerzburg, Oswald-Kuelpe-Weg 82, D-97074 Wuerzburg, Germany.
Email: benjamin.lange@uni-wuerzburg.de

The sexes differ with respect to communicative patterns and language use (Eckert & McConnell-Ginet, 2003; Tannen, 2001). This can be found, for instance, with respect to socioemotional variables. In verbal communication, women are more sensitive, affiliative, and supportive and use more words denoting feelings than men. Men's verbal behavior, in turn, is more characterized by competition, dominance, hostility, self-assertion, and hierarchies (e.g., Archer, 2009; Athenstaedt, Haas, & Schwab, 2004; Brownlow, Rosamond, & Parker, 2003; Dindia & Allen, 1992; Lange, 2011; Leaper & Ayres, 2007; Locke & Bogin, 2006; Makri-Tsilipakou, 1994; Mast, 2002; Yokoyama, 1999). These differences also seem to have a motivational facet.

Another language-related sex difference that is also linked to motivation is that men are more prone than women to verbal displays, that is, particularly men use language to advertise themselves (Lange, 2011, 2012; Lange & Euler, 2014; Locke & Bogin, 2006; Miller, 1999; Rosenberg & Tunney, 2008). There is a large body of anecdotal evidence suggesting that this sex difference is cross-culturally universal (Locke & Bogin, 2006). For instance, evolutionary psychological research shows that men are more inclined toward the use of special, impressive, progressive, rare, or even unknown words, at least in a mate choice context (Lange, 2011; Rosenberg & Tunney, 2008). In accordance, Griskevicius, Cialdini, and Kenrick (2006) found that after being exposed to mate choice cues men are more likely to produce creative linguistic displays. Generally, men, more than women, seem to use long words (Newman, Groom, Handelman, & Pennebaker, 2008). Also, male more than female belles lettres authors use loanwords and internationalisms, that is, words mostly of Latin and Greek origin borrowed into several or many languages and used predominantly in a higher (i.e., a more sophisticated, more technical, more elaborate) style (e.g., *to dominate, Olympus, monarch*; Zareckij, 2007).

Despite the large number of studies reporting language-related sex differences, it is worthwhile to keep in mind that most of these differences are fairly small and, furthermore, context sensitive (e.g., Hyde & Linn, 1988; Leaper & Ayres, 2007; Mulac & Lundell, 1986; Mulac, Lundell, & Bradac, 1986).

Most of the studies refer to prototypical communication in which a sender and a receiver actually interact personally in some way. The question could be whether language-related sex differences are so deeply rooted in human minds that they are expressed and perceived even when there is anonymous communication. Indeed, male dominance by means of language is even evident in rather anonymous situations. Guiller and Durndell (2007) found that in communication via computers, men try more than women to dominate and to react negatively to others' statements, whereas women are more supportive than men. Hence, anonymity does not necessarily reduce or eliminate sex differences but might even foster them (Postmes & Spears, 2002). In line with this, Thomson and Murachver (2001) found that in anonymous electronic communication, the sex of the message writer could be guessed correctly by means of sex-specific language use. Other studies also found that based on reading messages only, participants were able to guess the sex of the author (e.g., Koch, Mueller, Kruse, & Zumbach, 2005; but see Savicki, Kelley, & Oesterreich, 1999).

Entire or even lengthy messages, however, may not be necessary to predict the author's sex. Mere words might suffice, because even words alone clearly

communicate certain meanings. When people have to choose a pseudonym for themselves, for instance, one might assume that any arbitrary combination of letters or any word without deeper meaning should suffice to ensure anonymity. Pseudonyms used by people in anonymous situations should hence be well suited for hiding one's social identity, including one's sex, thus creating, for instance, a greater equality between the sexes. Indeed, gender identity concealment has been shown to be especially used by women who mask their sex more than men when choosing a pseudonym (Jaffe, Lee, Huang, & Oshagan, 1999). We, however, hypothesized that basic language-related sex differences are so fundamental that they are even expressed in (socially) anonymous situations and via even single lexical items, that is, via pseudonyms in the form of words or compositions of words (Hypothesis 1). Thus, even short pseudonyms might communicate significant information about their users or are at least used by individuals in order to try to infer such information. This might be due to the sender's affinity for selective self-presentation and impression management, which should be most pronounced in communication that—due to limitations of the communication channel(s)—lacks the social cues that are normally available in face-to-face communication (cf. Walther, 1996, 2007). This could also be expected from an evolutionary perspective that focuses on the necessity for an individual to advertise himself or herself (see above).

The above-mentioned notions led to our first hypothesis:

> **Hypothesis 1:** Pseudonyms used in written exams only for the purpose of anonymity can be correctly allocated to the sex of the pseudonym users (see Study 1).

