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> *"I believe that every human mind feels pleasure in doing good to another."*
> *Thomas Jefferson*

Abstract   Moral beliefs are at the heart of governing a person's behavior. In this paper, we introduce a way to automatically measure a person's moral values through hidden "honest" signals in the person's e-mail communication. We measured the e-mail behavior of 26 users through their e-mail interaction, calculating their seven "honest signals of collaboration" (strong leadership, balanced contribution, rotating leadership, responsiveness, honest sentiment, shared context, social capital). These honest signals – in other words, how they answered their e-mails - explained 70 percent of their moral values measured with the moral foundations survey. In particular, the more positive and less emotional they were in their language, the more they cared about others. We verified the results with a larger e-mail dataset of 655 employees of a services firm, where structural and temporal honest signals explained 67% of emotionality.

1 Introduction

In this paper, we illustrate the link between moral values and emotional behavior predicted through e-mail. In particular, we show that communication patterns measured through e-mail interaction correspond with the moral values of a person.

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1. 1 Emotions Control Moral Values

Former US Vice President Joe Biden ran into difficulties by becoming too emotional and touchy-feely with his supporters, while Senator Elizabeth Warren got a lot of criticism for claiming native American ancestry. In these instances, the politicians followed their feelings over rational behavior. Frequently people are not aware of their emotions. While we think that we are rational creatures who will make decisions based on reason, the opposite is true. People will make emotional decisions, and then find rational reasons to justify their emotional judgements (Ariely, 2008), this means that *a posteriori* reasoning is applied to justify *a priori* emotional decisions.

There is a bidirectional link between emotions and morals. Morals give an ethical compass to individuals guiding them in their decisions, to decide what is right or wrong. While moral behavior is commonly assumed to be a rational process, in reality it is driven by emotions. Specifically, moral emotions influence the link between moral standards and behavior (Tangney, Stuewig, & Mashek 2007; Huebner, Dwyer, & Hauser, 2009). Past research in the cognitive and neurobiological sciences suggested that emotions are necessary, sometime sufficient, for moral judgement (Greene, 2001; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Prinz, 2006; Schnall, Haidt, Clore, & Jordan, 2008). This means that acting on moral beliefs is controlled through our emotions (Haidt 2012). Emotions with negative valence such as shame, guilt, embarrassment and disgust are key drivers for what we find morally acceptable or not. Also, on the positive side, emotions such as gratitude, pride and moral elevation, inspiring others to act virtuously, are the trigger that makes us feel good, leading to rational justification of morally positive behavior. There is a strong link between moral standards and moral behavior. Indeed, "*as the self reflects upon the self, moral self-conscious emotions provide immediate punishment (or reinforcement) of behavior [...] When we sin, transgress, or err, aversive feelings of shame, guilt, or embarrassment are likely to ensue. When we "do the right thing,"* positive feelings of pride and self-approval are likely to result" (Tangney et al. 2007, p. 2-3). Similarly, consumer behavior can be triggered by moral emotions, as a response to company actions (Grappi, Romani, & Bagozzi, 2013). Already Thomas Jefferson assumed in the late eighteenth century that witnessing acts of charity and benevolence by others would instigate a yearning by individuals to behave in a similarly positive way.

1. 2 Nurturing positive emotions makes us happy

Positive emotions enhance psychological functioning (Mauss et al., 2011), increase life satisfaction and make us happy (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009). According to the bestselling book "Aging Well" (Vaillant, 2008), there are two points that get us to old age: attitude and gratitude. In more

detail, Vaillant identifies five key factors for happy aging: (1) Maintaining stable positive relationships, (2) Good coping skills in adversity, (3) Keeping a healthy weight and exercising regularly, (4) Not smoking and only drinking alcohol in moderation, (5) Pursuing continuing education. These five life-changing and life-extending factors require individual resolutions, which are triggered by emotional decisions. Whether it is accepting the first cigarette or bottle of beer at a fraternity party, or the decision to propose marriage to a loved one, or to stop smoking or drinking alcohol, emotions decide whether to cave in, or resist the short-term temptation for long-term gratification and what Aristotle calls in his Nicomachean Ethics "higher happiness". In this sense, individual resolution is important as the duration of people's positive feelings impacts wellbeing more than the intensity of these feelings (Diener, Sandvik, & Pavot, 2009).

