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The emergence of emotions and pro-social and religious sentiments during the September 11 disaster

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Analysing emotional states under duress or during heightened, life-and-death situations is extremely difficult, especially given the inability of laboratory experiments to adequately replicate the environment and the inherent biases of post event surveys. It is in this area that natural experiments come to the fore by combining the randomization that comes from natural data with an experimentally realistic event. The pager communications from September 11th, made publicly available by Wiki Leaks (Wiki Leaks, 2009), provide exactly the kind of natural experiment emotion researchers have been seeking. We have analysed the pager messages by applying an absolute count methodology and by presenting both positive and negative emotive categories as well as the development of pro-social and religious sentiment. Providing behavioural evidence on how people communicate under extreme circumstances and offers valuable insights into human nature. We demonstrate that positive and pro-social communications are the first to emerge followed by the slower and lower negative communications. Religious sentiment is the last to emerge, as individual attempt to make sense of event.

JEL Classifications: D03, D70, D64, Z12, N30, Z10

Keywords: Content Analysis, Positive Emotion, Negative Emotion, Religiosity, Disaster Communications, 9/11

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The emergence of emotions and pro-social and religious sentiments during the September 11 disaster

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Abstract: *Analysing emotional states under duress or during heightened, life-and-death situations is extremely difficult, especially given the inability of laboratory experiments to adequately replicate the environment and the inherent biases of post event surveys. It is in this area that natural experiments come to the fore by combining the randomization that comes from natural data with an experimentally realistic event. The pager communications from September 11th, made publicly available by Wiki Leaks (Wiki Leaks, 2009), provide exactly the kind of natural experiment emotion researchers have been seeking. We have analysed the pager messages by applying an absolute count methodology and by presenting both positive and negative emotive categories as well as the development of pro-social and religious sentiment. Providing behavioural evidence on how people communicate under extreme circumstances and offers valuable insights into human nature. We demonstrate that positive and pro-social communications are the first to emerge followed by the slower and lower negative communications. Religious sentiment is the last to emerge, as individual attempt to make sense of event.*

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I. INTRODUCTION

The existing research on disaster behaviour has provided only limited insights into interpersonal connections during extreme events (for an overview see Mawson, 2007). The chronology of emotional development and the nature of religion during a disaster are under-developed in current literature. Even though research has shown that both positive and negative emotions co-exist in stressful circumstances (Folkman & Moskowitz, 2000; Fredrickson et al., 2003) it has been unable to show how it evolves nor the relative speed or scale of different emotional changes.

It is well understood that communication analysis can reveal a vast amount of information about an individual's emotional state; this is also true for communications that occur during heightened, life threatening or life and death situations. In this study we explore pager text messages sent before, during, and after the September 11 attacks that were made publicly available by Wiki Leaks (Wiki Leaks, 2009) to better understand emotional responses in life threatening situations. Recent research has illustrated that while the written word can indeed reveal much, it is very difficult to find natural behavioural evidence to test it (Pennebaker, Mehl & Niederhoffer, 2003). Both the Final Reports on the Collapse of the World Trade Centre Towers (Federal Building and Fire Safety Investigation of the World Trade Centre Disaster, 2008) and the 9/11 Commission Report (2004) refers to communication in and out of the World Trade Centre Towers to friends, family and loved ones as events unfolded on the morning of September 11. This captured communication, forms a relatively clean quasi-natural experiment for the analysis of emotive content, where the participants are interacting within their normal environment (rather than in an artificial laboratory setting). The two great advantages of natural experiments are randomization and realism, where the realism of the event prompts natural behavioural responses while

maintaining the advantageous randomness of natural data (Reiley & List, 2007). The pager messages capture the participants' responses in their own native voices: the senders' unconscious selection of words and language reveals their true emotions and sense of urgency as events unfold (For a methodological overview, see Pennebaker, Mehl & Neiderhoffer, 2003)[1]. It is this natural, native selection of communicative language that allows for the study of emotional and *behavioural* aspects by utilizing word count analysis common to psychological studies (see, e.g. Foltz et al., 1998; Popping, 2000). Such behavioural evidence is valuable as unbiased information about individuals' emotional states throughout the event is difficult to obtain by interviewing survivors at a later stage. Post event results are inherently biased as only the emotional states of survivors are obtained.

