

Brief Research Report

How Self-Reflection Influences Use of Cognitive and Analytical Language

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ABSTRACT

Objective

We examined cognitive processes and analytic expression according to emotional prime, hypothesizing that negative affect may increase rumination as seen in analytic language (that is, lead to language of “explaining”), as well as insight and causality, reflecting language focused on specific reasons.

Method

Sixty-four participants were assigned randomly to write about either “*positive aspects of myself*” or “*aspects of myself that I would like to change*”. These narratives about positive and negative characteristics were subjected to the linguistic inquiry and word count (LIWC) in order to examine how the manipulations influenced expression.

Results

More insight and causation in language was seen in participants’ language that focused on positive (rather than negative) aspects of themselves, but more discrepancy was seen when writing about negative qualities. These findings were not a function of wordiness.

Conclusion

Causality and insight were prevalent in language after positive prompting, perhaps because people were providing rationale and support for positive self-talk. Discrepancy suggests counterfactual thought and was common in writing from a negative prompt.

Keywords

Language use; Analytical language; Sex differences in linguistics.

INTRODUCTION

What we say, and how we say it, reflects not only our explicit goals and motivations, but also several internal psychological states. Psychologists have several tools to examine how language signals what we are thinking and feeling. One way to examine language is through an open vocabulary classification system, whereby language is grouped naturally into various categories that show personality traits and psychological states of the speaker.¹ A different way employs the linguistic inquiry and word count (LIWC),² a computer program that distributes both the content of speech, as well as the manner of expression, into predetermined categories. These categories are the result of hundreds of studies

that have included more than 80,000 writers or speakers who have produced over 200 million words in a wide variety of contexts.² The diverse samples include speeches and social media posts, novels and plays, essays and articles, and personal narratives written both spontaneously and under specific directions.

Although most studies using the LIWC have focused on emotion and self-referencing,^{3,4} particularly as these reflect sex and status differences, a smaller number of studies have focused on cognition.^{5,6} Cognitive processes are reflected in both the content of language, as well as its expression. Language content signaling thought, causality, and insight is used in predictable circumstances, such as when people wish to transmit facts or reconstruct events

and provide explanations for them; causality and insight are used to discuss past events, providing construal, reconstruction, and reevaluation.⁷ Cognitive processes are also seen when people use words such as “know” or “because,” yet cognitive markers also include discrepancy and tentativeness, seen when people (particularly women) use “should” or “maybe”. Certainty (“always”) reinforces what is said but differentiation (“but”) qualifies what is said.² People also show more cognitive sophistication in their language as they age,^{7,8} which may ultimately have positive benefits as ruminating and writing about troublesome aspects of one’s life is beneficial to health.⁹

How people speak is described by several categories in the LIWC, including the dimension that taps analytical language. This type of language uses articles (below, with) and prepositions (and, the), both of which afford explicit connections among thoughts, distinctions among elements, and show how points relate to each other.⁴ Prepositions signal “concrete” information, relay true descriptive information about what something is or is like, and is more complex.³ This manner of speech is in contrast to a narrative, story-like informal style that may be seen when people are relaying events. Analytical language is used more often by men,^{6,8} although women employ discrepancies (should, could) more than men in most communication contexts.¹⁰ Less analytical language is now used in general, as informal language is increasing in many different venues, including those that formerly included a lot of analysis (including television (TV) news, political speeches, and news articles), decreasing as technology and issue-complexity increase, leaving “sound bites” that fail to show connections and critical relations among points.⁵

In sum, language content and expression reflects cognitive processes in systematic ways. Our question focused on whether systematic differences in analytic and cognitive language is a reflection of temporary emotional states. Our purpose was to examine language complexity and cognition in both content and transmission as a function of affective priming, positing that negative affect would increase rumination as seen in analytic language (that is, lead to language of “explaining”), as well as insight and causality, reflecting language focused on specific reasons.