1.3 Trusted peers (re)define our belief system

We do not make decisions in isolation, but influenced by others. If people trust somebody, they will follow their advice. In medieval villages, people did what their trusted person of authority, be it priest or village elder, told them. Today, they trust their friends, sometimes even online friends on Facebook and on other social media (Majchrzak, 2019). We know by work on social capital that primary relationships, i.e. strong ties, are key enablers of trust (Granovetter, 1973; Krackhardt, 1992). Social networking sites may augment and reinforce pre-existing strong ties, based on personal face-to-face encounters, thus contributing to the shaping of emotions and moral beliefs.

However, people also make decisions based on their belief system, which, as we have just seen above, is based or their emotions. For instance, the decision to trust a stranger is also an emotional decision based on intuition. In our daily life, we are constantly presented with new claims asking for intuitive decisions driven through emotions. Be it the touchy-feeliness of Joe Biden, or the Native American heritage of Elizabeth Warren, one has to decide to either accept a new claim as truth, or reject it as a lie. If the new claim is introduced by somebody we trust, we usually accept it as truth. Figure 1 simplifies the process taking place when deciding if a claim is interpreted as truth or lie.
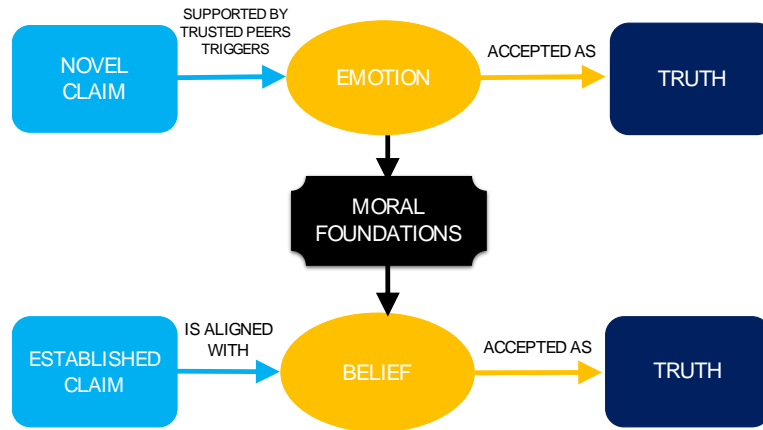
Fig. 1 Process of accepting a claim as truth

It is therefore reasonable to assume that what somebody tells us will influence our emotions, and thus our decisions (Watzlawick, Weakland, & Fisch, 2011), which are steered by our moral belief system. Pentland (2010) defines "honest signals" as personal patterns that an individual demonstrates while completing a task without being consciously aware of it. In this project, we show that the honest signals in e-mail, calculated through semantic and social network analysis, predict people's moral values.

2 Methods

In a first case study, we analyzed the mailbox of a co-organizer of a scientific event, studying his e-mail interaction with 26 participants of the event. To track their interactions, we calculated the "seven honest signals of collaboration" (Gloor, 2017) for each of the participants from his e-mail archive. These honest signals (strong leadership, balanced contribution, rotating leadership, responsiveness, honest sentiment, shared context, social capital) have been shown in earlier work (Gloor, Fronzetti Colladon, Grippa, & Giacomelli, 2017; Gloor, Fronzetti Colladon, Giacomelli, Saran, & Grippa, 2017) to be predictive of the several dependent variables such as customer satisfaction or work engagement.

The 26 participants of the event also took the Moral Foundations survey (Graham et al. 2013). It measures the moral values of the respondent in five categories (care, fairness, loyalty, authority, and sanctity). For the analysis, these five foundations can be grouped into two higher-order clusters: care and fairness, and loyalty, authority, and sanctity. In addition, participants took the Schwartz values test (Schwartz, 2012), which measures moral attitudes in the two aggregated dimensions conservation and transcendence. Conservation includes the

values of security, conformity, and tradition. Transcendence is composed of benevolence and universalism.

In an additional study, we compared the honest signals of 655 employees of a firm calculated through their e-mail, to show the link between emotions and temporal and structural e-mail communication patterns. We analyzed two months of e-mail, including the meta information such as sender, recipients, timestamp, and subject line of the messages, to compute the seven honest signals of collaboration (Gloor 2017). Our dependent variable in this second analysis is the emotionality of the messages calculated from the subject line.