A limited number of studies have explored the September 11 attacks with a content analysis. Back, Küfner and Egloff (2010, 2011) utilized frequency count analysis with Linguistic Inquiry and Word Count LIWC (see Pennebaker, Francis & Both, 2001). Their initial results showed that individuals did not react primarily with sadness but displayed some elevated levels of anxiety that disappeared quickly. In contrast, the level of anger continually escalated throughout the day. These findings were questioned by Pury (2011) who showed that these initial findings were erroneous citing the inclusion of automatically generated (non-human) messages into the analysis. These messages were incorrectly classified by LIWC as anger, but lacked contextual emotional meaning and showed a non-random time course. In response to this Back, Küfner and Egloff's (2011) adjusted results using automatic algorithms and human judgment (anger-rating analysis) which completely removed the anger escalation. These two analytical methods revealed distinct timelines, although they were positively correlated (r=0.50). In both cases the authors observed that the dramatic rise in anger

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[1] It was Freud (1901) who pointed out that "it is the inner conflict that is betrayed to us through the disturbance in speech" and that the "viewpoints and observations should hold true for mistaken reading and writing as for lapses in speech ... [given] the inner relation of these functions" (pp. 126 & 142).

disappeared concluding: "Additional analyses and sources of data will be needed for a thorough evaluation of the course of anger on September 11, 2001" (p. 2). Thus, as with the analysis of any natural data, one must be wary of and alert to potential confounds which may be hidden within the data. One needs to be able to qualify as accurate as possible the emotive content without biases (e.g. isolate automatic (non-human) responses) to get a measure for the relative importance of emotions over time without inter-temporal noise. In the methodological section we will therefore introduce a different approach.

Moreover, contrary to these three studies we simultaneously map both positive and negative emotions. Research shows that both positive and negative emotions co-occur in stressful circumstances (Folkman & Moskowitz, 2000) but there is very little literature about the chronological evolution of emotions in a crisis or disaster. It valuable to go beyond negative emotions as positive emotions can facilitate superior coping and survival outcomes. The coping and survival outcomes could be achieved by reducing the levels of stress and ease the mind of individuals under duress not only by offering a distraction but also allowing the individual to maintain a cardiovascular state conducive to coping with elevated stress levels. The positive effects include: changing people's mode of thinking, by broadening their (visual) attention, their momentary thoughts and their behavioural repertoires impacting cognitive and coping skills (Frederickson et al., 2003). Laboratory experiments have shown that positive emotions can improve attention, focus, and the processing of important information (Aspinwall, 1998, 2001). In addition we also explore religious sentiments. Studies of the human response to crises have been criticized for badly neglecting the religious dimension (Pargament, 1997). We therefore attempt to reduce this shortcoming by exploring not only religious beliefs, but also the point at which these beliefs start to emerge during the crisis.

II. METHODOLOGY

We apply a different methodological approach than the three previous September 11 studies as a frequency analysis in this context demands full control of the type of message traffic and participants. In other words, this approach is problematic when dealing with an "open microphone" setting, where all passing traffic is utilized and counted even if it is not specifically related to the topic at hand or if it is being sent by non-human participants. One needs to be able to isolate automatic (non-human) responses to get a measure for the *relative* importance of emotions over time. For example, during September 11 the volume of message traffic that contained event updates, consisting of little to no emotive content, increased. This leads to noise in an inter-temporal analysis. Therefore, we use an aggregate count method using Word Frequency Counter (WFC) by Hermetic Systems (2010) to reduce contamination within the emotive responses.

