"Don't say that!" A survey of persuasive systems in the wild

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Abstract. Language use is a type of behavior not yet addressed by the academic persuasive technology community. Yet, many existing applications seek to change users' word choices or writing style. This paper catalogues 32 such applications in common usage or reported in the popular media. We use Schwartz's Theory of Basic Human Values to understand what motivates each attempt to persuade; we use the Persuasive Systems Design (PSD) model to understand contexts and techniques of persuasion. While motivations span the full range of human values, most applications serve values of Achievement, Conformity, or Universalism. Many are autogenous in intent, using reduction, suggestion, and self-monitoring strategies to support behavior change. However, the corpus also includes many endogenous applications that seek to change others' attitudes.

Keywords: Persuasive technology; Persuasive Systems Design (PSD) Model; natural language; human values

1 Introduction

The popular media is rife with reports of applications that aim to influence the use of language. Consider these recent headlines:

- "Siri corrects people who use the wrong name for Caitlyn Jenner";
- "Watch your tone: Watson can detect attitude";
- "Software Makes Cyberbullies Think Twice Before Sending Mean Messages."

We also encounter such applications in everyday life. This study was inspired when a colleague shared a puzzling interaction with a performance review system. The colleague wrote that she had purged and organized a number of old files during the previous year. The system highlighted the word "old" and suggested a number of alternatives: seasoned, mature, outdated, inactive, and so on. Apparently, the system is designed to defend employers against age discrimination lawsuits by discouraging employees from using words that refer to age.

Like persuasive technologies more broadly, such systems are morally ambiguous. Twitterbots promote what some see as stifling "political correctness" and others see as basic respect and human decency. Persuasive tools that influence

language use can help us communicate more effectively, and could even help us change how we see ourselves (Patrick and Hagtvedt, 2012). At the same time, technology that restricts the use of certain words raises spectres of censorship and "doublethink" (Orwell, 1949). Whether technology influences public utterances (e.g., on Twitter) or private utterances (e.g., using Siri), there is potential for both benefits and harms.

Despite the prevalence and significance of applications designed to influence language use, we were unable to find any academic literature on the topic. We are confident there is no discussion of this topic in the proceedings Persuasive Technology Conference, in particular. In this initial survey of existing work "in the wild," we seek to address two questions. First, why deploy technology to influence human language? Second, how (using what mechanisms) do these existing applications influence behavior?

This paper catalogs 32 existing applications already in common use or discussed in the popular media. We analyze this corpus from two distinct points of view. First, inspired by the Value Sensitive Design framework (Friedman et al., 2006), we infer the human values underlying attempts to influence. Second, we analyze each application as a persuasive technology, using the Persuasive Systems Design (PSD) model (Oinas-Kukkonen and Harjumaa, 2009).

In the next section, we briefly explain the models that ground our analysis. Then, we explain our method for developing and analyzing the corpus. Next, we present the corpus and our analysis. Finally, we reflect upon what makes these applications persuasive technology and conclude with directions for future work.

2 Background

2.1 Human Values

Our analysis of the motivations underlying persuasive technology applications is inspired by Value Sensitive Design (VSD), a framework for addressing human values throughout the application design process (Friedman et al., 2006). VSD has been proposed as an approach to addressing ethical issues in persuasive technology (Davis, 2009). While Friedman et al. (2006) identify values of moral import commonly implicated by information technologies, they do not claim to provide a complete typology of values.

Our choice of Schwartz's (1994) Theory of Basic Human Values as an analytic framework is inspired by Knowles' (2013) analysis of the values underlying pro-environmental persuasive technologies. The Theory of Basic Human Values identifies values recognized across all human cultures. Values are classified in ten motivationally distinct categories: Power, Achievement, Hedonism, Stimulation, Self-Direction, Universalism, Benevolence, Tradition, Conformity, and Security.

2.2 The Persuasive Systems Design Model

The Persuasive Systems Design (PSD) model (Oinas-Kukkonen and Harjumaa, 2009) is a comprehensive theoretical framework for describing persuasive technologies. Prior studies have used the PSD model to analyze a corpus of existing

applications. For example, Kelders et al. (2011) use the PSD model to analyze web-based health and weight interventions, while Lehto and Oinas-Kukkonen (2011) use it to analyze web-based interventions for substance abuse.

The PSD model considers three phases of persuasive systems design: the Intent, the Event, and the Strategy (Oinas-Kukkonen and Harjumaa, 2009).