If so, we would expect pseudonyms used by women to receive higher scores by raters on attributes that are typical of women (*cute, peaceful*) and on "femininity items" from the Bem Sex-Role Inventory (BSRI; Bem, 1974) than pseudonyms used by men, which, in turn, should receive higher scores on typical male attributes (*showy, aggressive*) and on "masculinity items" from the BSRI. The BSRI has proven useful to measure masculinity and femininity and sex roles, and hence, the two most promising items (see below) from the BSRI were used in the current research.

There is also evidence on sex differences in certain personality dimensions. Women score moderately higher on *agreeableness, neuroticism, extraversion*, and *conscientiousness* (Costa, Terracciano, & McCrae, 2001; Lippa, 2010; Schmitt, Realo, Voracek, & Allik, 2008) from the Big Five Factor Model of personality traits (Costa & McCrae, 1992), which is the most widely used model to assess individual differences in personality. Hence, we furthermore investigated whether pseudonyms created by women would receive higher scores on these attributes than pseudonyms created by men, because it might be that pseudonyms also communicate aspects of the pseudonym user's personality or that pseudonyms are at least used by people to try to infer such information. So, our second hypothesis is as follows:

> **Hypothesis 2:** The pseudonyms would receive sex-differentiated ratings on these attributes (see Studies 1 and 2).

Expanding on the studies showing that mate choice cues motivate especially men to be verbally creative and to communicate their verbal creativity (e.g., Griskevicius et al., 2006; Lange, 2011), we had the third hypothesis:

Hypothesis 3: Pseudonyms created by men would be perceived as more creative than pseudonyms created by women (see Study 3).

We assumed that when choosing a pseudonym for themselves, men would be more motivated than women to be linguistically creative, even when mate choice is not the main focus, because this motivation could be deeply rooted in the mind of the average man—possibly due to evolutionary reasons fostered by cultural demand characteristics. Men might further see themselves in the role of the sender after all, anticipating some sort of receiver whom to impress (e.g., Lange & Euler, 2014).

Conscious or subconscious assumptions or stereotypes about language used by men or women or referring to men or women are supported by some linguistic findings which demonstrate that such differences indeed exist. Men, more than women, for instance, tend to use long words in all kinds of texts and speech (Newman et al., 2008). The length of a word in general and thus of a pseudonym as well might influence how creative and proficient its user is perceived (Lange, 2012; Lange, Zaretsky, Schwarz, & Euler, 2014). Male English forenames, however, are shorter than female English forenames, as measured by the number of syllables. Female forenames, in addition, are more likely than male forenames to end with a vowel, especially *a* or *e* (Anshen, 1989). A feature of female language use is the active use of diminutive suffixes, that is, suffixes expressing smallness, endearment, or intimacy (Zareckij, 2007). Female and male forenames and nicknames in the Indo-European languages possess certain sex-specific characteristics like open syllables at the end of female names and consonants at the end of male names, more syllables in the female names, and the absence of diminutive suffixes in male names (de Klerk & Bosch, 1997; Hough, 2000; Slater & Feinman, 1985). People, unconsciously aware of some of these linguistic sex differences, might use pseudonym length or other linguistic-morphological patterns when asked to guess the sex of a pseudonym user. Hence, we tested for sex differences in pseudonym length and other linguistic patterns and investigated how far these patterns explain guessed sex and perceived pseudonym creativity (see Study 4). In Study 4, also the grammatical gender of the pseudonyms (if at all possible) was scrutinized, because grammatical gender might be a strong cue for perceived sex/gender, even of inanimate objects (Phillips & Boroditsky, 2003). Moreover, gendered suffixes can influence the perception of a person's social status (Merkel, Maass, & Frommelt, 2012). There was no specific hypothesis here. Study 4 was hence rather exploratory. The research question was the following:

Research Question 1: To what extent the above-mentioned linguistic features were able to explain the results obtained in Studies 1 to 3.

Table 1 gives an overview of the hypotheses and the studies.

Table 1. Overview of the Hypotheses and the Studies.

Hypothesis	Study	Rated attributes	Pseudonyms	Raters
Hypothesis 1: Pseudonyms can be correctly allocated to the sex of their users	1	*sex* (from 1 = *rather male* to 5 = *rather female*)	38	86 (35 men)
Hypothesis 2: The pseudonyms receive sex-differentiated ratings on several attributes	1 + 2	Study 1: *showy, cute, aggressive, peaceful* Study 2: *self-reliant, romantic*[a]*; neurotic, extrovert, agreeable, conscientious, open to experience*[b] (from 1 = *not showy* to 5 = *very showy*, etc.)	Study 1: 38 Study 2a: 19 (10 male) Study 2b: 19 (9 male)	86 (35 men) 77 (30 men) 80 (34 men)
Hypothesis 3: Pseudonyms created by men are perceived as more creative	3	*creative* (from 1 = *not creative* to 5 = *very creative*)	38	103 (46 men)

[a]Taken from (the German version of) the Bem Sex-Role Inventory. [b]Taken from Big Five Factor Model of personality traits.