3 Results - E-Mail behavior reflects moral foundations

Table 1 shows the results of comparing both the Moral Foundations values harm/care, fairness/reciprocity, ingroup loyalty, authority/respect and purity/sanctity, as well as the Schwartz value clusters conservation and transcendence with the seven honest signals of collaboration (Gloor 2017). We find significant correlations for almost all moral values.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Harm Care	1.000																				
2	Fairness Reciprocity	.615**	1.000																			
3	In-Group Loyalty	0.155	-0.069	1.000																		
4	Authority Respect	-0.289	-.416*	.393*	1.000																	
5	Purity Sanctity	0.095	-0.313	.394*	.641**	1.000																
6	Conservation	-0.173	-.446*	0.174	.624**	.590**	1.000															
7	Trascendence	0.303	0.318	-0.154	-0.129	0.113	0.196	1.000														
8	Sentiment	0.259	0.357	0.077	-0.056	0.023	0.016	0.149	1.000													
9	Alter ART	-0.125	0.134	-0.209	-0.040	0.002	-0.077	0.335	-0.270	1.000												
10	Ego ART	0.172	-0.254	-0.141	0.100	0.086	.405*	0.163	0.014	-0.084	1.000											
11	Alter Nudges	0.056	-0.286	0.423	.479*	0.184	0.297	0.063	-0.059	-0.057	0.155	1.000										
12	Ego Nudges	-0.146	-0.184	0.092	0.321	0.351	0.257	-0.053	0.116	-0.347	0.030	-0.263	1.000									
13	Messages sent	.404*	0.296	0.241	-0.197	-0.059	-0.245	0.232	-0.121	-0.020	-0.101	0.138	-0.130	1.000								
14	Messages received	0.381	0.244	0.198	-0.202	0.018	-0.192	0.258	-0.068	-0.029	-0.097	0.046	-0.059	.916**	1.000							
15	Contribution index	0.282	0.242	0.098	-0.084	-0.060	-0.034	0.041	.363*	0.149	-0.312	0.039	-0.337	0.101	-0.102	1.000						
16	total influence	0.386	0.295	0.175	-0.222	-0.111	-0.233	0.261	-0.103	-0.010	-0.090	0.133	-0.134	.987**	.935**	0.070	1.000					
17	Betweenness centrality oscillation	.394*	0.322	0.222	-0.143	-0.084	-0.189	0.210	-0.120	0.185	-0.004	0.246	-0.232	.769**	.482**	.399*	.718**	1.000				
18	Betweenness centrality	0.378	0.227	0.177	-0.218	0.019	-0.189	0.268	-0.029	-0.036	-0.091	0.030	-0.055	.870**	.993**	-0.135	.901**	.394*	1.000			
19	Degree centrality	.398*	0.253	0.218	-0.194	0.019	-0.188	0.268	-0.028	-0.021	-0.078	0.083	-0.084	.933**	.992**	-0.061	.953**	.538**	.984**	1.000		
20	Complexity	0.297	.410*	-0.025	-0.197	-0.181	-0.025	0.033	.550**	-0.068	-0.093	-.543**	0.147	0.242	0.128	.717**	0.221	.379*	0.098	0.161	1.000	
21	Emotionality	-0.348	-0.197	-0.147	-0.041	0.034	-0.206	-0.042	-.456*	.422*	-.431*	-.646**	0.061	-0.194	-0.089	-.664**	-0.170	-0.306	-0.060	-0.105	-.768**	1.000
22	Reach2	0.098	-0.070	0.137	-0.014	0.204	.384*	0.178	0.324	0.018	-0.082	0.050	-0.117	0.324	0.256	.475**	0.310	0.356	0.228	0.281	.634**	-.631**

* p < .05; ** p < .01; *** p < .001.

Table 1. Pearson's Correlation Coefficients of Honest Signals and Individual differences

As Table 1 shows, there is a strong link between the number of messages sent and individuals' Harm/Care score. We also find a positive association of Rotating Leadership (betweenness oscillations) and of degree centrality with this score which reflects virtues of kindness, gentleness, and nurturance. Those who have the ability of being more caring of others, send more messages, have more direct social contacts and rotate in the network without maintaining static positions. The Fairness/Reciprocity score, on the other hand, is positively associated with language complexity. People who try to be fair use more complex language. People who score high on the Authority/Respect scale, receive more nudges by their peers. This means that individuals who value authority and respect need to get more nudges from their peers until they respond.

With regards to the dimension of Conservation of the Schwartz test, we find that those who care more about security, conformity and tradition answer emails faster and have higher social capital as captured in the variable Reach2 (Gloor 2017). Reach-2 defines the number of people that one can reach in two degrees of separation. In other words, this variable does not directly measure how many friends somebody has, but how many friends her friends have. It has been shown to be a good predictor of social and financial capital (Hadley et al. 2018.

We additionally find that the honest signals of communication can predict the moral values of a person. As the regression models for the Schwartz Values are somewhat less accurate we present the regressions for the Moral Values. The regression models with the best fit are shown in Table 2, illustrating which variables matter the most while predicting each individual trait.