The Intent includes the identity of the persuader and user, the source of intention (endogenous, exogenous, or autogenous), and the change type (behavior, attitude, or both). Endogenous intent arises from "those who create or produce the interactive technology," exogenous from "those who give access to or distribute the interactive technology to others," and autogenous from "the very person adopting or using the interactive technology."

The Event includes use context and user context. Use context concerns "features arising from the problem domain," while user context concerns "individual differences which influence user's information processing." Because these considerations are not easy to summarize, we adopted the Fogg Behavior Model (Fogg, 2009) to further analyze the Event. This model identifies three principal factors necessary for behavior change: motivation, ability, and trigger. A persuasive technology can change behavior by enhancing the user's abilities, by motivating the user, or by providing a trigger to perform the target behavior. Thus, the Fogg Behavior Model captures aspects of the interaction between use context and user context. No prior studies use this model to analyze existing applications.

The Strategy includes the persuasive message and the route of persuasion. The message includes not only content, but also the use of rational or symbolic strategies. The route of persuasion can be direct, in which the user is able to discern and identify the content of the persuasive message, or indirect. The Strategy also includes whether the system is intended primarily for the purpose of persuasion or whether persuasive features are secondary to some other purpose.

Finally, the PSD model catalogs 27 distinct design features, categorized according to whether they provide primary task support, dialogue support, system credibility support, or social support.

3 Methods

We first developed a set of candidate applications, then analyzed the design of each application, and finally inferred motivating values. We analyzed persuasive design before considering values so that we could eliminate from our corpus any applications that lack persuasive intent or do not address language use.

3.1 Building the corpus

Our corpus was seeded with an initial set of 18 popular media reports of applications that appeared to influence language use collected opportunistically from the second author's Facebook feed over the year June 2015 - May 2016.

From this initial corpus, we identified recurring news sources: *Wired*, *Mental Floss*, *Fast Company*, *Google News*, and *LifeHacker*. By searching these sources

for the keywords "technology," "word choice", and "word change," we added 3 more applications to our corpus. We also used Google to search for additional articles about known applications. For example, we found listicles with titles such as "Tired Of Getting Offended On The Internet? There's A Web Hack For That" and "5 Free Apps That Make You Seem Smart." We found 11 additional applications in articles in sources including *The New York Times*, *The Washington Post*, *Huffington Post*, *Vox*, *Business Insider*, *Slate*, *Medium*, and *Ars Technica*. Searching for other work by article authors and application creators and resulted in no further applications.

We also searched the *ACM Digital Library* and *Web of Science* for the keywords "persuasive technology," "behavior change," "word choice," and "word change." This method resulted in no relevant applications. We browsed the complete *Proceedings of the Persuasive Technology Conference* and found three tangentially related articles, but none that proposed specific applications. Reviewing citations of these three articles identified no relevant applications. We found articles on applications to help users choose stronger passwords, but excluded these because passwords do not serve as expressive language.

In our analysis of each application, we examined the application itself, its web site, and news stories concerning the application and its creators. We eliminated applications that did not seem to embody persuasive intentions, notably several web-based tools designed to facilitate plagiarism, such as the Article Rewriter[1]. We also eliminated the Trumpweb[2] as it was clearly intended to influence attitudes about a person and not language use. We included iCorrect, a satirical proposal for an iOS feature that helps parents require their children to text with correct spelling and grammar, because the proposal is detailed and plausible.

3.2 PSD Model Analysis

To structure our analysis, we created a spreadsheet of analytic criteria based on the four elements of the PSD model.

For the Intent, we identified the persuader and the users, which let us categorize the source of intention as endogenous, exogenous, or autogenous. We categorized each application as intended to change attitudes, behavior, or both.

For the Event, we interpreted the use context and user context as free text. We further determined whether each application seeks to enhance ability, increase motivation, or provide a trigger.

For the Strategy, we captured the message of each application as free text. We classified each application as using rational strategies, symbolic strategies, or both, and as using primarily direct or indirect persuasion. We determined whether each application was a primarily persuasive system or a persuasive feature secondary to a larger system.

[1] `http://smallseotools.com/article-rewriter/`

[2] `https://chrome.google.com/webstore/detail/the-trumpweb/fjkehfaokpmcbigmbgdhmjblecgfkedg`

Finally, we assessed whether each application (or its web site) deliberately employed each System Feature.