Current Studies

All studies were based on an original list of 2,857 pseudonyms, which were used in written psychology mid- and end-semester exams between 2003 and 2008 at a German university. The examinees had to create a pseudonym of their choice and write it down on the first sheet of their examination paper along with their real name. The pseudonym was obligatory due to data privacy regulations so that the results of the exams could be publicly posted while still guaranteeing anonymity. All examinees were free in creating a pseudonym for themselves. The sex of each examinee could, without exception, be correctly identified by means of the forenames. Hence, we knew for all pseudonyms whether they had been used by a man or a woman. From the original list, all pseudonyms were excluded which consisted of the examinees' real names, mere numbers, or which possibly gave hints to the examinees' identities (e.g., a combination of the first name and the birth date; $n = 761$), resulting in the final list of 2,096 pseudonyms that were used in the current research. Nineteen pseudonyms created by women and 19 pseudonyms created by men were randomly selected from this list using a random number generator. Thus, the stimuli presented to our participants in the rating studies (see Studies 1-3) and the linguistically analyzed material (see Study 4) consisted of a total of 38 pseudonyms. See the note in Figure 1 for a list of the 38 pseudonyms. The selection of pseudonyms was limited to 38 given the high number of different ratings that were planned (see below) and the necessity not to overcharge our participants. For all ratings in Studies 1 to 3, 5-point Likert-type scales were used. For
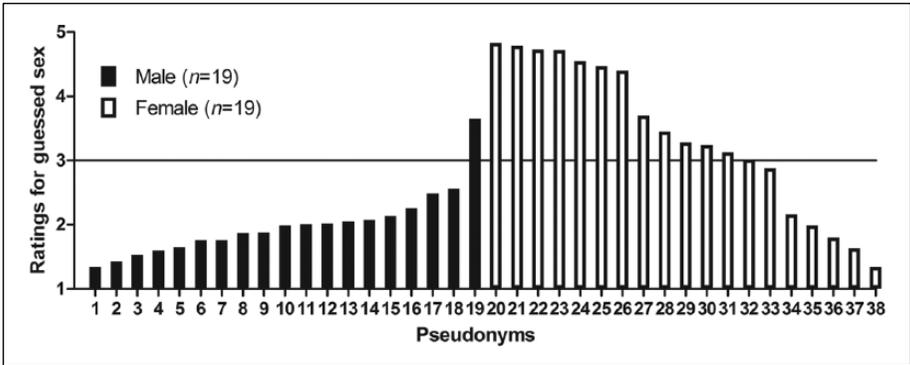
Figure 1. Ratings of the 19 male and the 19 female pseudonyms for guessed sex on a 5-point Likert-type scale from 1 (*rather male*) to 5 (*rather female*) using mean values in numerical order and by sex of the pseudonym user.

Note. The pseudonyms were the following: (1) Käptn Kroitel, (2) Roadster, (3) Troublemaker, (4) Evil Empire, (5) Deus Ex Machina, (6) Dr. Kitt, (7) Egoist, (8) Weizen, (9) Flexpoint, (10) Holzwurm, (11) Stic, (12) Maulwurf, (13) Puma, (14) Nachnach-Schreiber, (15) Ganymed, (16) Blackout, (17) Kroko, (18) Zerschmetterling, (19) Silicon, (20) Honeybunny, (21) Blümchen, (22) Sunnyshine, (23) Lila, (24), Entchen, (25) cutie, (26) Schmatzi-Patzi, (27) Karotte, (28) Flecki, (29) Wassermops, (30) geschafft?!, (31) Knubbel, (32) Mücke, (33) Seeigel, (34) Spinacio, (35) Yoshi, (36) Piranha, (37) Bazillus, (38) Trojaner.

all statistical analyses, the 38 pseudonyms were used as cases, that is, the mean values of the ratings each pseudonym received by the participants were used in the analyses. The results of all analyses are reported as two-tailed.

Study 1

Participants

Participants were 86 university students (35 men, 51 women; age: $M = 25.40$, $SD = 7.62$), who were offered experimental credit or course credit for several seminars.

Materials and Procedure

In a paper-and-pencil questionnaire, all pseudonyms had to be rated for the supposed sex of the pseudonym user (from 1 = *rather male* to 5 = *rather female*) as well as on the attributes *showy, cute, aggressive*, and *peaceful* (5-point Likert-type scale, from 1 = *not showy* to 5 = *very showy*, etc.; see Table 1).