According to Hart (2001), the two word analysis methodologies (aggregate count method and frequency analysis) are analogous to city views from a helicopter and the street, both valid but vastly different. The view from the air is broad rather than narrow, looks at totalities rather than instances and is not dazzled by context or close space observations: "We need to count words simply because words come to us in quantities. It is time, that is, for [us] to take a helicopter ride" (p. 58). Clearly, information is lost reducing the chance of getting a relative measure of emotive responses due to inability of controlling the overall individual information flow. In other words, an increase in anger may not be consistent with an increase in the relative importance of anger if, for example, the individual information flow has increased at the same rate (for a methodological overview see Weber, 1990). In line with the comments by Pury (2011) we have reduced the false positives by removing automatically generated computer messages. Additionally, to keep this work in line with previous studies

the selected key words were crosschecked against the LIWC dictionaries to ensure category consistency[2].

III. RESULTS

Figure 1 shows that initially the response is overwhelmingly *positive*, contrasted by the *negative* response which not only peaks at a lower level but does not occur until after the event conclusion (1-2pm). However, one should note that the overall level between positive and negative emotions is not fully comparable, as the absolute value is influenced by the composition of categories (e.g., number of words). Nevertheless, one should note that both emotions show similar aggregated values and patterns between 3 to 9 am and 7 pm to 3 am the following day. This may indicate that positive emotions can help generate a sense of control in order to increase the probability of positive survival outcome (Spilka, Shaver & Kirkpatrick, 1985). Furthermore, it seems that in extreme circumstances, people do not immediately respond with negative attitudes but approach such events in a positive and supportive manner, possibly helping to reduce the occurrences of panic or antisocial behaviour. The single category *friends & family* returns a strong effect, indicating that familiar persons are sought in dangerous situations. Moreover, our results indicate that individuals were not only positive about the unfolding tragedy, but there also appears to be a strong correlation between *friends & family* and the *social* categories as well. This could indicate a pro-social motivation in which individuals attempt to support and assist others to alleviate distress, a kind of helping behaviour displayed during common threat situations that generates "we-feelings" and a concern for the welfare of others (Batson et al. 1979).

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[2] The implemented (semi-automatic) data processes and the category lists are available upon author's request. The Appendix provides detailed information of the data preparation process and the category lists.

Figure 2 shows the interplay between prostrations of love[3], the anguish of death and individuals' religious beliefs. We observe that communications relating to death are very erratic over the course of the day, and follow a pattern similar to that of the *negative emotion* category, peaking between 1-2 pm and again at 7-8pm and 11-12am. Prostrations of love reach a peak in the hour following the last of the major events (10-11am). Interestingly, following the *love* peak, the analysis indicates that individuals do turn to their faith and beliefs for support but do so several hours after the conclusion of the attacks. This is in line with Pargament (1997) who believes that religion offers a way to come to terms with tragedies or suffering 'after' times of great crisis. Religious beliefs appear at later stages when people try to make sense and to understand events they have witnessed (Kelley, 1971), while they attempt to restore the meaning-belief system (Spilka, Shaver, & Kirkpatrick, 1985). As Spilka et al. (1985) pointed out, the observation that people seek meaningful explanations of events has a long history covering, e.g., the desire to know (Aristotle's *Metaphysics*), the quest for certainty (Dewey, 1929), the search for meaning (Frankl, 1963) or the desire to know and understand (Maslow, 1970).

It may not be surprising that religion becomes so important after a crisis, given that the crisis itself most likely disrupts the normal structure of understanding and needs set out in Maslow (1970). In the later stages or after a disaster or crisis event, religion becomes more accessible, given that the event has most likely stripped away the everyday structure of modern society. Here the strong traditional framework of organized religions can come to the fore, providing clear beliefs, coping mechanisms and social bounds. However, as the event subsides and life returns to a semblance of normality the need for the traditional religious

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[3] The category *"Love"* consists solely of the word love and its derivatives (such as loved and loves), which are also included in the broader *"Positive Emotion"* category.

framework fades, which may explain some of the ebb and flow of religious communications in and around crisis events.