To begin our analysis, we identified ten applications spanning the corpus. After independently coding these application, we discussed our coding to form a joint interpretation of the criteria. We used this revised understanding to independently code the remaining applications. We compared our independent analyses and discussed them to reach an agreement. Finally, we applied descriptive statistics to understand the corpus as a whole.

3.3 Values Analysis

We assessed whether each application supported each of the 10 categories in the Theory of Basic Human Values. Each of the two authors independently coded these applications, and then we discussed our coding to form a joint interpretation of the categories. Finally, we computed descriptive statistics and performed an informal clustering of applications that implicate similar values.

4 Results

Our corpus comprises 32 persuasive technology applications listed in Table 1. We first introduce the ies clustered by relevant values, and then present our PSD model analysis. We provide raw coding data online.[3]

4.1 Values Analysis

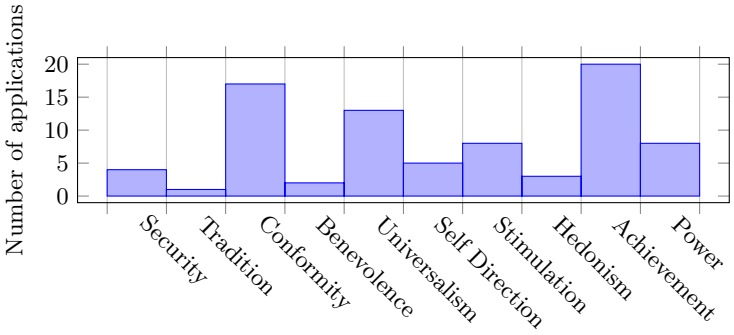
Figure 1 shows that every category of values is implicated by at least one application. Achievement (personal success) and conformity (restraint from violating norms) are addressed by more than half of the applications. The third most common category is universalism (respect for the welfare of all people). The fewest applications appeal to tradition.

We identify six clusters of applications according to common values. Table 1 presents the full corpus, organized according to the following clusters.

1. Conformity-Achievement. These applications are mostly style and grammar checkers that persuade the user to conform to a set of rules for good writing. Within this cluster, we identified four sub-clusters.
   (a) Conformity-Achievement-Universalism includes style checkers that value readability for readers across a broad range of reading skills.
   (b) Conformity-Achievement-Power includes style checkers that help people strengthen the impact of their writing or "avoid embarrassing mistakes."
   (c) Conformity-Achievement-Tradition includes only iCorrect, which values standard English over slang, abbreviations, and emoji commonly used in text messages.
   (d) The fourth sub-cluster includes applications with no third common value.

[3] Link to Google Spreadsheet: `http://bit.ly/2f1nzqX`

Fig. 1. Value categories present in corpus



2. Universalism-Achievement: These applications focus on improving writing to include a broader range of readers.
3. Stimulation-Hedonism-Achievement: These applications encourage users to do something novel and fun, while learning and challenging themselves.
4. Universalism: These applications focus on treating people with respect.
5. Security-Conformity: These applications seek to keep people safe by enforcing established laws or norms.
6. Outliers: These applications did not fit into other clusters.

Table 1. The Corpus

CONFORMITY-ACHIEVEMENT		
Conformity-Achievement-Universalism		
Readability Score	Web application that measures readability	www.Readability-Score.com
Microsoft Word	Grammar checker suggests changing "mankind" to "humankind," and recognizes "they" as a singular personal pronoun	products.office.com/en-us /word
Conformity-Achievement-Power		
1checker	Web-based grammar checker	www.1checker.com
Ginger	Web-based grammar checker with sentence rephraser and "personal trainer"	www.gingersoftware.com
Grammarly	Grammar checker as a web browser plugin	www.grammarly.com
Spam Analyse	Web application shows users how to rewrite email newsletters to avoid being flagged as spam	www.SpamAnalyse.com
White Smoke	Grammar checker as a web browser plugin	www.whitesmoke.com
Conformity-Achievement-Tradition		
iCorrect	Satirical proposal to force kids to use correct grammar and punctuation in text messages	www.michaelweisburd.com /icorrect
Conformity-Achievement		
Style and Diction	Command-line tools identify wordy and commonly misused phrases; measure readability	www.gnu.org/software /diction/diction.html
The Passivator	Web browser plugin flags use of passive voice	www.ftrain.com /ThePassivator.html