Results

Rating the Sex of the Pseudonym User. The sex of the pseudonym users was "guessed" correctly above chance. The pseudonyms created by men, $M = 2.00$, 95% confidence interval (CI) [1.75, 2.25], were rated as being rather used by men, whereas the

pseudonyms created by women, $M = 3.37$, 95% CI [2.81, 3.94], were rather considered to have been used by women. This result was statistically significant and showed a large effect size ($t_{(36)} = 4.64$, $p < .001$, $d = 1.51$). Figure 1 gives a graphical summary of these ratings.

As can be seen in Figure 1, only one male pseudonym received a rating higher than the neutral rating of 3, whereas most female pseudonyms received ratings higher than 3 and were thus perceived as being used by a woman. However, there were six female pseudonyms that gained ratings below the neutral rating of 3 and were thus perceived as being rather used by men. In accordance, the means ($Ms = 2.00$ vs. 3.37) tended to the male side.

Male and female participants showed high agreement in their ratings so that mean male ratings for guessed sex correlated highly with mean female ratings for guessed sex, $r_{(36)} = .98$, $p < .001$. Hence, we concluded that neither of the sexes was significantly more accurate in guessing the sex of the pseudonym users.

Additionally to these analyses, we investigated the accuracy of the ratings, similar to the procedure used by Rule and Ambady (2008). Accuracy scores were calculated for each of the 86 participants. If a pseudonym created by a man received a rating <3 and a pseudonym created by a woman a rating >3, it was considered a correct guess, otherwise an incorrect one. We excluded neutral ratings, thus investigating only those estimations of pseudonym users' sex that took a stand by clearly giving either male or female ratings. Mean accuracy was high with 74.86% (male participants = 75.81%, female participants = 74.22%; *ns*) and thus significantly above chance (which would have been 50%; $t_{(85)} = 32.53$, $p < .001$). The two most accurate participants reached an accuracy of 87.10% each and were both male. Age and accuracy were positively but nonsignificantly correlated with each other ($r = .13$, $p = .23$).

Additional Ratings: Showy, Aggressive, Cute, Peaceful. The pseudonyms created by men were rated higher than the pseudonyms created by women on the attributes *showy* ($Ms = 3.40$ vs. 2.62; $t_{(36)} = 3.28$, $p = .002$, $d = 1.07$) and *aggressive* ($Ms = 3.03$ vs. 2.26; $t_{(36)} = 2.73$, $p = .010$, $d = 0.89$). Pseudonyms created by women, on the contrary, were rated higher on the attributes *cute* ($Ms = 3.02$ vs. 2.00; $t_{(36)} = 4.22$, $p < .001$, $d = 1.37$) and *peaceful* ($Ms = 3.68$ vs. 2.26; $t_{(36)} = 2.90$, $p = .006$, $d = 0.94$).

Study 2

Participants

Nineteen randomly selected pseudonyms (10 male and 9 female ones) were rated by 77 volunteers (30 men, 47 women; age: $M = 28.68$, $SD = 7.98$) on attributes taken from the BSRI and the Big Five factors model (see Table 1). The other 19 randomly selected pseudonyms (9 male and 10 female ones) were rated by a different sample of 80 volunteers (34 men, 46 women; age: $M = 26.60$, $SD = 4.68$), mainly university students, as to the same attributes. Study 2 consisted of two samples of pseudonyms and raters

in order to reduce test length, as the pseudonyms had to be rated for seven attributes (the Big Five plus two BSRI items). Hence, this study was split into two halves.

Materials and Procedure

Study 2 was conducted online. The users of the pseudonyms were rated regarding the attributes *self-reliant* and *romantic*, because in the German version of the BSRI (Schneider-Dueker & Kohler, 1988) the attribute *being self-reliant* shows the highest discriminatory power for the masculinity scale and *being romantic* for the femininity scale. Likewise, the users of the pseudonyms were rated in terms of the Big Five factors of personality (Costa & McCrae, 1992), for which descriptions of each factor were provided additionally in parentheses: *neurotic/emotional instable* (nervous, anxious, getting upset easily), *extrovert* (seeking the company of others, not shy, active), *agreeable* (tolerant, warm, helpful), *conscientious* (exacting, persistent, reliable), *open to experience* (intellectual, cultured, creative).

Results

Sex-Role-Inventory: Self-Reliant, Romantic. Pseudonyms created by men, $M = 3.32$, 95% CI [3.09, 3.54], were rated higher than pseudonyms created by women, $M = 2.97$, 95% CI [2.76, 3.18], on the attribute *self-reliant* ($t_{(36)} = 2.39$, $p < .05$, $d = 0.78$). The most self-reliant pseudonym was *Puma* ($M = 4.12$), a word denoting, in English as well as in German, a genus of large predator cats, and was indeed used by a man. Pseudonyms created by women, $M = 3.15$, 95% CI [2.77, 3.52], on the contrary, were rated higher than pseudonyms created by men, $M = 2.33$, 95% CI [2.18, 2.48], on the attribute *romantic* ($t_{(36)} = 4.26$, $p < .001$, $d = 1.38$). The most romantic pseudonym was *Blümchen* ($\approx$ *little flower; M = 4.50$) and indeed used by a woman.