IV.   CONCLUSIONS

Understanding human behaviour in times of stress or under extreme circumstances requires not only an understanding of how people act but also an understanding of what they communicate and when. However, the existing literature on disasters provides only limited insights into interpersonal connections during extreme events. We show that as the September 11 terror attacks unfolded, individuals reached out to friends and family, the emotive and behavioural content of these initial communications demonstrated an overwhelmingly positive emotional attitude. However, after the collapse of the second tower, communications became increasingly negative and thereafter individuals sought comfort in religion and their belief systems. This shift may be indicative of a short-term instinct to provide and seek support while trying to solve or address problems that later give way to negative emotions.

Our results also support Pargament's (1997) argument that religion is an important coping mechanism is disaster and crisis situations. However, this only becomes evident well after the proverbial "dust has settled" demonstrating that religion must be offering a form of support or understanding that is less available in the immediate aftermath of such event through other channels. In general, the broad range of positive public responses such as rescue work, volunteering, providing resources, or donating blood clearly indicates a different picture from the long-held views that terrorist attacks would cause mass panic or social disorder (Mawson, 2007).

We also argue that utilizing absolute word count analysis can be useful in removing message confounds when analysing the evolution of emotions in text communications during disaster or crisis situations. While some of the relative importance of emotive responses is lost by stepping back from the analysis, it is important in situations where absolute control of the message source is difficult to utilize another methodology.

Overall, our findings seem to indicate the usefulness of working with a model of behaviour and decision making that recognizes the social nature of human beings. An understanding of how humans think and how emotions shift under extreme conditions may provide insights into how humans will behave during future extreme situations and a better understanding of this social nature makes for better public policy as van der Heide (2004) states, "Disaster planning is only as good as the assumptions it is based upon. Unfortunately this planning is often based upon a set of conventional beliefs that have been shown to be inaccurate or untrue when subjected to empirical analysis…It is more efficient to learn what people tend to do naturally in disasters and plan around that, rather than design your plan and then expect people to conform to it." (van der Heide, 2004: p.340).

