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Wireless Emergency Alerts

Training Data Sets of Risk Communication and Perception:

Task Final Report

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TRAINING DATA SETS OF RISK COMMUNICATION AND PERCEPTION: TASK FINAL REPORT

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Executive Summary

The goal of this project is to characterize risk perception and response to a designated hazard. The classification of these individual perspectives across the public sphere contributes to the development of a model that evaluates and predicts risk response to an official alert or warning. Cataloging and understanding this response reveals what the public considers important and its priorities in the face of danger, which may differ greatly from the priorities and perspectives of the experts who send the alerts. Such understanding will also allow inefficiencies to be eliminated from risk communications. This approach places emphasis on the decisions the public makes upon receiving an alert or warning and investigates the cognitive factors that influence the decision-making process.

With sponsorship from the U.S. Department of Homeland Security, Science and Technology Directorate, the Pacific Northwest National Laboratory is addressing these challenges by developing a risk ontology that allows for better understanding of risk response and thus an improvement in risk communication between the expert and the layperson. By building this ontology from messages tweeted from real users in real time, it captures actual, untailored responses to an identified hazard. In addition, by mining tweets specific to one hazard, the characteristics of one community can be assessed to not only include geographic location, but also encompass the attitudes, belief system, culture, and demographics that contribute to the community's perception of risk and thus its response to expert warnings.

The project's hypothesis is that an ontology that unifies linguistic signatures, sensory processing, knowledge application and emotional response will allow for a solid understanding of the process of risk perception. By applying this ontology to textual responses to officially documented hazards (specifically, natural disasters), the project seeks to develop a training data set for a model that evaluates and predicts risk response, as well as to determine the factors that motivate a positive response from receivers of an alert. This model will be further used to improve the effectiveness and efficiency of official alerts and warnings by (1) establishing the sender as an authority in risk communication, (2) allowing for early warning and sufficient time for response, (3) building a culture of resilience, (4) reducing risk and uncertainty by increasing propagation of relevant knowledge, and (5) augmenting preparedness for similar future hazards.

1.0 Introduction

Decision making is never without risk. The lack of direct correlation between action and consequence lends itself to uncertainty and doubt. The risk manifests in the lack of guarantee of a good choice and the absence of a return policy on a bad choice. A rift also exists between expert-perceived risk and layperson-perceived risk (Slovic, Fischhoff and Lichtenstein) that renders communication inefficient; public agencies prioritize the majority—the laypeople—over the expert opinion, regardless of whether the perceived risk is founded in reason or not. For instance, laypeople exhibit a tendency to overestimate small frequencies and underestimate larger ones (Lichtenstein et al.). This is the reason why a community may react strongly to the presence of a nuclear power plant even with expert assurance that it is safe. Likewise, it also explains why a community that resides on a fault line ignores expert warnings of possible damaging tectonic activity. Such ignorance would prove disastrous if a high magnitude earthquake were to occur.

The goal of the present research into hazard risk perception and response is to unify expert recommendations with layperson perceptions and understand why some laypersons react to a hazard with extreme aversion, as opposed to indifference or compliance (Slovic, Fischhoff and Lichtenstein). Because expert recommendations are usually justified with statistics and extensive research, the focus must be on risk perception from the layperson point of view. Such an approach is recommended by the Hyogo Framework for Action, which advocates a "people-central" approach in efforts of disaster reduction. This type of approach takes into account the demographic, gender, cultural and livelihood characteristics of the target audiences, including guidance on how to act upon warnings, and supports effective operations by disaster managers and other decision makers (International Strategy for Disaster Reduction).

The creation of an ontology that characterizes risk response and communication is necessary in achieving this research. By building this ontology from messages tweeted from real users in real time, it captures actual, untailored responses to an identified hazard. In addition, by mining tweets specific to one hazard, the characteristics of one community can be assessed to not only include geographic location, but also encompass the attitudes, belief system, culture and demographics that contribute to the community's perception of risk and thus its response to expert warnings. Furthermore, the creation of an ontology would satisfy other priorities for action detailed in the Hyogo Framework for Action, such as the following:

1. Ensuring that disaster risk reduction is a national and local priority with a strong institutional basis for implementation;
2. Identifying, assessing and monitoring disaster risks and enhancing early warning;
3. Using knowledge, innovation and education to build a culture of resilience at all levels;
4. Reducing the underlying risk factors; and
5. Strengthening disaster preparedness for effective response at all levels.

With sponsorship from the U.S. Department of Homeland Security, Science and Technology Directorate, the Pacific Northwest National Laboratory is addressing these challenges by developing a risk ontology that allows for better understanding of risk response and thus an improvement in risk communication between the expert and the layperson.

2.0 Overview of Project

The goal of this project is to characterize risk perception and response to a designated hazard. The classification of these individual perspectives across the public sphere contributes to the development of a model that evaluates and predicts risk response to an official alert or warning. Cataloging and understanding this response reveals what the public considers important and its priorities in the face of danger, which may differ greatly from the priorities and perspectives of the experts who send the alerts (Slovic, Fischhoff and Lichtenstein). Such understanding will also allow inefficiencies to be eliminated from risk communications. This approach places emphasis on the decisions the public makes upon receiving an alert or warning and investigates the cognitive factors that influence the decision-making process.

Decision making under uncertainty is a complex phenomenon that is being researched in the course of this project using neurobiological and psychological concepts. First, information is acquired and processed; however, in times of uncertainty, information may be insufficient (Mileti and Sorensen). Under such conditions, human nature is biased to favor what is established over what remains ambiguous, regardless of the potential that may be extracted from the ambiguity (Ellsberg). The comparative ignorance hypothesis (Fox and Tversky) is founded in the Ellsberg paradox and cites lack of knowledge as the reason behind such ambiguity aversion. Decision making under uncertain and ambiguous circumstances is thus heavily influenced by cognitive biases based in assumption and instinct. This perceived risk is the basis on which public and environmental agencies focus their efforts (Slovic, Fischhoff and Lichtenstein). Thus, understanding perceived risk is necessary both in ensuring that the efforts of these agencies are not misdirected and that the receiver is not inundated with irrelevant information.

The project's hypothesis is that an ontology that unifies linguistic signatures, sensory processing, knowledge application and emotional response will allow for a solid understanding of the process of risk perception. By applying this ontology to textual responses to officially documented hazards (specifically, natural disasters), the project seeks to develop a training data set for a model that evaluates and predicts risk response. The model will then be used to determine the factors that motivate a positive response from receivers of an alert. This model will be further used to improve the effectiveness and efficiency of official alerts and warnings by (1) establishing the sender as an authority in risk communication, (2) allowing for early warning and sufficient time for response, (3) building a culture of resilience, (4) reducing risk and uncertainty by increasing propagation of relevant knowledge, and (5) augmenting preparedness for similar future hazards.

3.0 Background and Literature Review

At its most basic, risk is the probability that negative consequences arise from a particular event (United Nations). These events can be as common as the choices made in daily life or as complex as the ethics behind drug testing (Tannert, Elvers and Jandrig). Human response to risk has been studied extensively in an attempt to understand the effect of risk perception on decision making.