Big Five. There was no statistically significant difference between the sexes for the neuroticism ratings of the pseudonyms ($p = .634$). In terms of the attribute *extrovert*, pseudonyms created by men, $M = 3.44$, 95% CI [3.25, 3.63], were, contrary to our expectations, rated even significantly higher than pseudonyms created by women, $M = 3.17$, 95% CI [2.98, 3.36]; $t_{(36)} = 2.07$, $p < .05$, $d = 0.67$.

Pseudonyms created by women, $M = 3.34$, 95% CI [3.10, 3.58], were rated higher on *agreeable* than pseudonyms created by men, $M = 2.91$, 95% CI [2.70, 3.13]; $t_{(36)} = 2.79$, $p = .008$, $d = 0.91$. The most agreeable pseudonym was again *Blümchen* ($M = 4.14$). There were no significant sex differences for the ratings on *conscientious* and *open to experience* (ps > .12).

Study 3

Participants

Participants were 103 volunteers (46 men, 57 women; age: $M = 28.51$, $SD = 8.30$), mainly university students.

Materials and Procedure

In Study 3, which was also conducted online, the 38 pseudonyms were randomly presented and rated for the attribute *creative* using a 5-point Likert-type scale (from 1 = *not creative* to 5 = *very creative*).

Results

Pseudonyms created by men, $M = 2.84$, 95% CI [2.60, 3.08], received higher creativity ratings than pseudonyms created by women, $M = 2.38$, 95% CI [2.12, 2.65]. This difference was statistically significant and yielded a large effect size ($t_{(36)} = 2.70$, $p < .05$, $d = 0.88$). The most creative pseudonym was *Zerschmetterling* ($M = 4.20$) and indeed used by a man. This pseudonym is a portmanteau word, that is, a composition of two semantically different words. *Zerschmetterling* is formed by blending the words *zerschmettern* (≈ *to crash*) and <u>*Schmetter*</u>*ling* (≈ *butterfly*), both morphologically and semantically. Although creativity is one trait of the personality dimension *open to experience*, the ratings for the latter dimension did not significantly correlate with the creativity ratings (see Table 2).

Study 4

Materials and Procedure

Study 4 was a linguistic analysis of the 38 pseudonyms. For each pseudonym, the first and second authors, both trained in linguistic analyses, counted the numbers of words, syllables, characters, and morphemes. In addition, the pseudonyms were categorized according to their grammatical gender, because in the German language, contrary to the English language, each noun has one of three grammatical genders (masculine, feminine, neuter). For each pseudonym, the word final position was also examined to test whether the sexes differed in this respect. Finally, it was assessed whether the pseudonyms were so-called internationalisms (see above), and if so, which ones and whether there were any differences between the sexes in this regard.

Results

It was found that men used predominantly grammatically masculine pseudonyms, whereas women used predominantly grammatically feminine ones ($\chi^2 = 6.73$, $p = .035$). This could indicate that grammatical gender might have been used by our participants as a simple cue to guess the sex of the pseudonym user in Study 1 (Phillips & Boroditsky, 2003). Hence, we investigated again whether the sex of the pseudonym user could be guessed correctly, but this time only using those pseudonyms which were genuinely not German but English and/or unspecified as to gender ($n = 17$). This yielded a similar result as in the first analysis when investigating the mean ratings the pseudonyms received ($Ms = 2.04$ vs. 3.65; $t_{(15)} = 3.96$, $p = .001$, $d = 1.84$).

Table 2. Intercorrelations Between the Pseudonym Ratings and the Linguistic Attributes (Studies 1 to 4).