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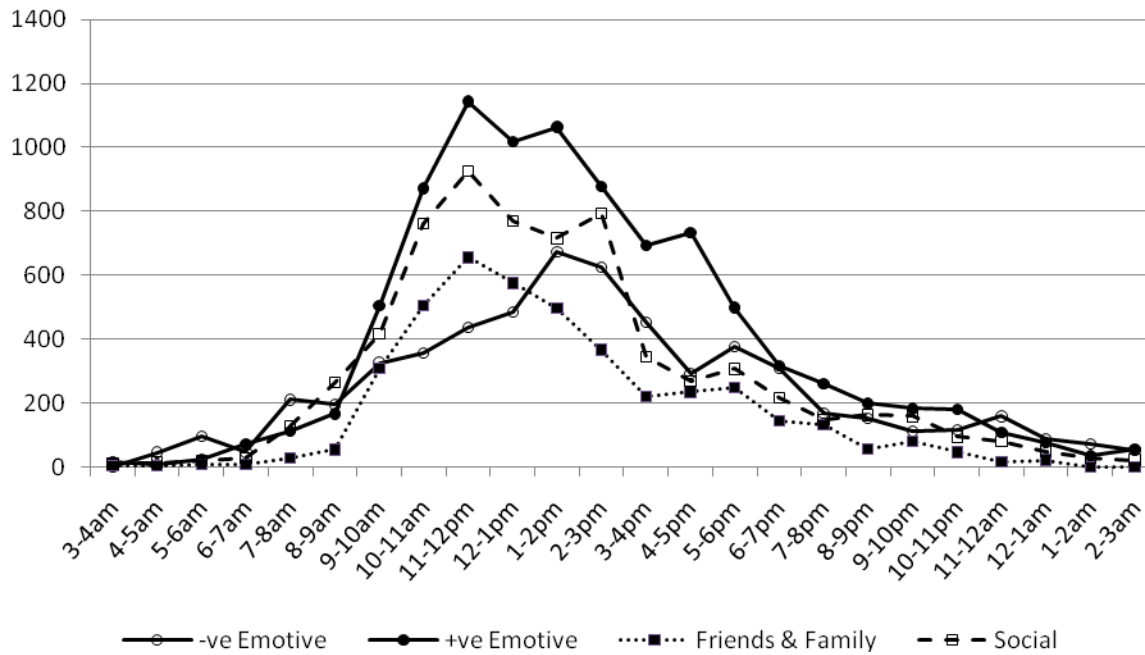
Figure 1: Timeline of Communication. *8:14 am* - American Airlines Flight 11 hijacked, between *8:42 - 8:46 am* United Airlines Flight 175 aircraft hijacked. *8:46:40 am* American 11 flew into WTC Tower 1. *8:51 – 8:54 am* American Airlines Flight 77 hijacked. *9:02:59 am* United Airlines Flight 175 hits south side of WTC Tower 2. *9:37:46 am*, American Airlines Flight 77 crashes into the Pentagon. *9:28 am* hijackers take over United Airlines Flight 93. *9:58:59 am* Collapse of WTC Tower 2 . *10:02:23 am* Flight 93 crashes into an empty field in Pensylvania. *10:28:22 am* Collapse of WTC 1.
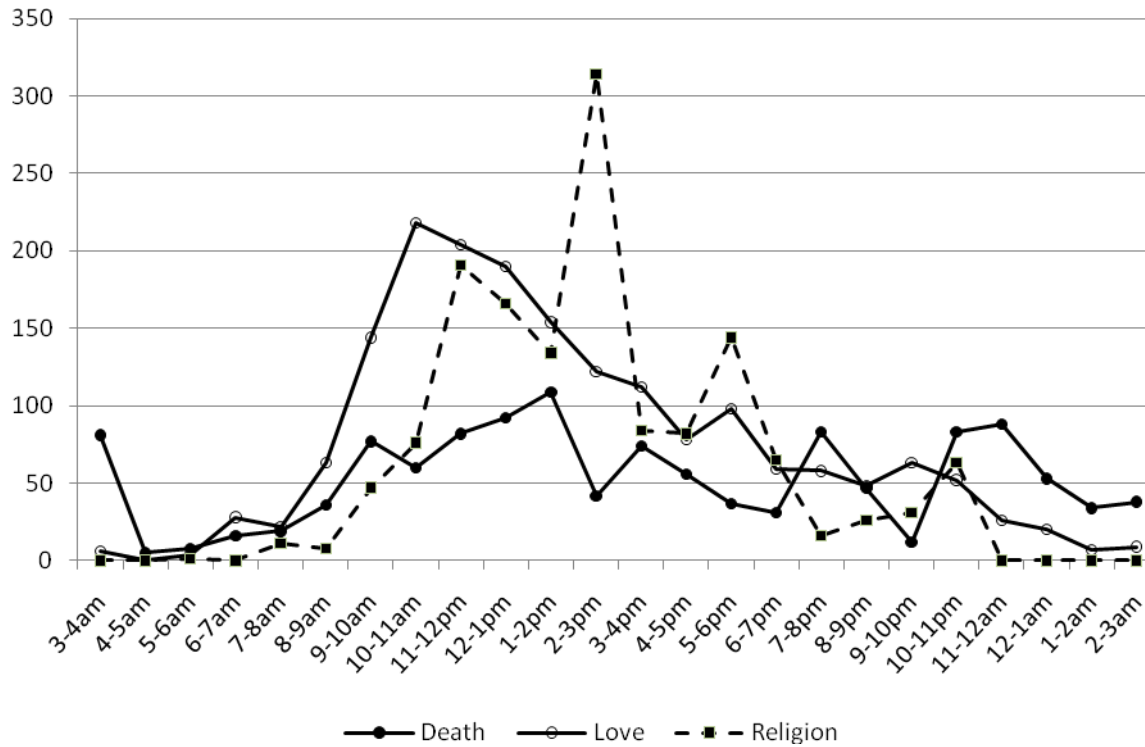
Figure 2: Death, Love and Religion. **"Religion"** as category might be "contaminated" (when used in international affairs). However, that element of religiosity is more relevant in the second half of the timeline. Osama bin Laden was first suspected at 4:00 pm and Bush's televised Address to the Nation was in the evening (8:30 p.m.). During this speech, he sought to console the nation by reciting portions of the 23rd Psalm (Bacevich & Prodromou, 2004).