3.1 Understanding Risk Perception and Communication

Trainor (2010) proposes that layperson risk assessment upon initial receipt of a warning or an alert begins with (1) understanding the warning and (2) believing that the warning is credible. Mileti and Sorensen (1990) define understanding as attaching personal meaning to the warning, creating a personalized reality from which further risk judgments will be made. Such differences are why technical terms (e.g., tornado warning vs. tornado watch) are not intuitive (Trainor). Furthermore, laypeople must believe that the threat could materialize and become a real and present danger. They must also (3) personalize the threat and believe that the threat will affect them personally. These first three steps are crucial because warnings are more likely to be heeded and responded to with protective action if they are understood, believed and personalized (Mileti and Sorensen). The subsequent processes evaluate the layperson's logistics for initiating protective action. The layperson must determine (4) whether action is needed, (5) whether it is feasible, and (6) whether resources are available for execution. Protective action is dependent on the characteristics of independent members of a community who may be better equipped to respond because of sufficient knowledge, previous experience, physical ability or economic resources (Mileti and Sorensen).

3.2 Risk Identification

Before risk can be perceived or assessed, a hazard must be identified (Hoppner, Buchecker and Brundl). For instance, an audio alert must be heard by the warning recipient before any action can be taken (Mileti and Sorensen). Such identification is dependent on information gathering and processing.

The ability of the warning receiver to cognitively process information is dependent on the availability of information. When presented with an impending hazardous event, the warning receiver does not inertly await for more information to be given to him or her; rather, he or she vigorously searches for new information that may allow him or her to decide how to react (Mileti and Sorensen). Furthermore, the layperson must deem this information (e.g., information disseminated through alerts, warnings, news, word-of-mouth) to be convincing and reasonable. Mileti and Sorensen ascribe necessary information as that of (1) location of the risk, (2) guidance and direction provided to the public as a plausible response to the risk, (3) characteristics of the risk, and (4) the amount of time the public has to respond. Thus, it is important for the layperson to fully understand the implications of the risk before making a decisive action plan.

The credibility of the warning is also important. The communicators of the warning must be transparent and trustworthy to inspire belief in their messages (Hoppner, Buchecker and Brundl). For laypeople, credibility is heavily aided by confirmation (Mileti and Sorensen) that may manifest as physical or social cues. Physical cues are reliant on the five senses; for instance, the warning receiver may see the heavy rain that characterizes a flash flood or smell the smoke that accompanies a fire (Federal Emergency Management Agency). These physical cues are processed through various cortices in the brain and form

the reality observed by the receiver. It must be noted that such processing is unique to each individual and thus, there is no objective reality (Mileti and Sorensen). Reality is instead confirmed through social cues, such as communication with family and friends to confirm or verify the legitimacy of an alert. This has been shown to be more influential than warnings from officials (Corley et al.), but not as influential as personal experience or perception (Bostrom).

3.3 Cognitive Processing of Risk Perception

A prominent theory of perception is embodied cognition, which asserts that the integration of the mind, body and state of the body is essential for cognitive action that will manifest in motor behavior (Borghi and Cimatti). Embodied cognition is closely associated with semantic memory (Binder and Desai) in that the two theories' characterizations of perceptual symbols which, when integrated with a particular context sensed through embodied cognition, motivates action (Barsalou). For instance, language and number representation must be mapped to a perceptual symbol that is processed through embodied cognition to assign it meaning (Andres, Olivier and Badets). The stimulus—in this example, language or number representation—is further tagged with abstract feelings of good or bad (i.e., affect) that associate the input stimulus with the outcome (Schmitt, Brinkley and Newman; Slovic et al.), which is then stored in semantic memory. Semantic memory contains all acquired knowledge, information and perceptual experience that can be recalled to apply to new situations (Binder and Desai). Knowledge retrieval is significant because it integrates individual experience with semantic abstractions in the context of real-world knowledge (Goldberg et al.) to personalize information that can be acted upon from a cognitive and psychological standpoint.

Conceptual abstractness is also supported by the fuzzy-trace theory (Reyna and Rivers), which posits that humans remember in intuitive gist representations of objects or feelings, rather than analytical verbatim-based representations. That is, the semantic features of an event (i.e., the overall idea or concept and the emotions that accompany it) hold much more significance than the specific, factual details of the event. Fuzzy-trace theory has been shown as a derivative of prospect theory (Reyna and Brainerd), which employs heuristics and cognitive biases (i.e., the framing effect) in assessing loss. It posits that loss is more significant than gain, which is significant in risk assessment because it implies that laypeople react more strongly to prevent loss than to take the risk of a probabilistic gain (Kahneman and Tversky).

3.4 Linguistic Implications

The frame effect is important in illustrating the importance of language. An experiment conducted by Tversky and Kahneman (1986) poses two treatments of equal value in a positive (i.e., save 200 lives out of 600 total) and negative (i.e., 400 people will die out of 600 total) frame. In conjunction with the prospect theory and fuzzy-trace theory, results revealed that an overwhelmingly greater proportion of people would support a treatment when presented in a positive frame than in a negative frame. Thus, it follows that language that constructs a positive frame encourages risk-aversive behavior, while one that constructs a negative frame will motivate risk-seeking behavior (Tversky and Kahneman).

Though not as striking, positive and negative language can also motivate differences in risk perceptions. Not only is perception dependent on cognitive biases, such as the framing effect, but it is also thoroughly processed by embodied cognition, recalled from semantic memory, and integrated with sensory cues (as discussed above). To unify these concepts, imagine an alert that warns the actor to "flee" as opposed to "run." The former, placing the actor in a negative frame, elicits a negative affect. Furthermore, when embodied, cognition tells the legs to escape, which recruits the muscles of the legs as if to prepare for the

action itself. Simultaneously, a memory of a previous experience in which the actor was similarly fleeing from danger could be recalled. Combined with sensory cues of a large funnel cloud, the sounds of screaming, and retrieved knowledge that the combination of both could only mean a fairly destructive tornado, the risk would be perceived as imminent.

The significance of language is thus undeniable. It has been found that emotions and mood can be abstracted from text such as social media (Aisopos, Papadakis and Varvarigou). Language processing also elicits a neurobiological reaction (Isenberg et al.). Furthermore, with the improving capabilities of artificial intelligence, computers are being trained to process language as well as humans. Linguistic tools, such as Linguistic Inquiry and Word Count (LIWC) and the Penn Treebank Part of Speech (POS) tagger, enable this by parsing complex thoughts and sentences into their fundamental segments (i.e., into dictionaries of word categories by LIWC and into grammatical parts by Penn Treebank). As posited by the fuzzy-trace theory, the layperson relies on gist representation more than surface verbatim representations in decision making (Reyna and Brainerd). This implies that because the gist of the word is more telling than the word itself, words can be classified in simpler representations of abstract ideas, such as the categories defined by LIWC.

Such division is based on the premise that it is not the content of the sentence itself that matters, but the way in which the content is expressed (Danescu-Niculescu-Mizil, Gamon and Dumais). For instance, Pennebaker (2013) emphasizes that 60 percent of the vocabulary used in daily life is composed of function words (e.g., a, an, the, them, that) that offer no content at all, but are instrumental in communicating ideas. For example, using only pronouns, Pennebaker was able to determine a writer's personality. Furthermore, as a tense-aspect-mood language, English naturally reflects the speaker's position in time, the continuity of the action in time, and the modality of the action (i.e., degree of obligation, necessity, ability) (Bybee, Perkins and Pagliuca), which reveals much information about the current action or thought process of the speaker.