		Dependent Variable			
Predictors	Harm/Care	Fairness Reciprocity	In-Group Loyalty	Authority Respect	Purity Sanctity
Sentiment	74.3173**	65.5398**			62.8351**
Alter ART	.2245**	.1179*		.0976^	.2483**
Ego ART				.1260^	.2049**
Alter Nudges	-18.2495**	-6.9631^		10.7797*	
Ego Nudges	8.7743**			8.2856*	16.2718**
Messages sent					.0173**
Messages received		.0126**	.0082^	.0096^	
Contribution index					
total influence			-.0660^		-.1453**
Betweenness centrality oscillation	.0992***			-.1109*	
Betweenness centrality		-.0004**	-.0004*	-.0006*	
Degree centrality			.1930*	.2010*	
Complexity					
Emotionality	-176.6017***		-35.3722^		-52.3369*
Reach2			-.2093^		
Constant	18.3043	-17.9746	157.2252*	-16.7616^	-49.0391**
Adjusted R-squared	0.6246	0.4514	0.3812	0.5512	0.6396

^ $p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2. Moral Foundations Test - Regression Models

We find for instance that the more positive and the less emotional people are, the more they care about others. A similar behavior (positive and non-emotional language) is also indicative of people who value sanctity and purity. On the other hand, the more people nudge others and are nudged themselves by e-mail, they more they value authority and respect.

3.1 Verifying the Link between Emotion and E-Mail Dynamics and Structure

To further demonstrate the link between emotions and e-mail behavior, we analyzed an e-mail archive with two months' worth of e-mail of 655 employees of a professional services firm, where we compared the structural and dynamic honest signals with their emotionality calculated from subject lines. This means that different from the first analysis, this time we only had the words contained in the subject line. However, in previous work the predictive power of this approach had been illustrated (Gloor et al. 2017b), as sentiment, emotionality and complexity of subject line and email body are correlated if the sample is big enough.

Variable	Coefficient
Betweenness centrality oscillation	-.0026***
Degree centrality	.0002***
Contribution index	-.0604***
Reach2	-.00002***
Constant	.4138***
Adjusted R-squared	0.6681

Table 3. Predicting Emotionality – Regression Model.

We find that 67% of the emotionality of an employee is explained by rotating leadership defined as betweenness centrality oscillation, central leadership defined as degree centrality, contribution index, and social capital defined as reach-2 (see Table 3) (Gloor 2017). In other words, there is a hidden strong link between the structure and dynamics of communication, and the contents of the communication. This goes back to the original definition of "Honest Signals" (Pentland 2010) which give away what somebody really thinks without explicitly saying it. Here we have shown that this is even true for e-mail communication: how central somebody is in the network, how much she sends compared to receiving e-mail, and how many times she changes her network position, and how popular her friends are, gives away her emotional state.

4 Discussion and Conclusions

Getting e-mail with an established claim from a trusted source will make the recipients interpret it positively, eliciting a different type of response – based on their moral foundations – than if they do not trust the source. The same is true if one is getting e-mails with novel claims. They will trigger different types of emotional responses based on if the recipients trust the source, and on their moral foundations. Either way, in this research we have shown that analyzing individuals' e-mails can reveal their moral foundations. We have measured the seven honest signals of communication to characterize the e-mail behavior of different people. At the same time, we asked the people whose e-mail communication was analyzed to take the Schwartz Value test (Lindeman & Verkasalo, 2005) and the Moral Foundations test (Graham et al. 2013), finding a significant link between e-mail behavior and moral values. There is a strong link between ethics and emotions, both on the business and the psychological side (Lurie 2004, Pulcini 2017, Tangney et al. 2007). The ethical and moral values of a person are given away by their "honest signals" as expressed through their e-mail behavior. This e-mail behavior is predictive of emotions, which are predictive of the ethical and moral values of a person.

While the results we found are intriguing, this is preliminary work motivating much further research. Our study should be repeated in a broader setting with more participants. Additionally, in the second study of this research, we take subject lines as a proxy of email bodies – consistent with past research which showed that people sentiment and emotionality measured on subject lines are correlated with the same metrics calculated on email bodies (Fronzetti Colladon & Gloor, 2019). Nevertheless, this study should be repeated also accessing email bodies and not only subject lines, for a more accurate assessment of honest signals related to language use.

We have shown that how somebody communicates in e-mail can predict their moral values and emotionality. These insights can be applied to virtual mirroring (Gloor et al. 2017), providing an automated way for making the moral values of individuals more obvious to them, thus assisting them for better self-management and self-understanding, ultimately leading to higher happiness in the Aristotelian sense.

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