UNIVERSALISM-ACHIEVEMENT		
ChangeMyView	Reddit site lets users share and get feedback on persuasive writing	www.reddit.com/r /changemyview
Expresso	Web browser plugin helps users edit their text to improve readability metrics	www.expresso-app.org
Hemingway	Web-based text editor highlights complex sentences and promotes "bold" language	www.hemingwayapp.com
Textio	Web platform helps HR departments eliminate unintended gender or racial bias in job postings	www.textio.com
Unitive	Web application provides structure for writing unbiased job ads	www.unitive.works
STIMULATION-HEDONISM-ACHIEVEMENT		
Wonder Keyboard	Virtual keyboard for expanding vocabulary and learning English as a second language	www.typewithwonder.com
XKCD Simple Writer	Web-based text editor highlights words not among the 1000 most commonly used	www.xkcd.com/ simplewriter
UNIVERSALISM		
PC2Respect	Web browser plugin changes "politically correct" to "treating people with respect"	www.twitter.com/hashtag /PC2Respect?src=hash
Halogen	HR software suggests alternatives to words such as "old," "pretty," and "short"	www.halogensoftware.com
Honest	Chrome extension changes "skinny," "slim," and "thin" to "fit," "toned," and "healthy"	untitledscience.github.io /HonestChrome
@DropTheIBot	Twitterbot responds to users of the term "illegal immigrant" and exhorts them to use other terms such as "undocumented immigrant"	Account suspended
Common Sans	Typeface that strikes through the phrase "refugee" and adds "human"	www.commonsans.com
Siri	Siri answers questions about "Bruce Jenner" using the name "Caitlyn Jenner" and feminine gender pronouns	www.apple.com/ios/siri
SECURITY-CONFORMITY		
ReThink	Web browser plugin asks users if they want to send messages that use bullying language	www.rethinkwords.org
Google/Bing	Search term autocomplete algorithms exclude some sexually explicit words	www.Google.com, www.Bing.com
YikYak	YikYak asks users to rethink messages flagged as containing threatening language	www.yikyak.com
OUTLIERS		
Zero Trollerence	Twitter bot "enrolls" users in an "online course" to show them how to change their habits	www.zerotrollerance.guru
Seen	Typeface redacts phrases tracked by the NSA and GCHQ, based on the Snowden papers	www.projectseen.com
Emojimo	Virtual keyboard replaces text with emojis	itunes.apple.com/us/app/ emojimo -keyboard/ id918318362?mt=8
Just Not Sorry	Gmail plugin identifies phrases that undermine the writer's authority and justifies how and why to rephrase	chrome.google.com/ webstore/detail/ just-not-sorry-the-gmail /fmegmibednnlgojepm idhlhpjbppmlci
Toneapi	Web application gives feedback on the emotional tone of a text and provides tools for revision	www.toneapi.com
Cliche Finder	Web-based text editor highlights cliches	cliche.theinfo.org

4.2 PSD Analysis

The Intent For each application, we classify the source of intentions as endogenous, exogenous, or autogenous. We find that 13 (40.625%) of the applications are endogenous, 4 (12.5%) are exogenous, and 15 (46.875%) are autogenous. An example of an endogenous application is Common Sans, created for the nonprofit Solvatten, which seeks to promote human rights. The clearest example of exogenous intent is iCorrect, because parents adopt it for use by their children. Another example is Textio, which HR managers may adopt on behalf of their team. By contrast, most of the grammar and style tools in our corpus are adopted by the user for their own use.

We classify the change type as attitude, behavior, or both. We find that the majority (23, 71.875%) of applications promote behavior change, 6 (18.75%) promote both attitude and behavior change, and just 3 (9.375%) promote attitude change alone. For example, Grammarly teaches writers to strengthen their tone, grammar, and sentence structure, and thus focuses on behavior change. @DropTheIBot seeks to change both behavior and attitudes: to persuade Tweeters to stop using the phrase "illegal immigrants" and to reconsider the morality of immigration. By contrast, Common Sans seems unlikely to stop anyone from using the word "refugee," but rather promotes new attitudes towards refugees.

The Event We find that 24 (75%) of the applications aim to enhance user's abilities, 12 (37.5%) motivate change, and 19 (59.375%) trigger performance of the behavior. Percentages do not add up to 100% since each application could influence user behavior or attitudes in multiple ways.