This thought process is also apparent through sentence construction. The dependency theory and sequential cognition posits that there is a gradual accumulation of meaning through the progression of a body of text (Altmann and Steedman; Schank; Schank and Tesler). Schank and Tesler represent this in their model of conceptual dependency, which proposes that a word is stored in the mind until a subsequent word is able to give it meaning. It is not that the later words in a sentence are the most important, but that their cumulative meaning is more significant. This is why the full meaning of a sentence can be deduced only at the end of the sentence. The implication of this is that word order is important and must be considered when analyzing the intent and meaning of a text.

4.0 Risk Perception and Communication Ontology

4.1 Overview

The purpose of the ontology is to characterize tweets into corresponding categories of risk perception. Though tweets are limited to 140 characters, they enable many possibilities for expression. For instance, mood and emotion are inherent in personal writing (Aisopos, Papadakis and Varvarigou), as are relationships between two tweeters (Adali, Sisend and Magdon-Ismail). The former could reveal the immediate response to a warning or a hazard, while the latter could indicate the social impact and role of the tweeters within their social networks. Twitter was chosen as the textual basis for analysis because its character limit is most representative of the current 90-character allowance for cell phone-based alerts.

Tweets are complex in their contextual form because of content and lack of proper grammatical structure. The challenge lies in accounting for tone, attitude and intention in the absence of a human reader. Because the goal is to devise an automated system that can analyze tweets in terms of risk response and perception, the tweets must be simplified into smaller parts that a machine can process and classify individually or in small clusters, without context attached. By using existing linguistic tools such as LIWC and the Penn Treebank POS tagger, the tweet can be parsed into components for easier classification (i.e., into dictionaries of word categories by LIWC and into grammatical parts by Penn Treebank). The project's approach considers each word using tense, aspect, modality and pre-defined word categories by LIWC in the absence of context.

Tweets posted during five recent disasters—the Moore (Oklahoma) tornado of 2013, El Reno (Oklahoma) tornado of 2013, Southern California flash floods of 2013, Alamo (California) gas leak of 2013 and Hurricane Sandy of 2013—were harvested to analyze risk communication and risk perception (see Appendix A). The data analysis will be detailed in a future report. Using this data and concepts from cognitive neuroscience and social psychology (as described in the background), an ontology was developed to best categorize perceptions and responses to disaster risk.

4.2 Ontology

The layperson must not be caricatured as exceedingly bright or exceedingly reckless. Trainor (2010) dispels notions that the layperson acts solely to maximize benefits, or irrationally and senselessly to facilitate escape. That is, the layperson should be assumed to act with bounded rationality in wanting to maximize his utility, but within limits of his knowledge, time and ability to cognitively process these factors in the formation of a decision (Gigerenzer and Selten). The ontology reflects bounded rationality by considering the various factors that contribute to making a decision.

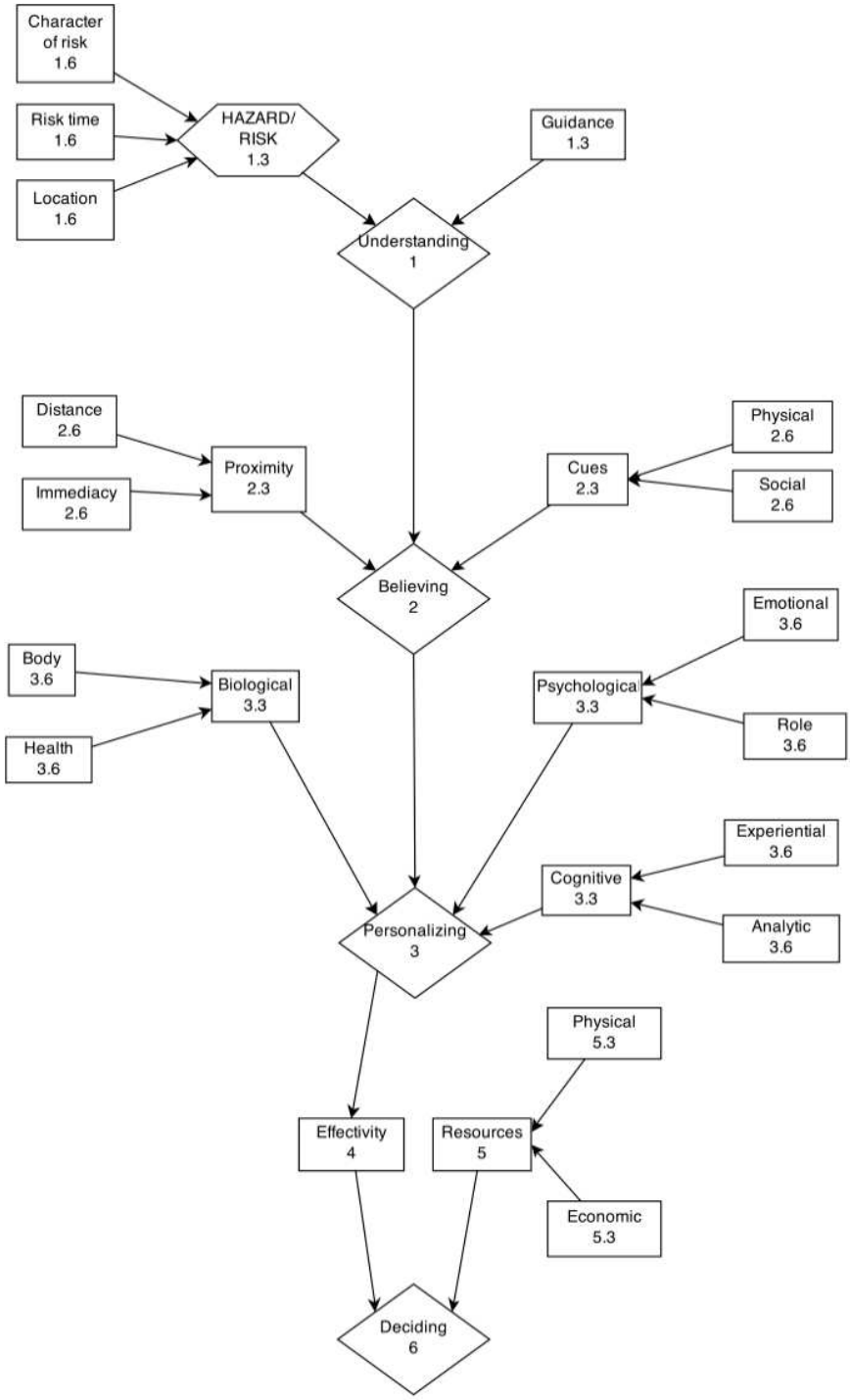


Figure 1. The developed ontology for characterizing risk response. The rhombi represent the key steps in thought processing, and the rectangles represent linguistic categories that are components of each thought process. Hazard/risk is emphasized as the key factor for understanding (the starting point).

4.2.1 Structure

The structure of the ontology is divided into layers that mirror the steps of the thought process. The purpose of this is to reflect the information processing and decision making of the layperson. This decision making is highly contingent upon (1) recognition of the hazard or event, (2) belief that the potential magnitude of the hazard or event will be significant, (3) personalization of the hazard or event, and (4) ability to act upon his or her decision (Mileti and Sorensen). Subsequently, the affected layperson must then decide (5) whether protective action is needed, (6) whether those steps are feasible and (7) whether he or she possesses sufficient resources to execute a decision (Trainor).