METHOD

Participants and Design

A total of 64 participants (27 men, 37 women) were assigned randomly to write about either “positive aspects of myself” or “aspects of myself that I would like to change”. Each volunteered or participated for class credit, as per conditions of approval by the Institutional Review Board (IRB). Their writing occurred in the context of several other lab tasks not reported here. The manipulations resulted in a 2×2 (Sex×Affective Prompt) design.

Dependent Measures

Written responses to the prompts were typed verbatim into MS Word documents. Then, in order to examine cognitive language

according to affect priming, the LIWC² was applied to each reflection, producing a percentage of language comprising our categories of study. The LIWC taps language of psychological processes (social, affective, cognitive, perceptual processes), personal concerns, and functional words (such as pronouns), distributing language into over 70 pre-set categories.

Data Analysis

The results from the categories of interest (various aspects of cognitive language and analytical language) were then compared *via* multivariate analysis of variance test (MANOVA) with prompt and participant sex as independent variables. Follow-up analysis of variance tests (ANOVAs) were used to further examine significant MANOVA effects.

RESULTS

The linguistic variables that comprise the category of cognitive thought (insight, differentiation, discrepancy, causation, tentativeness, and certainty) were entered as dependent variables in a 2×2 (Sex×Prompt) MANOVA, resulting in a medium and significant main effect of prompt, $F(6, 55)=5.81, p=0.001, \text{Wilks' } \lambda=0.61, \eta_p^2=0.388$. There was no main effect of sex or an interaction, both $F_s(6, 55)<1.76$, both $p_s>0.125$. Means and standard deviations from this analysis are seen in Table 1.

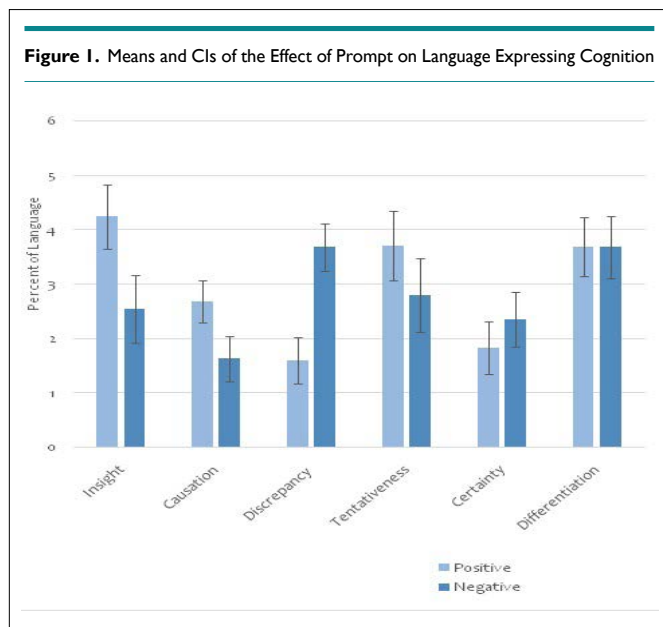
Table 1. Means and Standard Deviations for Percentage of Various Aspects of Language as a Function of Sex and Affective Prompt

	Sex			
	Men		Women	
	Affective Prompt			
	Negative	Positive	Negative	Positive
Analytic Language	48.43	43.68	31.53	52.54
	(32.92)	(23.31)	(26.76)	(31.95)
Cognitive Mechanisms Insight	2.51	3.82	2.54	4.73
	(2.27)	(2.87)	(2.06)	(5.22)
Causation Causation	1.16	3.35	1.86	2.01
	(1.61)	(2.61)	(1.93)	(2.44)
Discrepancy	3.42	1.78	3.79	1.40
	(2.43)	(3.10)	(2.10)	(1.69)
Tentativeness	1.21	4.35	3.62	3.05
	(1.73)	(4.62)	(4.06)	(2.77)
Certainty	2.58	1.86	2.24	1.78
	(3.28)	(3.28)	(2.28)	(2.07)
Differentiation	3.25	3.80	3.89	3.57
	(2.52)	(3.42)	(2.70)	(3.39)

Note. Numbers represent percentage of language classified in the LIWC category.