Attributes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	M
1.Real sex[a]	(–)																	—
2. Guessed sex[b]	.62***	(.66)																2.69
3. Showy	−.48**	−.44**	(.90)															3.01
4. Aggressive	−.42*	−.69***	.77***	(.90)														2.64
5. Cute	.58***	.81***	−.68***	−.85***	(.82)													2.51
6. Peaceful	.44**	.70***	−.74***	−.99***	.88***	(.91)												3.29
7. Self-reliant	−.37*	−.56***	.67***	.64***	−.57***	−.59***	(.78)											3.14
8. Romantic	.58***	.81***	−.50**	−.74***	.91***	.79***	−.44**	(.80)										2.74
9. Neurotic	.08	.08	.02	.11	−.12	−.18	−.38*	−.17	(.81)									3.08
10. Extrovert	−.33*	−.29	.78***	.55***	−.52**	−.53**	.69***	−.36*	−.16	(.73)								3.30
11. Agreeable	.42**	.60***	−.68***	−.88***	.84***	.91***	−.52**	.80***	−.34*	−.51**	(.80)							3.13
12. Conscientious	.25	.29	−.44**	−.48**	.54**	.55***	−.07	.50**	−.35*	−.58***	.61***	(.78)						3.05
13. Open to experience	.18	.20	−.18	−.38*	.33*	.45**	.12	.47**	−.60***	−.14	.63***	.71***	(.79)					3.06
14. Creative	−.41*	−.51**	.22	.38*	−.53**	−.41*	.11	−.49**	.20	.11	−.33*	−.20	.05	(.91)				2.61
15. Number of words	−.32*	−.31	.40*	.24	−.31	−.24	.31	−.26	.18	.19	−.22	.05	.13	.34*	(–)			1.13
16. Number of syllables	−.21	−.23	.52**	.39*	−.40*	−.40*	.28	−.27	.29	.43**	−.47**	−.38*	−.23	.41*	.62***	(–)		2.89
17. Number of characters	−.09	−.02	.20	.09	−.15	−.13	−.18	−.10	.42**	.22	−.17	−.48**	−.31	.43*	.24	.57***	(–)	8.66

Note. N = 38; Cronbach's alphas representing the consistencies of the participants' ratings are shown in parentheses in the diagonal.
[a]Real sex of the pseudonym user (dichotomized variable: 1 = *male*, 2 = *female*). [b]Sex as rated by the studies' participants (metrical variable: 1 = *rather male* to 5 = *rather female*).
*p < .05. **p < .01. ***p < .001.

Pseudonyms created by men were longer than those created by women. This was the case for the number of words the pseudonyms consisted of, as all pseudonyms created by women were monolexical (consisting of only one word), whereas the pseudonyms created by men consisted of up to three words, as in *Deus Ex Machina* (Ms = 1 vs. 1.26; $t_{(36)}$ = 2.04, p < .05, d = 0.66). Pseudonyms created by men were also, on a descriptive level, longer than pseudonyms created by women regarding the number of characters, the number of morphemes, and the number of syllables. However, none of these differences reached statistical significance.

Creativity ratings (see Study 3) correlated positively with the number of characters (r = .43, p = .008), the number of words (r = .34, p = .038), and the number of syllables (r = .41, p = .011). As perceived sex differences in linguistic creativity (see Study 3) might thus be partially explained (i.e., mediated) by parameters of pseudonym length, we employed mediation analyses following Preacher and Hayes (2004) with each of the parameters of pseudonym length as the respective mediator, sex as the independent variable, and perceived creativity as the dependent variable. The parameters of pseudonym length did not have a significant effect on the relation between pseudonym user's sex and perceived creativity (all ps > .20). Perceived sex differences in creativity remained significant when considering parameters of length (all ps < .034).

Could it be that our participants used length information to guess the pseudonym user's sex? As male and female pseudonym users significantly differed from each other in terms of the number of words the pseudonyms consisted of with all pseudonyms created by women being monolexical (see above), we repeated the analysis of Study 1 using only monolexical pseudonyms (19 female, 15 male). The result was similar (although somewhat lower in effect size): The sex of the pseudonym users was again guessed correctly above chance. The pseudonyms created by men, M = 2.11, 95% CI [1.82, 2.40], were still rated as being rather used by men (although more "feminine" than before), whereas the pseudonyms created by women, M = 3.37, 95% CI [2.81, 3.94], were, as before, rather considered to have been used by women. This result was again statistically significant and still of large effect size ($t_{(32)}$ = 3.84, p = .001, d = 1.33). Using mediation analyses, the results were similar: None of the linguistic length features had a significant mediation effect on the relation between real and perceived pseudonym user's sex (all ps > .54). Perceived sex was predicted by real sex with high statistical significance even when taking the length parameters into consideration (all ps < .001).

A noteworthy result was that, although the three parameters of pseudonym length (i.e., the number of characters, the number of words, and the number of syllables) correlated significantly with several other parameters, the number of morphemes did not show any significant correlation with any other parameter (see Table 2).

Furthermore, the preference for internationalisms of Greek and Latin origin was more obvious in pseudonyms created by men (χ^2 = 4.89, p = .027), which means that women preferred Germanic (either Modern German or English) morphological material instead.

There were no significant sex differences in the use of *-e* and *-a* in the word final position taken together or alone. However, women used diminutive suffixes like *-i* in

Schmatzi-Patzi (*Schmatz* ≈ *hearty kiss*) more often than men (χ^2 = 10.13, p = .003). In this analysis, both English and German suffixes were considered. See Table 2 for the intercorrelations between the values of all ratings and the linguistic features.