The ontology is structured from a center-out perspective. There are three levels, with the thought processes (described above) corresponding to the first level, the characteristics of these processes corresponding to the second level and descriptions of these characteristics corresponding to the third level. The progression from the first level to the third level is representative of more detailed analysis and observation (e.g., "hurricane" possesses less detail than "hurricane nearby," which possesses less detail than "destructive hurricane nearby").

The numbers given in each rhombus and box are ordinal and reflect the process of risk response in a quantitative manner. This is important for visualizing the decision-making process of a layperson, as described in section 4.2.2 Methodology. Examples of the process of risk response include the following: understanding; considering location of the risk, hazard and guidance; characteristics of risk and risk timelines; and "believing," which is evaluated by proximity in terms of distance then immediacy.

4.2.2 Methodology

The ontology utilizes the interplay between sentence structure and thought processes not only to classify risk perception, but also to visualize the development of thought process through a tweet. It considers each word individually to eliminate the context that surrounds the word, which allows better coding for automation.

Each word in the tweet is numbered according to position (e.g., for this sentence, "each" = 1, "word" = 2, "in" = 3 … "position" = 10).

The tweet is processed through LIWC and each word is annotated with a category defined by LIWC. This category is matched up with one of the subunits. Words classified as *articles, conjunctions, fillers* and *impersonal pronouns* are omitted and given a value of zero.

Each subunit (see section 4.2.3) receives a number that corresponds to the step of processing in decision making, but the number has no cardinal importance. For each classification of a word in the tweet, a coordinate point representing the word number or subunit can be plotted and further processed. Although these points are discrete, they represent the progression of thought process. Because the subunits are ordinal (see Figure 1) and word order in the tweet is ordinal, a plot of the word number and subunit gives an ordinal representation of the thought process (see section 4.2.1). For instance, because "deciding" is labeled as 6^{th} in Figure 1, words classified in subunits that are close to 6^{th} (i.e., "resources" or "effectivities") offer a deeper layer of thinking than those that are farther (i.e., "location" or "distance").

Table 1. LIWC2007 Output Variable Information

The following table was adapted from *The Development and Psychometric Properties of LIWC2007* (Pennebaker et al.). The categories shown here are classified in each subunit below. The complete list of words in each category can be obtained from LIWC2007. Because categories are hierarchal, words are classified in the lowest subcategory unless otherwise specified (e.g., "end" would be classified in *time* rather than *relativity*).

Category	Abbrev	Examples	Words in category
Linguistic Processes			
Word count	wc		
words/sentence	wps		
Dictionary words	dic		
Words>6 letters	sixltr		
Total function words	funct		464
Total pronouns	pronoun	I, them, itself	116
Personal pronouns	ppron	I, them, her	70
1st pers singular	I	I, me, mine	12
1st pers plural	we	we, us, our	12
2nd person	you	you, your, thou	20
3rd pers singular	shehe	she, her, him	17
3rd pers plural	they	they, their, they'd	10
Impersonal pronouns	ipron	it, it's, those	46
Articles	article	a, an, the	3
[Common verbs][a]	verb	walk, went, see	383
Auxiliary verbs	auxverb	am, will, have	144
Past tense [a]	past	went, ran, had	145
Present tense [a]	present	is, does, hear	169
Future tense [a]	future	will, gonna	48
Adverbs	adverb	very, really, quickly	69
Prepositions	prep	to, with, above	60
Conjunctions	conj	and, but, whereas	28
Negations	negate	no, not, never	57
Quantifiers	quant	few, many, much	89
Numbers	number	second, thousand	34
Swear words	swear	damn, …	53
Psychological Processes			
Social processes[b]	social	mate, talk, they, child	455
Family	family	daughter, husband, aunt	64
Friends	friend	buddy, friend, neighbor	37
Humans	human	adult, baby, boy	61
Affective processes	affect	happy, cried, abandon	915
Positive emotion	posemo	love, nice, sweet	406
Negative emotion	negemo	hurt, ugly, nasty	499
Anxiety	anx	worried, fearful, nervous	91
Anger	anger	hate, kill, annoyed	184
Sadness	sad	crying, grief, sad	101

Category	Abbrev	Examples	Words in category
Cognitive processes	cogmech	cause, know, ought	730
Insight	insight	think, know, consider	195
Causation	cause	because, effect, hence	108
Discrepancy	discrep	should, would, could	76
Psychological Processes	certain	always, never	83
Inhibition	inhib	block, constrain, stop	111
Inclusive	incl	and, with, include	18
Exclusive	excl	but, without, exclude	17
Perceptual processes[c]	percept	observing, heard, feeling	273
See	see	view, saw, seen	72
Hear	hear	listen, hearing	51
Feel	feel	feels, touch	75
Biological processes	bio	fat, blood, pain	567
Body	body	cheek, hands, spit	180
Health	health	clinic, flu, pill	236
Sexual	sexual	horny, love, incest	96
Ingestion	ingest	dish, eat, pizza	111
Relativity	relativ	area, bend, exit, stop	638
Motion	motion	arrive, car, go	168
Space	space	down, in, thin	220
Time	time	end, until, season	239
Personal Concerns			
Work	work	job, majors, xerox	327
Achievement	achieve	earn, hero, win	186
Leisure	leisure	cook, chat, movie	229
Home	home	apartment, kitchen, family	93
Money	money	audit, cash, owe	173
Religion	relig	altar, church, mosque	159
Death	death	bury, coffin, kill	62
Spoken categories			
Assent	assent	agree, OK, yes	30
Nonfluencies	nonflu	er, hm, umm	8
Fillers	filler	blah, I mean, you know	9

"Words in category" refers to the number of different dictionary words that make up the variable category.
The LIWC dictionary generally arranges categories hierarchically. For example, all pronouns are included in the overarching category of function words. The category of pronouns is the sum of personal and impersonal pronouns. Exceptions to the hierarchy rules include:
[a] Common verbs are not included in the function word category. Similarly, common verbs (as opposed to auxiliary verbs) that are tagged by verb tense are included in the past, present and future tense categories but not in the overall function word categories.
[b] Social processes include a large group of words (originally used in LIWC2001) that denote social processes, including all non-first-person-singular personal pronouns and verbs that suggest human interaction (e.g., talking, sharing).
[c] Perceptual processes include the entire dictionary of the Qualia category (a separate dictionary), which includes multiple sensory and perceptual dimensions associated with the five senses.

4.2.3 Subunits

The subunits in the ontology reflect the factors that comprise each layer. Concepts and terms are based on sensory and cognitive processes, as well as psychometric and sociocultural theories of risk perception. Definitions, unless otherwise indicated, are adapted from Mileti and Sorensen (1990). Italicized words are the word categories that belong in each classification. The categories are taken from the standard LIWC dictionaries (see Table 1) unless otherwise indicated by an asterisk (*).