Follow-up ANOVAs were performed; means and CIs are seen in Figure 1. More discrepancy (e.g., “should” or “maybe”) was seen in those writing from the negative compared to the positive prompt, $F(1, 60)=11.14, \text{MSE}=5.57, p=0.001, \eta_p^2=0.157$. Causation (i.e., “because”) was more likely among those writing after a

positive rather than negative prompt, $F(1, 60)=4.27$, $MSE=4.86$, $p=0.043$, $\eta_p^2=0.066$, as was insight, $F(1, 60)=4.17$, $MSE=11.14$, $p=0.046$, $\eta_p^2=0.065$. No significant effects were seen for tentativeness, certainty, or differentiation.



We used univariate ANOVA to examine the broad category of analytical language; means and standard deviations are located in Table 1. Analytical language was not affected by sex or prompt type, both $F_s(1, 60)<1.20$, $MSE=834.54$, $p_s>0.277$; the interaction was also not significant, $F(1, 60)=3.02$, $p=0.09$.

Because “wordier” responses may have led to increases in more evidence of cognitive processing or analytic language, we used word count (WC) as a covariate in the foregoing analyses. The MANCOVA with cognitive processes did not show an effect of WC, $F(6, 54)=1.72$, $p=0.130$; nor was WC significant in the ANCOVA for analytic language, $F(1, 59)<1$, $p=0.452$.

DISCUSSION

Our results show how affect may drive systematic differences in cognition. Surprisingly, causality and insight were prevalent in language after positive prompting, perhaps because people were providing self-justification for positive self-talk. Discrepancy was more prevalent following a negative prompt, suggesting counterfactual thought. No differences in the informal, story-like style that marks lack of analytic language were seen, suggesting that participants were focusing equally on narration regardless of prompt. Unlike previous research,^{5,10} there were no sex differences in analytic or cognitive language. Results were not due to how many words were written by participants in response to their prompt.

Language that includes causation (such as effect, or reason) as well as personal insight (such as understood, know) typically demonstrates a type of cognitive complexity that reflects reasoning and facts, and which relays events in a straightforward way. In response to thinking about their good qualities, participants may

have used more of these linguistic devices so that they could explain themselves as they spoke about good aspects of themselves, coming up with evidence to support their argument—unsurprising considering that writing positively about the self in public should lead people to provide justification and rationale so as not to appear too boastful. Moreover, this sort of language likely did not include fillers because the narrative was fairly well-known. For example:

“I like to think I’m a pretty trustworthy and dependable person if you get to know me. If a friend or family member needs something from me, I’m usually quick to do it with no issue or expectation of reward. If a friend needs a ride somewhere or needs to be picked up, for example, I’ll usually drop what I’m doing and help them out. If a friend or family needs me to keep a secret, I usually always do. But this characteristic of myself does have drawbacks sometimes.”

Unlike previous research^{3,5} no sex differences were seen in the use of words signaling causality, insight, or certainty. One possible reason that there were no sex differences is that the task was very structured, and the affective prime was the main determinant of content.

Negative prompts increased discrepancy, which may reflect counterfactual (“what if?”) thinking. This finding is not surprising given that “should” and “would” are likely good linguistic devices to explain or deconstruct negative events. Justification or post-hoc explanation about what has happened, or perhaps what should be happening or have happened, marked writing about negative behavior. For example:

“I should improve my social skills. I struggle to make normal conversations with people and hate meeting new people. I hope to be able to normally hold a conversation with someone without feeling nervous. I want to learn to meet new people and make new friends.”

And:

“I could improve on not worrying if people are mad at me or always trying to make everyone happy. At some point someone will get mad at you and it is a waste of time to try and please everyone.”