APPENDIX

Data Preparation

In preparing the paper in line with Pury (2011) the following (semi-automatic) processes were implemented:

1. Open original text files as obtained from wikileaks.com and break into hour blocks.
2. Remove auto generated computer messages
3. Remove all headers, leaving only message portion.
4. Remove all punctuation
5. Create category lists from key words
6. Cross check user category lists with LIWC dictionaries
7. Run Hermetic Word Frequency Counter

Category Lists

Word	Savage &Torgler Cat	LIWC Cat.
abandon	Neg-Emo	Neg-Emo
accept*	Pos-Emo	Pos-Emo
accident*	Event	.
afterlife	Religion	Religion
agree	Pos-Emo	Pos-Emo
alarm*	Event/Neg-Emo	Neg-Emo
alert	Event	.
alive	Death	Death
alone	Neg-Emo	Neg-Emo
alrm	Event/Neg-Emo	Neg-Emo
alrt	Event	.
angry	Neg-Emo	Neg-Emo
answer*	Time	Insight
apologize	Pos-Emo	Social
appreciate	Pos-Emo	Pos-Emo
asap	Time	.
attack*	Event/Neg-Emo	Neg-Emo
attk	Event/Neg-Emo	Neg-Emo
avenge	Neg-Emo	.
await*	Time	.

away	Time	.
awe	Pos-Emo	.
babbee	Social	Social
babe	Social	Social
babee	Social	Social
baby	Social	Social
battered	Event	.
battery	Event	.
bbrother	Family	.
believe (s/ed)	Pos-Emo	Insight
best	Pos-Emo	Pos-Emo
blackout	Event	.
bless	Religion	Religion
block*	Event	.
bodies	Event	.
body	Event	.
bond	Pos-Emo	.
boy	Family	Humans
brave*	Pos-Emo	Pos-Emo
bravo	Pos-Emo	Pos-Emo
break*	Event	.
breath	Event	.
breathe	Event	.
breathing	Event	.

broke*	Event/Neg-Emo	Neg-Emo
brother	Family	Family
bruising	Event	.
burn*	Event	.
bye	Pos-Emo	Social
call*	Social	Social
calm*	Pos-Emo	Pos-Emo
care*	Pos-Emo	Pos-Emo
casualties	Death	Death
caution	Pos-Emo	.
cellphone	Social	Social
chaplain	Religion	Religion
child*	Family	Humans
christ*	Religion	Religion
church*	Religion	Religion
collapse*	Event	.
comprehension	Pos-Emo	Insight
concern*	Pos-Emo	.
confess	Religion	Relig
cooperate	Pos-Emo	.
cries	Neg-Emo	Neg-Emo
crisis	Event	.
cry	Neg-Emo	Neg-Emo
cutoff	Event	.
dad*	Family	Family
dam	Neg-Emo	Neg-Emo
damage*	Event/Neg-Emo	Neg-Emo
damm	Neg-Emo	Neg-Emo
damn	Neg-Emo	Neg-Emo
dang	Neg-Emo	Neg-Emo
darling	Pos-Emo	Pos-Emo
daughter	Family	Family
dead	Death	Death
dear	Pos-Emo	Pos-Emo
death	Death	Death
debris	Event	.
ded	Death	Death
deeply	Pos-Emo	.
deer	Pos-Emo	Pos-Emo
deeth	Death	Death
def	Death	Death
defy*	Pos-Emo	.
deny*	Pos-Emo	.