- Understanding – the attachment of meaning to a message, as indicated by verbs in the *present tense* and *future tense* and including:
    - Guidance – possible measures of protective action, signified by *discrepancy* and *inhibition*
    - Hazard/Risk – a dangerous event that may cause injury or loss (United Nations), described by:
        - Characteristics of risk – detailed descriptions of risk, signified by *characteristics of common hazards*
        - Location – information about which locations are at risk, signified by *place names** and *geographic landmarks**
- Believing – the determination of the legitimacy of the message, as indicated by *insight,* through the observation of:
    - Proximity – the nearness of the hazard, in time and space, as indicated by *prepositions,* via:
        - Distance – space, as signified by *relativity*
        - Immediacy – time, as signified by *relativity*
    - Cues – factors in the environment that serve as signals, as indicated by *perceptual processes,* can be:
        - Physical, as indicated by *numbers* and *quantifiers*
        - Social, as indicated by *adverbs*
- Personalizing – the implications of risk for oneself, signified by *past tense,* can be evaluated by:
    - Biological – considerations of impact on a biologic system of the body as indicated by *personal pronouns* and contextualized by:
        - Body – physical implications on the body, as indicated by *body*
        - Health – non-physical implications on the body, as indicated by *health*
    - Psychological – considerations of impact on mental aspects of the body, as indicated by *personal pronouns* and contextualized by:
        - Emotional – fast, instinctive, and intuitive reactions to danger (Slovic et al.), indicated by *affective processes* and *swear words*

        - Role – the place of the tweeter within his or her social network, which can be defined by *social processes*
    - Cognitive – considerations of thought processing of the brain, which can be indicated by *personal pronouns* and can be characterized by:
        - Experiential – founded in memory and intuition (Slovic et al.), signified by *certainty* and *tentative*
        - Analytic – founded in logic and analysis (Slovic et al.), signified by *causation*
    - Effectivity – the ability of the tweeter to interact with the environment (Sahin et al.), as signified by *auxiliary verbs*
- Resources – possessions of the tweeter, including:
    - Physical – tangible objects such as a car (e.g., for evacuation), signified by *personal concerns*
    - Economic – financial prospects that enable action (e.g., money to pay for a hotel after evacuation) and are signified by *personal concerns*
- Decision – actions taken by the tweeter, as signified by *absent* or *present progressive* tense

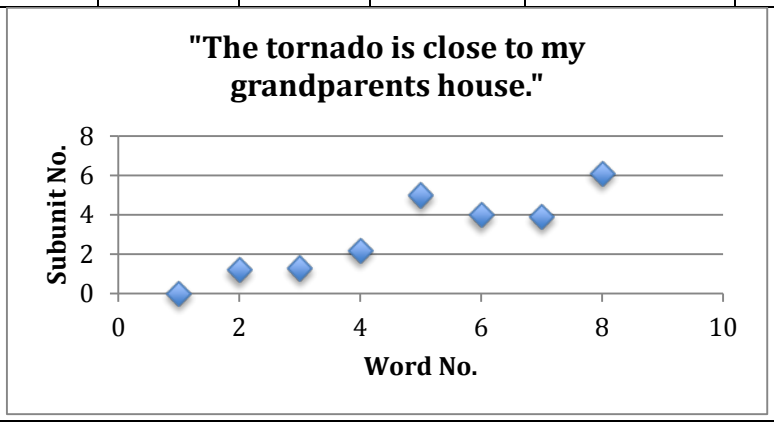
The ontology culminates in the stage of the tweeter's thought process when the tweet was composed.

4.2.4 Sample Ontological Classification

The following tables feature examples of risk responses classified manually by the methodology presented above. The tweets are from two different hazards and demonstrate different progressions in thought; the length of the tweet (i.e., word count) is irrelevant. The trend observed in the scatter is the most important.

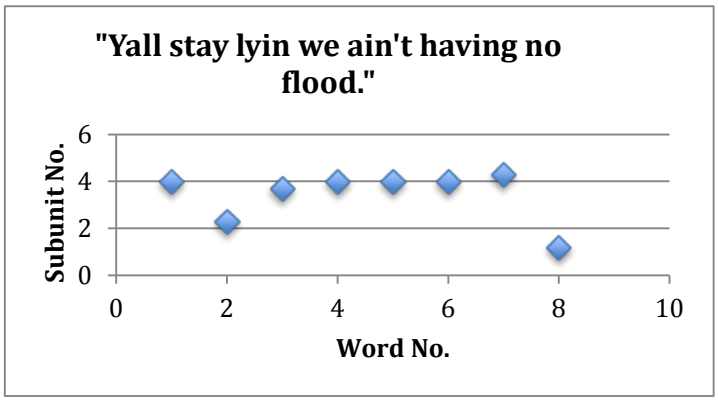
A positive relationship between word number and subunit number indicates that the tweeter is closer to the decision-making part of the thought process, rather than understanding.

Tweet:	The	tornado	is	close	to	my	grandparents'	house
Word No.	1	2	3	4	5	6	7	8
Subunit	N/A	Hazard	Guidance	Distance	Effectivity	Personalization	Family	Physical
Subunit No.	0	1.3	4	2.6	2.3	3	3.6	5.3



In the following example, there is a negative trend between word number and subunit number. This implies that the tweeter is still in the "understanding" part of the thought process.

Tweet:	Yall	stay	lying	we	ain't	having	no	flood
Word No.	1	2	3	4	5	6	7	8
Subunit	Personalization	Immediacy	Deciding	Personalization	Effectivity	Deciding	Analytic	Hazard
Subunit No.	3	2.6	6	3	4	6	3.6	1.3



5.0 Final Training Datasets

We have developed an ontology that incorporates cultural and psychometric evaluations of risk that characterize response to risk communication messages by the target audience. We provide a sample selection of tweets that has been annotated to reflect this ontology. The exact training data are available in JavaScript Object Notation (JSON) format upon request to court@pnnl.gov. The goal of automation is to develop software that gives feedback to official warning and alert originators to make risk communication more effective for the general public.

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Appendix A. Twitter Messages

A.1 Moore, Oklahoma Tornado

Moore, Oklahoma Tornado
S/O to a great sports figure for coming to Moore, ok to help us out! Thank you @bweeden3 we appreciate it very much!
The tornado is close to my grandparents house.
Tornado emergency for Moore #OK from @koconews Take shelter now
Monster tornado on the ground near New Castle OKC. My crew safe. Take cover now! Pray for folks in the path.
I lived in this same neighborhood on may 3 1999 and this was all to reminding of that please hold your loved one close and pray for Moore
Living my life long dream of tornado chasing rn man #fwm
Still a tornado warning for Paul's Valley area.. Continue to be taking cover.
They now say the tornado was 2 miles wide. Thank god for Gary England from @NEWS9. Gary you are a life saver!!!
@iamRandyWayne I'm been donating supplies and tomorrow me and some friends are going to go move debris at crossroads but doesn't like enough
Please pray for all those in Moore Oklahoma #tornados have devastated the area. http://t.co/b2WhCnNYiR
Stunning progress in #Moore. I've always said if Americans could work together everyday like we do in tragedies, we'd be MUCH better off.
this weather man said he wanna see the tornado tighten up . tf ?
I cannot even imagine being a parent in Moore and told that my kid isn't coming home from school... #prayformoore
Really thinking the worst storms today will be western/NW Oklahoma into SW and central Kansas. Long track tornadoes, damaging hail likely.
TORNADO ON THE GROUND. Huge wedge tornado crossing I44 near SW 149th. TAKE SHELTER @NEWS9 http://t.co/9rviqj3GwD
Taking shelter in our house! Massive tornado just west of us
Just another day in OK- live streaming tornado footage at work while the sirens blare. http://t.co/00nmOklPCN
Tornado shrouded in debris is May 3rd all over again. West Moore High and Warren Theater. South OKC take cover.
RT @NWSNorman: There were approximately 13,500 people in the path of the Newcastle-Moore-OKC tornado on May 20th. #okwx