An example of an application that falls into all three categories is Just Not Sorry. Since users learn what phrases to avoid to strengthen their authority, the application enhances the user's abilities. Since the application gives reasons why users should change their writing style, it provides motivation. Finally, since users are prompted to change their behavior as they are writing in Gmail, the application triggers change. Therefore, Just Not Sorry enhances ability and motivation, as well as providing a trigger.

The Strategy We find that 13 (40.625%) of the applications use symbolic strategies, 6 (18.75%) use rational strategies, and 13 (40.625%) use both. For example, we classify Common Sans as primarily symbolic. By striking through the word "refugee" and replacing it with "human being," Common Sans conveys the message that refugees are human beings first. By contrast, Readability Score employs rational strategies. This tool presents numeric feedback and recommends improvements based on research findings. An example of an application that uses both rational and symbolic strategies is Toneapi, which gives numeric feedback on readability and tone, but also uses green to represent positive tone and red to represent negative tone.

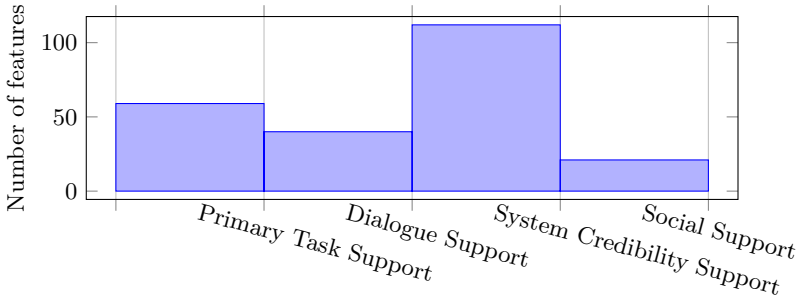
Next, we find that 30 (93.75%) of the applications use direct persuasion and just 2 (6.25%) use indirect persuasion. One of these is Google's search bar autocomplete algorithm, which does not suggest sexually explicit words as search

terms, but also does not point out that suggestions are being withheld. It indirectly discourages the user from searching for certain terms without making its persuasive intent apparent.

Finally, we find that the majority (26, 81.2%) of the applications are intended primarily to persuade, while just 6 (18.75%) constituted persuasive features of a system with some other primary purpose. Siri and Word are examples of applications with secondary persuasive features.

System Features To complete our application of the PSD model, we analyze system features. We find a total of 59 examples of Primary Task Support features, 40 examples of Dialogue Support features, 112 examples of System Credibility Support features, and 21 examples of Social Support features (Figure 2). System Credibility Support features, the most common type of features, are found mainly in the applications' websites or in their use of supporting platforms such as Twitter or Google Chrome.

Fig. 2. Number of system features identified in each category across all applications



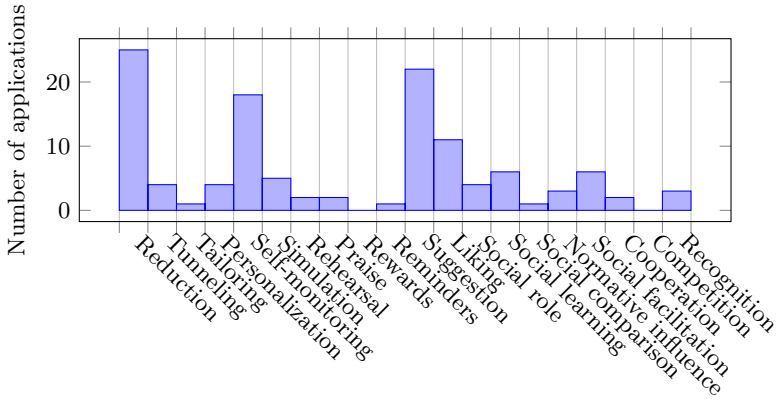
Excluding System Credibility Support features, the three most common features are Reduction, Self-Monitoring, and Suggestion (Figure 3).

We find that a majority (25, 78.125%) of the applications include reduction features to make the desired behavior easier to perform. One application that does not employ reduction is Zero Trollerance, which actually complicates users' interactions with Twitter by annoying them.

More specifically, we find that 22 (68.75%) of the applications provide suggestions. For example, Toneapi suggests particular words for the user to change to alter the tone of their writing. It also suggests synonyms that are more positive, more negative, or neutral. Many other style checking tools suggest word changes, including Microsoft Word, Grammarly, Hemingway, 1checker, and so on. One application that does not make suggestions is the Passivator, which flags use of the passive voice but does not suggest alternative phrasing.