deserve*	Pos-Emo	.
desperate	Neg-Emo	Neg-Emo
devote	Pos-Emo	Pos-Emo
die*	Death	Death
difficult*	Neg-Emo	Neg-Emo
dying	Death	Death
emergencia	Event	.
emergencies	Event	.
emergency	Event	.
emotion	Neg-Emo	Neg-Emo
endures	Pos-Emo	.
evac*	Event	.
exit*	Event	.
exodus	Event	.
expire*	Event	.
explode*	Event	.
failures	Neg-Emo	Neg-Emo
faith*	Religion	Religion
families	Family	Family
family	Family	Family
farewell	Neg-Emo	.
father	Family	Family
fault	Neg-Emo	Neg-Emo
fear*	Neg-Emo	Neg-Emo
feel*	Pos-Emo	Insight
fine	Pos-Emo	Pos-Emo
fire*	Event	.
flames	Event	.
forget	Neg-Emo	.
forgive*	Religion/Pos-Emo	Pos-Emo
friend	Family	Friends
frustrate*	Neg-Emo	Neg-Emo
fuck	Neg-Emo	Neg-Emo
future	Pos-Emo	.
god	Religion	Religion
good	Pos-Emo	Pos-Emo
goodbye	Social	Social
grace	Religion/Pos-Emo	Pos-Emo
happiness	Pos-Emo	Pos-Emo
happy	Pos-Emo	Pos-Emo
hate	Neg-Emo	Neg-Emo
health	Pos-Emo	.
heart	Pos-Emo	.

heaven	Religion	Religion		religion	Religion	Religion
hell	Religion	Religion		remorse	Neg-Emo	Neg-Emo
help	Social	Social		repent	Religion	.
home	Home	Home		ring	Social	.
hon	Family	Friends		risk	Neg-Emo	Neg-Emo
hone	Family	Friends		rubble	Event	.
honee	Family	Friends		sad	Neg-Emo	Neg-Emo
honey	Family	Friends		scare*	Neg-Emo	Neg-Emo
hope*	Pos-Emo	Pos-Emo		scary	Neg-Emo	Neg-Emo
hug	Pos-Emo	Pos-Emo		selfish	Neg-Emo	Neg-Emo
husband	Family	Family		service	Religion	.
injure*	Event	.		share*	Pos-Emo	Pos-Emo
injury	Event	.		shit	Neg-Emo	Neg-Emo
islam*	Religion	Religion		sister	Family	Family
jesus	Religion	Religion		son*	Family	Family
keepalive	Pos-Emo	.		sorely	Neg-Emo	Neg-Emo
kill*	Neg-Emo	Neg-Emo		sorrow	Neg-Emo	Neg-Emo
kiss*	Pos-Emo	Pos-Emo		sorry	Neg-Emo	Neg-Emo
life	Pos-Emo	.		stress	Neg-Emo	Neg-Emo
lifeline	Event	.		suicide	Death	Death
loss	Neg-Emo	Neg-Emo		sweet*	Pos-Emo	Pos-Emo
lost	Neg-Emo	Neg-Emo		sympathy	Neg-Emo	.
love*	Pos-Emo	Pos-Emo		tears	Neg-Emo	Neg-Emo
marriage	Pos-Emo	Social		telephone	Social	Social
marry	Pos-Emo	.		temple	Religion	Religion
mass	Religion	.		terror	Neg-Emo	Neg-Emo
meaning	Pos-Emo	Insight		together*	Pos-Emo	.
miss*	Neg-Emo	Neg-Emo		truelove	Pos-Emo	.
mom*	Family	Family		understand	Pos-Emo	Insight
mother	Family	Family		warn*	Neg-Emo	.
moved	Event	.		well	Pos-Emo	Pos-Emo
mum*	Family	Family		why	Neg-Emo	.
muslim	Religion	Religion		wife	Family	Family
oh-shit	Neg-Emo	Neg-Emo		wives	Family	Family
panic	Neg-Emo	Neg-Emo		woman	Social	Social
pap*	Family	.		women	Social	Social
phone*	Social	Social		worried	Neg-Emo	Neg-Emo
plead	Neg-Emo	.		worry	Neg-Emo	Neg-Emo
plz	Pos-Emo	Pos-Emo				
pray*	Religion	Religion				
relation*	Pos-Emo	Insight				
relatives	Family	Family				

denotes the inclusion of stemmed words, e.g. warn is the base for all extension words such as warned, warning and warns.