Moore, Oklahoma Tornado
Death toll in Moore, OK is 5. 3 at a 7-11 near tornado path. #PrayForMoore
HUGE TORNADO in NORTH NORMAN AND SOUTH MOORE. TAKE PRECAUTIONS NOW. WATCHING IT FROM MY UPSTAIRS WINDOW. Deadly, take shelter RIGHT NOW.
Just a regular day at work taking shelter from tornadoes.
That tornado is huge
National guard is in moore now. Thank good.
I have to much swag 4 dis tornado.
Wow looks like the storm missed me so I can't watch it
IF YOU ARE IN NORMAN/MOORE TAKE COVER NOW. TORNADO ON THE GROUND IN NEWCASTLE
Saw two looks like more tornados forming. Taking shelter now. Wish I could reach my family :(
Anyone who steals someone's property after a tornado is sick, absolutely!!!
So that tornado in Newcastle is right where I was about 30 minutes ago.
Pray for our friend that got picked up by the tornado and it throw her and broke her back.
My dog says.... I survived the may 20th tornado! http://t.co/4hC0aTn4dw
this tornado is moving fast
That tornado will knock us all down, but it won't stop us from getting back up.
This is what the tornado looked like from our house. #okwx This is I-40 at Choctaw Road. http://t.co/yEKm22Jt2c
Hopefully this tornado takes me out
#everyOklahoman thinks there should be a tornado emoji.
@jdsutter mayor of Moore is going to propose a requirement for shelters in all new construction...but OK isn't a state big on regulation.
NWS confirmation of twister size. I can officially say I've been on the heels of an EF5 tornado. #NotSurprised #CrazyExperience
Pray for Moore!
Like what is he gaining by calling tornados "funnel clouds"? http://t.co/lNOBYETeJV
Damage at the start of the tornado path is like the tree version of a paper cut #okwalk http://t.co/G00DtKbUxt
"@4WarnStormTeam: Emergency crews asking you to stay out of Moore area. They are having trouble getting in to help." Please listen.
When I see a tornado then ill be scared until then everyone just stop
Tornado just touched down three miles from my house...so..

Moore, Oklahoma Tornado
i still havent heard from my grandma and dad that lives in moore.. starting to really worry
Still trying to realize that the tornado that hit Moore was only 0.5 miles away from my house. #moore #tornado
Tornado isn't a verb Mike.
Tornado on the ground. Lake thunderbird
Pray for the people in Moore, OK. A very bad tornado hit there earlier today http://t.co/Zef2SOBpk0
This was the Moore Medical Center. Cars stacked 3 high in the parking lot. @keyetv saw rescue crews searching area. http://t.co/gT9AjUZA55
Crazy tornado has been on the ground for two hours!
Y'all act like May ain't tornado season
Days been bit stressful. Glad I got to help out the town of Moore made quite a few people's day and it felt great.
I thought maybe I'd wake up and this would all have been a dream. But it's real, and now the shock is gone. Tears just keep flowing. #Moore
Just a heads-up, friends, that I may be storm chasing tomorrow. Stay tuned for updates. Initial guess at a target is Kiowa, KS. #chasing

A.2 El Reno, Oklahoma Tornado

El Reno, Oklahoma Tornado
Sooo WINDY! No wonder this is tornado alley.
we in a tornado watch .
“@tornadopayne: Another rotating storm.. Incredible... West of Wynnewood in southern Okla.. http://t.co/nVAJ5Kyl0b”
Landed in OKC just before tornadoes hit. Had to immediately take shelter underneath terminal as a big one passed. Was under there for 3hrs
goin to do work out in the disaster area
@f###tyler I'm about to die. I live in Oklahoma & its about to tornado again.. Please before I die follow me back. That will make my life.
“@abbie_walton: Take a shot every time they say tornado”
@JerrodRyburn @bbauder3 the wind inside tbe tornados go that fast. They dont move that fast though.
“@evchamb: @AugieCraig tornado watch for the western part until 10 pm ” in case the tornado finds me, it's been nice knowing all of you.
@MikeOKwx @themahler @garyeOK heavy rain and wind in Calumet. Power flashed a few times.
Hopefully this is the backside of the storm... Lots of rain a little hail. #oklahoma @ Westbury… http://t.co/BmcmsulsYs
It's literally only the sounds of tornado sirens, ambulances, barking dogs, and hail hitting s$$$ right now.
Our shelter is packed!and everyone's not even in it yet!
Probably the question I am asking is. Why was channel 4 telling people to go south or north and drive out the storm. That seems stupid.
tornado chasing cars are not the most comforting thing to see when driving through an area that was… http://t.co/8Sb1RWRkxh
Driving by OKC West heading towards Yukon. Debris everywhere. All this damage is terrible. Breaks my heart.
I can hear the tornado
Here we again with this s$$$, my view from storm shelter http://t.co/OVvKw6Io9h
TORNADO EMERGENCY OKC
Batton down the hatches, here comes the storm. #OklahomaWeather
When I hear the word " tornado " I get scared & have breakdowns.
Go home tornado you're drunk
When there are possible tornados my mom treats everything like a tornado. It's raining, we better get

in the cellar.

Physically and mentally exhausted from helping with the disaster relief but at peace knowing I helped make a diff #PrayForOklahoma

Here's my poor trampoline after wind lifted over the fence into the street. Been without electricity for over 3 hrs http://t.co/jod5tql2ZM

Everyone please pray for my kelvy! He lost his house in the tornado but he is fine! I love you so much!! @KwizzyR

It's crazy that the guy from storm chasers on discovery channel died chasing the tornado in El Reno :/

F### you wind how dare you blow my chairs off my porch. Hoe

Taking shelter w/ everyone & their dogs! @ All Souls' Episcopal Church http://t.co/ZaUVgdl5wm

Why is that random dude driving through a tornado?

You never realize how much you rely on electricity until a storm turns your power off for a day and a half! I can finally charge my phone!

Tornado is south of us... family in the cellar....

I actually don't understand why people freak out so bad when there's a tornado

Another day of #tornado coverage from #Oklahoma. Gov #Fallin touring damage this morning and will hold presser 9CST. http://t.co/VGrhRZI0Cc

I hope everyone takes shelter and stays as safe as possible.

I pray for Moore its going straight for it

bestfriends in moore, please do not hit moore

I'm never scared about a tornado coming

Hiding out at the Chilis restroom. Storm is right over us! Praying for Gods protection!

Man, had a long night at work just got off almost go hit by tornado

F### storm chasing; this motherf###er is chasing me

Praying this tornado doesn't hit Falls Creek.

Yall see the ratings for last weeks tornado that started in El Reno they just keep getting bigger. http://t.co/hEie1O2Ml9

They just issued a tornado emergency. Higher than a tornado warning. Heading for the OKC metro now. Sirens just started.

After that tornado today I just can't sleep

I hope it doesn't storm like this on us next week..

Well Oklahoma city is under tornado warning like other cities really hope everyone is ok.....

if i die in this tornado .. just know ima miss y'all.

El Reno, Oklahoma Tornado
Pray for Oklahoma... I'm safe and I'm headed back into Moore to help. Anybody who wants to join shoot me a text
Damn.... Another tornado. #prayforoklahoma
Aww hail. Here comes the hail.
I hate tornado season.
My heart breaks hearing that a mother and child have already been killed from this storm. #PrayForOklahoma
the storm chaser is swerving through the highway right now
Here comes the disaster
Damn its getting hit in Moore again
Everybody I'm texting asked me why I'm scarred of the tornado.