Limitations and Implications

While supervised computer models seek to delineate algorithms that map on to known data patterns, an unsupervised one delineates patterns that are seen organically in the data.¹¹ Our results confirm previous unsupervised models in predictable ways, generally harmonizing with the results of research based on over 200 million words. More importantly, the language that reflects the pre-determined categories has been shown to reflect meaningful psychological processes in speakers. As such, our findings not only contribute to the research literature on use of the LIWC, but add to work describing how cognitive processes may be manifested in our language given temporary, but salient, emotional states.

CONCLUSION

Analytic language taps expression of thought, whereas cognitive mechanisms measured by LIWC reflect content. Analytic expression did not vary as a function of affective prime, but content of language did, with persons showing language including reasoning and facts when prompted to think of good things about themselves, but using language including discrepancies (such as “should”) when prompted to reflect on their negative attributes.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Kern M, Eichstaedt JC, Schwartz HA, Park G, Ungar LH, Stillwell DJ, et al. From ‘Sooo excited!!!’ to ‘So proud’: Using language to study development. *Dev Psychol.* 2014; 50(1): 178-188. doi: [10.1037/a0035048](https://doi.org/10.1037/a0035048)
2. Pennebaker JW, Boyd, RL, Jordan K, Blackburn, K. The development and psychometric properties of LIWC2015. Web site. https://repositories.lib.utexas.edu/bitstream/handle/2152/31333/LIWC2015_LanguageManual.pdf. Accessed June 16, 2020.
3. Tausczik Y, Pennebaker J. The psychological meaning of words: LIWC and computerized text analysis methods. *Journal Of Language And Social Psychology.* 2010; 29(1): 24-54. doi: [10.1177/0261927X09351676](https://doi.org/10.1177/0261927X09351676)
4. Pennebaker, JW. *The Secret Life of Pronouns: What Our Words Say about Us*. New York, NY, USA: Bloomsbury Press/Bloomsbury Publishing; 2011.
5. Jordan KN, Sterling J, Pennebaker, JW, Boyd, RL. Examining long-term political trends in politics and culture through language of political leaders and cultural institutions. *Proc Natl Acad Sci U S A.* 2019; 116(9): 3476-3481. doi: [10.1073/pnas.1811987116](https://doi.org/10.1073/pnas.1811987116)
6. Brownlow S, Pate M, Alger A, Naturile N. What were they thinking? Analytic and cognitive language in Instagram captions. *Soc Behav Res Pract Open J.* 2019; 4(1): 21-25. doi: [10.17140/SBRPOJ-4-117](https://doi.org/10.17140/SBRPOJ-4-117)
7. Pennebaker J, Stone L. Words of wisdom: Language use over the life span. *J Pers Soc Psychol.* 2003; 85(2): 291-301. doi: [10.1037/0022-3514.85.2.291](https://doi.org/10.1037/0022-3514.85.2.291)
8. Newman M, Groom C, Handelman L, Pennebaker J. Gender differences in language use: An analysis of 14,000 text samples. *Discourse Processes.* 2008; 45(3): 211-236. doi: [10.1080/01638530802073712](https://doi.org/10.1080/01638530802073712)
9. King, LA, Pennebaker JW. Thinking about goals, glue, and the meaning of life. In: Wyer RS Jr, ed. *Ruminative Thoughts. Advances on social cognition*. Hillsdale, NJ, USA: Lawrence Erlbaum Associates, Inc; 1996: 9; 97-106.
10. Pennebaker, JW, Mehl MR, Niederhoffer KG. Psychological aspects of natural language use: Our words, our selves. *Ann Rev Psychol.* 2003; 54: 547-577. doi: [10.1146/annurev.psych.54.101601.145041](https://doi.org/10.1146/annurev.psych.54.101601.145041)
11. Soni, D. Supervised vs unsupervised learning. towardsdatascience Web site. <https://towardsdatascience.com/supervised-vs-unsupervised-learning-14f68e32ea8d>. Accessed June 16, 2020.