Discussion

The current research investigated three hypotheses and one research question (see Table 1). Hypothesis 1 (pseudonyms can be correctly allocated to the sex of their users) was confirmed. Hypothesis 2 (pseudonyms receive sex-differentiated ratings on several attributes) was partially confirmed. The pseudonyms created by men received higher ratings on the attributes *showy* and *aggressive*, on the BSRI item *self-reliant*, as well as, contrary to our expectations, on the Big Five dimension *extrovert*. The pseudonyms created by women were rated as higher on the attributes *cute* and *peaceful*, on the BSRI item *romantic*, as well as on the Big Five dimension *agreeable*. The assumed sex differences regarding the Big Five dimensions *neuroticism* and *conscientiousness* were not confirmed. Hypothesis 3 (pseudonyms created by men are perceived as more creative) was confirmed with a large effect size. With respect to our Research Question 1 (about which linguistic features can explain the findings from Studies 1 to 3), we found the following: Men and women tend to use pseudonyms with a congruent grammatical gender. Pseudonyms by men were longer in several ways than those by women. However, this cannot entirely explain the ability of our participants to correctly rate the sex of the pseudonym creator. Creativity ratings can be partially explained by pseudonym length. However, pseudonyms by men are still perceived as significantly more creative when controlling for pseudonym length. Men, more than women, tend to use internationalisms when creating a pseudonym for themselves, whereas women are more prone to the use of diminutive suffixes.

Regarding Hypothesis 1 (see Study 1), our data show that the sex of a pseudonym user was guessed correctly above chance with statistical significance and was hence somewhat communicated via the pseudonym. The present research demonstrates that entire messages are not needed to guess the author's sex (e.g., Thomson & Murachver, 2001). Single words seem to suffice. In our judgement, this result cannot be explained merely by the fact that men tend to use grammatically masculine pseudonyms and women grammatically feminine pseudonyms, as using only those pseudonyms in the analysis that had no clear grammatical genders per se yielded basically the same results. Although it cannot be ruled out that our participants assigned a grammatical gender to those pseudonyms that originally did not have one, it seems rather unlikely that this solely explains the results, as many pseudonyms, such as *Flecki, Weizen*, or *Kroko* (see note of Figure 1) do not clearly evoke one specific grammatical gender. As a matter of fact, *Flecki*, for instance, could be either masculine or feminine or even neuter in terms of grammatical gender. *Sunnyshine* would most likely evoke masculine gender (if evoking any grammatical gender at all), because "shine" is "Schein" in the German language and grammatically masculine there. This pseudonym, however, was used by a woman and was perceived as female by our participants. *Wassermops*, a German noun (or, to be precise, a composition of nouns), is clearly masculine

regarding grammatical gender, but was chosen by a woman, and again, our participants rather perceived this pseudonym as being used by a woman (cf. Figure 1). The pseudonym *geschafft?!* is not even a noun but a verb in a past participle form. Grammatical gender might also play a role (cf. the grammatically masculine German pseudonyms *Bazillus* and *Piranha* in Figure 1), but cannot entirely explain our results, as many pseudonyms were not (grammatically) gendered per se.

It was striking that the pseudonyms created by women showed a higher within-group variability in terms of received ratings on assumed sex than the pseudonyms created by men (see Figure 1). This is at odds with studies demonstrating higher male than female variance regarding numerous variables, including language-related ones (e.g., Strand, Deary, & Smith, 2006). It might be that women when creating a pseudonym for themselves are less prone than men to maintain their gender identity. However, we can only speculate here.

The findings on rated sex of the pseudonym users conform to gender stereotypes (Eagly, 1995) in that pseudonyms created by women were rated higher than those created by men on being cute and peaceful, whereas male pseudonyms ranked higher on being showy and aggressive (see Hypothesis 2, Study 1). However, there is limitation in Study 1 because participants there were not only asked to rate pseudonym users' sex but also to rate the pseudonyms on typical male and female attributes. By asking our participants to rate sex, we may have primed them to be thinking about sex or gender when rating those attributes, thus making sex or gender salient, which might have influenced their ratings on the sex-typical attributes (cf. Palomares, 2004). Still, in Study 2 also, where no such limitation existed, pseudonyms created by women received higher ratings on a "feminine" attribute from the BSRI, namely, *romantic*, whereas pseudonyms created by men were rated higher on a "masculine" attribute from the same inventory, namely, *self-reliant* (see Hypothesis 2, Study 2). It can thus be assumed that, although there are also formal language features operating as linguistic markers of sex (Mulac & Lundell, 1986), our participants used these semantic aspects to guess the pseudonym user's sex. They might have thought, "This pseudonym has an aggressive connotation. Men are more aggressive than women on average. Hence, I assume that it has possibly been used by a man." So, humans have notions—be they conscious or maybe even unconscious—on male and female language use (Mulac, Giles, Bradac, & Palomares, 2013). And they employ these not only when speaking themselves but also when asked to identify the sex of the producer of some piece of language. This might include semantic aspects. One explanation for the ability of our participants to infer such sex-specific connotations might also be the pseudonym users' affinity for selective self-presentation when choosing the respective pseudonym in anonymity (cf. Walther, 2007). When social cues are missing due to anonymity, pseudonyms or nicknames would hence be the only or one of very few vehicles to communicate one's social identity, including one's sex (Subrahmanyam, Greenfield, & Tynes, 2004; Subrahmanyam, Smahel, & Greenfield, 2006). Hence, the pseudonym user seemed to have still behaved as participating in a real social interaction. They might have even anticipated some sort of receiver (e.g., the corrector of the written exam) and hence acted as the sender in this rather unusual "interaction" when