A.3 Southern California Flash Flood

Southern California Flash Flood
#MentalHealth Commission to examine flood toll. http://t.co/p63XNw5pcO @abcnews
87F at 00:46 and 109-115F during the day and we've got issued with a flood warning. Go figure.
a flash flood warning in the middle of the desert between LA and Vegas and traffic is at a… http://t.co/z0GzzKanUc
Exactly where is the flood
Flash flood #liverweet #evacuateMovieTheater http://t.co/16327EHHNQ
flash flood amber alerts :(
Flash flood on my tv guys!!!! http://t.co/zau8u6A3vN
Flash flood warning #palmsprings #coachellavalley @MyDesert
Flash flood warning
Flash flood warning in PS..we about to get downpoured and I have a showing. Doh. #palmsprings http://t.co/3E9AW8w0jA
Flash flood warning in Southern California #ok
Flash flood warning issued in county: The National Weather Service has issued a flash flood warning for the... http://t.co/kIQKgISe6b
flash flood warning please get off my TV screen.
Flash flood warning? K.
Flash flood warning. What desert? #vscocam @ Ace Hotel & Swim Club http://t.co/Eq2Guj0gLZ

Southern California Flash Flood
Flash flood warning
Flash flood warnings all day. I'm going to board that flood like a boss.
Flash flood warnings during this weather pisses me off
Flash flood watch for valley, mountain and desert areas: A flash flood watch was scheduled for most of San Diego... http://t.co/YwN5ZZkKeh
Flash flood watch scheduled for SD Co.: A flash flood watch was scheduled for most of San Diego County Monday, a... http://t.co/U23NAnGz6W
Flash flood?
F### this flash flood warning s$$$!! It's so annoying!
I hate flash flood warning! S$$$tt I'm trying to watch my show!!
I keep getting these flash flood warnings, but no flash flood
I want to punch the person who keeps sending the flash flood warning !!!
I was stuck here in Laughlin, Nevada for 3 hrs in a stupid ass flood -.- cool experience tho :b
No flood here. Ayeeee http://t.co/lKtihPe0bG
Not cool #brawley #storm #flood @ City of Brawley http://t.co/cXOddVt67U
Oh crap its flooding bad out here. Just saw a 2 fire engines, a battalion chief, a medic unit and a repair unit rush down the road.
San Diego braces for another round of wild weather: A flash flood watch was scheduled for most of San Diego... http://t.co/4akpXhPAer
Seen a flash flood warning lil while ago
Soooo tired of these flash flood warnings on my phone
Stupid flash flood warning ruined my tv show -.- t
the flash flood warning scared me
The flood in Indio hella crazy
These flash flood warning are fcking annoying & creepy lol
These flood warning alerts
This flash flood warning scared the f### out of me. http://t.co/kTsD5AU67W
Those flash flood warnings are always bulls$$$
We've had like seven flash flood warnings these past two weeks & NO FREAKIN RAIN
Wish I'd was here to see the flash flood here. @ Santa Rosa Mountains http://t.co/2z1GWIf2pS
Flash Flood say what?
Hmmm should I still clean outside? Flash Flood Warning!! #Yuma @ Fry's #107 Fuel Center

Southern California Flash Flood
http://t.co/6ZEGodmXAh
San Bernardino And Riverside County Valleys - The Inland Empire Flash Flood Watch in effect until 8PM PDT MON http://t.co/h9S9TG5fh7
FLASH FLOOD WARNING.
F### YOU NATIONAL FLOOD WARNING
THIS FLASH FLOOD IS STRAIGHT NUTTY
The flash flood warning kept popping up on my phone & scared me every time
On s$$$ we are under flood alert!! An I the only one who got this message?!!!
Another flash flood warning? Uh ohh I hope there isn't any more thunder storms
Hopefully we have a thunder storm so the school could flood hahahahaha
Flash flood warnings in the desert are no joke!!! We're driving through a river and about to run out… http://t.co/ZIHZJlt3YQ
Saved a bird and helped push a stalled car out of a flood. Two good deeds in one day and my car is the one that overheats and leaks
Flash flood? Ain't it gotta rain for that?
When these s$$$ go off like Wtf ain't nobody got time foe your flood s$$$ http://t.co/cNrnkHPuwj
whats up with these flash flood warnings
As hot and sunny as it is outside im gettin more flash flood warnings TF
Yall stay lyin we ain't having no flood
Flash flood warning on my tv isn't letting me keep up with the kardashians
Why am I getting a Flash Flood Warning? In this place with this kind of heat? I'm praying there'll be a flood.
THIS COMBINATION OF SONGS. FLOOD WARNINGS RIGHT NOW.
THIS STUPID ASS FLOOD WARNING JUST RUINED MY WHOLE SHOW GO AWAY OMFG

A.4 Alamo, California Gas Leak

Alamo, California Gas Leak
"emergency evacuation everyone leave yoir hones and travel south" me: no
@KyHill21 it's in Alamo. There's a gas leak on Danville blvd which is the Main Street used for commuting
@ryantacconi2 I'm going to your house your safe from the gas leak I don't wanna die
a gas leak will probably kill everyone in the US! #lynetteispanicing☺

Alamo, California Gas Leak
All these Danville people running around looking like chickens with their heads cut off
Breaking news: the people of Danville and Alamo have paid to have the gas leak explode somewhere else
Gas leak in Danville and my sisters stranded home alone my prayers have been answered #jk #kinda
Kudos to @Safeway for distributing Free water during the #Alamo gas leak
Never have I ever been so scared to get out of the car at a gas station than I am in Oakland.
Of course I am in Alamo and my phone starts making sounds like a bomb was about to go off I check my phone and there is a evacuation alert!
Omg gas leak in Alamo! Omg quick flee to Danville omg tweet about it at the same time ahhhhh
Powers out, there's a gas leak, and worst of all my dog just pooped in the house. I think it's the apocalypse
woke up to an empty house and a bunch of alerts to evacuate Danville...uh...where's my family
You people in the bubble wouldn't last a minute in the ghetto, given the reaction to this gas leak.
####Alamo Pintado Rd , Solvang * Gas Leak Outside * 34623910 - 120117898 * FSBC130007408 * E30
Gas leak in Alamo, CoCo County, traffic control in effect at Stone Valley Rd at Danville Blvd and Jackson at Danville Blvd, avoid area
Alamo: Danville Blvd at Stone Valley Rd closed due to possible gas leak
@KjHolleschau it's cause of the gas leak in Alamo pic.twitter.com/mzGZHi71t7
The alert is because there's a gas leak in Alamo.
SIGALERT: Alamo: Danville Blvd closed between Stone Valley & Jackson due to gas leak. Stone Valley ramps from 680 also closed.
Possible gas leak...RT @cococws: Evacuation for portions of Alamo(31) (http://www.cococws.us)
Whoa, Contra Costa folks there's an evacuation being ordered. Gas leak along Alamo blvd sounds like.
Apparently there is a huge gas leak in #Alamo and the entire area is being evacuated.... http://instagram.com/p/cKNfp2KAWn/
Fat gas leak Danville blvd evacuate Alamo hide your kids
Contra Costa County Sheriff's have issued evacuation for parts of Alamo due to gas leak in area along Danville Blvd. http://bit.ly/kcbslive
@RhymesWithReady Apparently, there's a gas leak in Alamo and they're evacuating a pretty wide area
Evacuation Immediate due to gas leak near Alamo. http://1.usa.gov/18Dfjpv #cawx #contracosta
The Danville Bubble is keeping me safe from the Alamo gas leak.

