

Extending Psychophysics Methods to Evaluating Potential Social Anxiety Factors in Face of Terrorism

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Abstract

Objective: There is an urgent need to develop tools to effectively measure the impact of psychological responses consequent a terror attack or threat. There is also a need to understand the impact both the personal preparedness of each citizen, and acts of counter terrorism by governments. This paper addresses the question 'how to create a database of the citizen's mind about anxiety-provoking situations in the face of terrorism'.

Approach: The approach is grounded in a combination of experimental design, psychophysics, as a branch of psychology and consumer research. The theoretical foundation is illustrated using a set of fifteen empirical studies using conjoint analysis, which help uncover how people respond to anxiety-provoking situations. The approach identifies the mindset towards terrorism at the level of the individual respondent. This study identifies critical drivers of anxiety; the specific terrorist act; the location of the act; the feelings and the proposed remedies to reduce anxiety.

Results: By exploring responses embedded in a general study of 'dealing with anxiety provoking situations', the study uncovers the 'algebra of the individual respondent's mind; how important the basic fear of terrorism actually is, how important it is to specify the type of terrorism (bombing versus contamination of the food supply), and how fears of terrorism are structured.

Discussion: The outcome of this study is the formation of an empirical dataset which provides a framework for a sub-discipline in social sciences. We examined the problems from three perspectives: as a scientist - to understand general patterns; as an engineer - to solve a specific problem and as a clinical psychologist – both at the level of a single individual (idiographic) and at the level of the general population (nomothetic).

Keywords: Anxiety; Terror; Coping; Psycho-physics; Conjoint analysis

Introduction

In view of the increase in terror attacks, researchers have been studying the perception of terror threats world-wide since 9/11. Gender, benevolence values and normative influences are related to threat perception. The sense of personal threat correlates with increased contact with friends and family [1]. Furthermore, age, gender, location, and the values of openness to change and hedonism related to threat perception, which, in turn, predicted behavioral change and relationship contact.

Social psychologists play an important role in explicating responses to threats of terror [2-4], studied anxiety about terrorism and the search for measures which allay this anxiety. Residents of New York City-women, young adults and people who recently immigrated into the U.S. experienced higher anxiety about the 9/11 attack. This anxiety was positively related to the amount of hours watching TV news about the attack. There was also a positive relationship between hostility toward the perpetrators, TV watching, and anxiety. Maladaptive coping strategies and TV watching explained considerably more variance on anxiety than did demographics. Income, religion, education, and ethnicity did not have an effect on anxiety [5].

People are vitally interested in what their government does to protect them in the face of terrorism [4]. Tanielian TL and Stein BD [6] reported that individual responses to collective threats may undermine the effectiveness of government policies to address such threats. Solomon Z et al. [7] wrote that there is an urgent need to develop effective tools to measure the impact of psychological, social and political responses to terror attacks. These responses range from the consequence of a threat or actual attack, through personal preparedness of each citizen

(e.g., behavioral and social procedures), to acts of counterterrorism by governments (e.g., new security institutions).

Whereas the U.S government, and many other authorities around the world have undertaken unprecedented efforts to increase the ability to respond to terrorism, little has been done to focus on effective interventions to cope with terror threats or terror on the individual level. There are some notable results. For example, although adolescents reported employing more avoidance focused coping behaviors, it was primarily the use of emotion-focused coping behaviors which predicted responses to stress [8]. Problem-focused coping did not alleviate stress reactions.

A number of studies have examined coping behaviors following terrorism. Studies of the impact of September 11 (the terrorist attacks in the USA in 2001) found that both people who experienced the attack directly [9] and those who experienced it indirectly, such as through the media [10,11], showed elevated levels of distress, lowered sense of security, and pathological reactions such as post-traumatic stress disorder (PTSD) and depression. Studies carried out in Spain [12],

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France [13,14], Ireland [15], Algeria [16], Sri Lanka [17], Australia [18], Guatemala [19], Japan [20], Britain [21] and Israel [22] similarly point to the psychological impact of exposure to terror.

There is also an almost complete absence of evaluation research on counter-terrorism strategies. Lum C et al. [23] concluded that there is little scientific knowledge about the effectiveness of most counter-terrorism interventions. Some evaluated interventions either did not work, or occasionally actually increased the likelihood of terrorism and terrorism-related anxiety [23]. The findings of [23] dramatically emphasize the need for government leaders, policy makers, researchers, and funding agencies to evaluate the effectiveness of counter-terrorism programs in their agendas.

More of the research on terrorism and counter terrorism needs to be empirical and evaluative, using scientific principles and perhaps different methods, such as experimental design, where one can trace the relations between antecedent situations leading to anxiety, and actions leading to relief from that anxiety. This series of studies describes and quantifies the psychological consequences of terrorism and outlines response strategies for dealing with them. Such information adds to the existing knowledge and should prove useful for policy makers attempting to develop state and local response strategies.