choosing the pseudonym. Hence, our findings demonstrate that sex-typical preferences and behavioral tendencies were strongly reflected in the pseudonyms men and women chose to identify themselves with. In addition, these findings are remarkable because humans have been shown to possess a need for uniqueness (Fromkin, 1972; Lynn & Snyder, 2002; Snyder & Fromkin, 1980), particularly in individualistic cultures (Triandis, 1995), and thus tend to resist being categorized as usual or typical. Individuals can therefore be assumed to avoid being gender stereotyped ("typical male," "typical female"). The choice of a pseudonym leaves open all options to express uniqueness and avoid gender stereotypes, but gender-typical expressions creep in nevertheless, as our results clearly show. The pseudonym users were not able to hide their sex (if they tried to) or did not want to hide it (i.e., they opted for a selective self-presentation and behaved as being in a social interaction).

Generally, the findings for the Big Five traits (see Hypothesis 2, Study 2) show that language communicates gender as well as personality (Schwartz et al., 2013). The results, however, did not confirm all of our assumptions. There was no statistically significant difference between the sexes for the neuroticism ratings of the pseudonyms. Moreover, contrary to our expectations drawn from the literature on sex differences in personality, male pseudonyms were perceived as more extrovert than female ones. This finding is in accordance with research, showing that male-typical language use is considered rather extroverted compared with female-typical language use (Berryman, 1980). Usually, the five personality factors are tested by an inventory administered to human beings (Costa & McCrae, 1992). However, in our study, human beings' pseudonyms were only rated by our participants on these factors. It is thus possible that these participants might have had a different concept of *extrovert* in mind than the one used in the Big Five model, even though each of the five dimensions was explained in the questionnaire. Our results suggest that our participants thought of attributes like *showy* or even *aggressive* when rating the pseudonyms for extraversion (see Table 2), which might explain why the users of male pseudonyms received higher ratings on extraversion. Indeed, assertiveness—generally a trait expressed more in men than in women (Costa et al., 2001; Kimble, Marsh, & Kiska, 1984)—is one aspect of extraversion (Costa & McCrae, 1992).

Earlier studies showed that men aim to be more creative by means of language in a mate choice context compared with women (e.g., Lange, 2011). Our results demonstrate that even apart from any specific mate choice context pseudonyms created by men are perceived as being significantly more creative than female ones (see Hypothesis 3, Study 3). Male more than female pseudonyms might thus be perceived as novel and, consequently, might attract attention. This result might be surprising considering that men are not more verbally proficient than women are (Hyde & Linn, 1988). We may thus conclude, as hypothesized, that men are more motivated than women to produce creative verbal displays. This motivation might be so deeply rooted within their minds that it is even expressed in situations where mate choice is not salient (Lange & Euler, 2014). In line with this, it could also be that men are more prone to (optimized) selective self-presentation than women after all, at least so in some contexts (Guadagno, Okdie, & Kruse, 2012; Tifferet & Vilnai-Yavetz, 2014).

One aspect within the assumed male motivation for creative displays might be the proneness to use particularly long words (Newman et al., 2008). Indeed, pseudonym length seems to explain some portion of the creativity ratings variance (see Study 4). In line with this, more text might be interpreted as a higher affinity for selective self-presentation (cf. Walther, 2007).

The question remains open why the creativity ratings and the ratings on the Big Five dimension *open for experience* did not correlate with each other, although creativity is one facet of *open for experience*. One answer could be that *open for experience* refers to creativity more in terms of reception than production. The pseudonym users, on the contrary, were clearly productive when creating the pseudonym.

Future research should investigate sex differences in pseudonym/nickname use in computed-mediated communication from both an evolutionary perspective as well as from the perspectives of social psychology, media psychology, and communication science in order to find out whether such short words communicate not only sex/gender but also personality, sociosexual orientation, and the like.

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