We find that 18 (56.25%) of the applications include self-monitoring features. For example, Toneapi supports self-monitoring by displaying the prevalence of

Fig. 3. Number of applications employing each system feature



each emotional tone in a piece of writing. Another example is found in the Honest plugin, which tracks the number of words it has replaced and displays this number in the upper right corner of the browser. an application that pointedly does not support self-monitoring is ReThink, which records how often the user has been prompted to stop bullying, but does not display this information to the user.

We saw few examples of Tailoring, Rehearsal, Praise, Reward, or Reminders. We also saw few examples of Social Support features.

5 Discussion

What defines persuasive technology? We began this research with the assumption that we would not consider grammar or style checkers. They are old applications: the Unix diction tool dates to the 1970s, and Word's grammar checker is familiar to everyone who writes on a computer. Their designs were not informed by persuasive system design principles. However, users adopt these tools with the intent to change their own behavior, specifically their writing habits. These tools do not automatically fix "problems" based on mechanical rules, like autocorrect, but instead make suggestions that the user can adopt or ignore based on their own judgment. Within the PSD model, we can see these tools as autogenous persuasive applications, or behavior change support systems. We find a range of persuasive features, including suggestion, self-monitoring, and personalization. Today, such tools are moving beyond word processors and the Unix command-line. With text messaging and social media, people communicate through writing more than ever. Browser plug-ins such as Ginger and Grammarly can provide pervasive feedback on all our writing, formal and informal. Wonder Keyboard and iCorrect take this to an extreme by integrating with text messaging.

While many applications in our corpus are autogenous in intent, even more are endogenous or exogenous: we can clearly identify the application creator, or

a third party, who seeks to others to change or reconsider their language use. Consider, for example, Halogen, Common Sans, or ReThink.

Web search applications particularly challenged our understanding of persuasive technology. Since users are used to having search engines suggest autocompletions of search terms, when sexually explicit terms are not autocompleted, the user is forced to purposefully finish typing them. The absence of suggestion is the point of persuasion. This strategy might be considered "anti-reduction" as users must do more work to perform undesired behaviors.

6 Conclusion

We offer three main contributions to the persuasive technology community:

- we introduce influence of language use as a new domain for design;
- we show how Schwartz's Theory of Basic Human Values and the PSD Model can be used in tandem to analyze the content and form of existing persuasive applications;
- we provide a corpus of applications that can be further studied from a variety of perspectives, not just persuasive technology but also other disciplines such as rhetoric or linguistic anthropology.

By now, this corpus could be expanded with reports of new applications.

We find that motivations span the full range of human values, although most applications serve values of Achievement, Conformity, or Universalism. Most are autogenous in intent; many emply reduction, suggestion, and self-monitoring strategies to support behavior change. However, the corpus also includes endogenous applications that seek to change attitudes. Applications do not only seek to enhance users' abilities, but also provide motivation and triggers.

This first cut of an analysis suggests further opportunities for analysis and theory building. There is more work to be done to understand the relationships between underlying values, persuasive system design, and language use as a kind of behavior. For instance, why are Social Support features comparatively rare in this corpus? Are they ill-suited to influencing language use, or merely underutilized? Furthermore, our corpus includes few persuasive features in systems that serve some other primary purpose. However, many applications in our corpus alter user experiences of existing platforms (e.g., Twitterbots and Web browser plugins). Should the PSD model be extended to explicitly account for such roles? Moreover, is there a greater role for secondary persuasive features in tools for writing and speech? What is the moral dimension in this context of source of intent? Finally, our analysis of the values implicated by these applications was necessarily cursory. Still another direction is to explore in greater depth the moral implications of existing applications using VSD theories and methodology.

This work also suggests opportunities for design. Our PSD model analysis suggests that many of the applications in our corpus could employ persuasive system features more effectively. Hence, one direction for future design work is to iteratively evaluate and improve the design of applications in the corpus,

informed by persuasive systems design theory. Further, work in cognitive psychology (e.g., Patrick and Hagtvedt (2012)) suggests new opportunities for behavior change support systems to support self-efficacy, growth mindset, or other kinds of personal development. Finally, existing tools such as ChangeMyView suggest opportunities for new tools to help individuals write more persuasively. At the same time, what moral hazards are risked by efforts to influence language use through technology? Development of such behavior change support systems should be informed not only by PSD theory but by consideration of human values.

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