Alamo, California Gas Leak
Gas leak in Alamo, CoCo County, traffic control at Stone Valley Rd at Danville Blvd and Jackson at Danville Blvd. RT @chp_goldengate
Alamo evacuation for a gas leak on Danville blvd and my family and I are the only ones left on our street- go erickson family
Residents on Alamo Square Drive in Alama ordered to evacuate. @srvfpd_fires confirms gas leak. Story developing
Great I'm being forced to evacuate my house from a gas leak in Alamo....
#UPDATE: @PG&E says 3rd party contractor's crew hit #Alamo gas main with backhoe; nearby businesses evacuated http://bit.ly/18DfYai
EMERGENCY, evacuation in Contra Costa county, CA Alamo to leave immediately , Gas leak, turn off gas b4 leaving, Animals,leashed or caged.RT
Y 4 the whole county? RT @KCBSNews: Contra Costa County Sheriff's issued evacuation Alamo gas leak Danville Blvd http://bit.ly/kcbslive
ALERT: Contra Costa County Sheriff's have issued evacuation for parts of Alamo due to gas leak in area along Danville Blvd.
Gas leak on Danville Blvd. An immediate evacuation has been ordered for portions of Alamo, Contra Costa County http://www.google.org/publicalerts/alert?aid=7339194caf2078fb&hl=en&gl=US&source=web …
Damn, Alamo had a gas leak and they had to evacuate the whole city!
#Alamo #Gas Leak: A 3rd-party (non-PG&E) crew struck a gas main; PG&E crews are on scene working 2 repair/make scene safe.
Wanted to let everyone know about the gas leak in Alamo. Stay safe! http://fb.me/1RdneP6jG
Gas leak in #Alamo forces businesses, homes to evacuate-people asked to avoid area, stay off phones http://bit.ly/1bO2FnL @CCTimes @3rdERH
Woah! Reports that Alamo & Danville, CA were evacuated for a GAS LEAK & now ALL of Contra Costa County is supposed to stay indoors!!
Gas leak forces evacuations of Alamo shopping center
This is what I know up to the moment regarding the gas leak in Alamo. BTW, repairs will take time. http://bit.ly/145gJjN @CCTimes
#Alamo Gas Leak Update: @PGE4Me crews are working as quickly as possible to safely stop the flow of gas, and will remain 2 complete repairs
Suspicious gas leak in Alamo... pic.twitter.com/npslSX3D7h
Alamo Gas Leak Update: The leak was caused by a backhoe! Still no word on when roads will reopen. http://fb.me/2H50ZpCTk
VIDEO: Resident carries her pet cat Sabi one mile home in blazing heat during Alamo gas leak.

Alamo, California Gas Leak
PG&E crews worked for 4.5 hours to stop a gas leak which caused evacuations of businesses and residents in Alamo: http://abc7ne.ws/592aj
SHERIFF'S OFFICE: Technical Glitch Caused Countywide Evacuation Orders for Alamo Gas Leak http://tinyurl.com/kdf4wry

A.5 Hurricane Sandy

Hurricane Sandy
Mailbox just blew off house #sandy
Three houses burned to the ground during the storm.
sandy violated nyc 16 people dead...train flooded and tunnel ...sheesh
Congratulations #sandy, my car is now flooded too :(
Death toll now up to 96 from #Sandy. #RIP to the beautiful souls.
Hurricane Sandy Killed the Jersey Shore Boardwalk... :(
#poweroff like 4 hours ago so bored stpid#HurricaneSandy
I'm at Frankenstorm Apocalypse 2012 - Hurricane Sandy (Boston, MA) w/ 442 others
#Sandy go home pls that is it !!!
#Sandy go home! This is supposed to be a time for me and hubby to enjoy surroundings not struggle with hurricane... :(
#sandy go the f### home already ! Jersey is tired of your ass!
Crossing Into powerless part of manhattan. No 3G! May not be able to tweet #Sandy #firstworldproblems
Crossing my fingers that this massive storm doesn't cause another blackout like the one this summer
Cruise is cancelled due to Hurricane Sandy.
Cruising around jersey...doesn't look too good #HurricaneSandy
Cruising out into this "storm".. Maybe this is the only way to blow my car up #destiny
Crushed car...tree just missed that house ... hurricane Sandy u bitch u ..lol @ NEW YORK
Damn this storm is gonna be the real deal…
Damn this storm is no joke, people stop complaining about how cold or how wet you are because these people are losing everything
Hurricanes are expensive. #justsayin
Deutschland bank in front of us has extra power supply and some rooms have light, but it is sadly empty #Sandy

Hurricane Sandy
Devastated about #Sandy. This motherf-er went through my brother and sister-in-laws bedroom window
devastated. the only place i ever felt at home is no more. i feel like the rug was pulled out from beneath me. #njsandy #sandy #seasidepark
Devastating hurricane last week and now a nor'easter snow storm this week??? IT REALLY IS THE END OF DAYS!!!
Devastation on Staten Island. Just helped a church member clean out his entire family owned store. Nothing was salvageable. #Sandy
Devestation of #Frankenstorm #Sandy is the new norm w/ no power/heat still 2 teenaged girls doorbelled us for GOP
heart breaking to watch what's going on in new jersey #sandy.. I think its way bigger than people think #jerseyshore4life
Heart goes out to all the people trying to put their lives back together #sandy
heart goes out to all without power on East Coast tonight. its cold out there, stay warm. weather man says another storm is coming #Sandy
Heart goes out to those rocked by #Sandy...
Heart goes out to those whose life has been changed by Sandy.Our support will be ongoing! OUR CHINS ARE UP FOR YOU.
Heart goes out too NY still suffering frm tht hurricane : (
Hope everybody listen to the warnings and stays safe and we all rise this storm out
Hope everybody made it safe thru Sandy we are all good on my end.God Bless
Hope everybody made it through the storm OK. See you next week!
Hope everybody stays safe with this hurricane that's about to hit!
Hurricane Sandy is not a joke. Wonder whats going to be left?? Heard the OC music pier is gone.
Hurricane sandy is not doing not anything big cause we still got school tomorrow -,-
Hurricane Sandy is not even going to be that bad!!...right?
Hurricane Sandy is not f###ing around. This is serious people. @ New York City
Wow #hurricanesandy truly did destroy my house...
Wow #sandy do you really need to be 800 miles wide?
Wow #Sandy is beating the side of my window really hard. It sounds like the glass is gonna break
wow #sandy is intense...prob the worst thing I have been through. Not gunna lie kinda scared
Wow #sandy whhat did u do to us
WOW #Sandy you really hit us f###ing hard...

Hurricane Sandy
Wow 5.3 million people has no power except me! Hurricane may hit 3 billion dollars damage! Its first billion dollars hurricane!
Wow after hitting Jersey this hurricane has scattered hair gel and tank tops all the way up to Brooklyn #Sandy #Douchey
Wow after the sandy hits were suppose to get a blizzard FOH
Wow all subways and buses are going to be suspended starting 7pm tonight bc of the storm. That's some crazy stuff.