Methods

The approach: Stimulus-response methods and psychophysical thinking

Despite their popularity, questionnaires are limited to the questions that are asked and entail a bias due to respondents' tendency to please the interviewer in a personal interview, or to be 'politically correct' either in the personal interview or in a paper/computer based interview. Rosenthal R [24] described the tendency to comply with requests of the interviewer as a well-known tendency in the social sciences literature. This tendency can lead to biased results, even when the respondent is not aware of such biases. Furthermore, in the absence of corroborating 'objective data,' respondents being the only source of data, the probability is higher that bias will mar the validity of the results. Ideally, the research should be 'interviewer-proof,' and 'bias-reducing.' And, most importantly, the respondent should not be able to 'game' the interview, by providing the thought to be appropriate answer.

An alternative way to examine issues of social policy is to use the methods which originate from physics and chemistry, and borrowed by experimental psychology. These methods go by the general rubric of 'stimulus-response' methods, whereas knowledge is defined as the ability to predict and even influence a specific action by knowing what aspects of the antecedent conditions to change.

The guiding principles of stimulus-response are taken from the logic of experimentation. For social sciences the ingoing belief is that the key learning comes from the pattern of responses to test stimuli. When the respondent is presented with a series of test stimuli and the ratings to these stimuli obtained, the key information becomes the relation between what the researcher presented and how the respondent scored the test stimuli. The respondent need not even be aware of the criteria underlying the scoring. The regularity of such patterns and the ability to uncover the underlying relations between variables and responses is what constitutes the science.

The application of stimulus-response thinking to the world of social science can be traced back a century and a half to the seminal thinking of psychophysics, the first branch of experimental psychology, and the

inspiration for the approaches discussed here. Psychophysics searches for orderly relations between what we perceive through our senses and the nature of the physical stimulus is the magnitude of that stimulus. The goal of psychophysics is to develop relations between variables. It is these relations which generate the substance of our knowledge about how we perceive stimuli, and transform those stimuli into subjective responses. Stevens SS [25] presents Psychophysics as informed by physics and chemistry, especially by the search for 'regularities' in nature as applicable to the issue at hand.

How does psychophysics fit with social policy?

The psychophysical way of thinking conceives of variables in experimental design as physical stimuli that are mixed and matched. Box GEP et al. [26] claim that at its very basic level, psychophysics can be viewed as an application of experimental design. Psychophysics thinks of the respondent as integrating information about the mixtures of stimuli, coming up with a response, which is deconstructed by statistics to examine the contribution of the individual components. Transferring such thinking to the social sciences, social issues are treated as simple, stand-alone phrases, i.e., elements that can be mixed by a schematic, the experimental design to create test combinations, the stimuli.

These combinations are presented to respondents, who assign ratings according to specific criteria, e.g., judged anxiety. We search for the contribution of each element, i.e., each individual variable. For the topic of social issues studied here, the test elements either appear or do not appear in a combination, a so-called test vignette. In this specific situation, where the variables are integer, absent or present, the application of psychophysical thinking and experimental design is known as conjoint analysis. The objective of conjoint analysis, this experimental design using absence/presence of elements, is to measure the contribution of each individual element by knowing the response to the mixture.

Despite the apparent limitation of conjoint analysis, working with a binary state of every element, absent or present, conjoint measurement has found application in the social sciences because it can deal with messaging, ideas that are either absent or present, without any in-between. Moskowitz HR et al.; Moskowitz HR and Gofman A [27,28] demonstrated early conjoint analysis approaches to public policy. The approach [29] described first identifies the raw materials to be studied, which in the case of public policy comprises relatively single-minded, stand-alone phrases dealing with the different facets of a social issue. These phrases are as assigned to one of a number of alternative categories. Each category comprises like-minded ideas, which may differ qualitatively in what they convey, but can be considered as alternatives. For purposes of the experiment itself the respondent is exposed to and evaluates combinations, test vignettes or concepts, compound stimuli that more typically resemble the compound stimuli of nature. The experimental design dictates these combinations, which are not random, but rather constructed according to strict mathematical principles.

The ideas are mixed and matched by experimental design to create combinations of ideas. The ideas appear independently of each other in a statistical sense, although it is hard for a respondent to discern the underlying design. The respondent rates the combination, i.e., the test concept, on a scale. The ratings are then analyzed to show the number of scale points contributed by each component.

The Samples and experimentation designs of terrorism-based anxiety

The terrorism study was one of 15 different studies run as part of

the 'Deal With It!' database. Each of the 15 studies was constructed in the same way:

1. A study comprised four categories, or unifying idea, each category containing nine elements
2. Each respondent evaluated 60 combinations created from the elements, with a combination or test vignette comprising 2-4 elements, at most one element from a category, but sometimes no elements from a category.
3. The 60 vignettes for a given individual were created by experimental design, with the property that the 36 elements were statistically independent of each other, and each element appeared exactly five times.

The data were all analyzed in the same way

4. The responses of a given individual on the anchored 9-point scale were transformed to a binary scale, with ratings of 1-6 transformed to 0, and ratings of 7-9 transformed to 100. Thus analysis worked with two dependent variables, the original 9-point rating (PER variable), and the newly created binary variable (INT).
5. Each rating, from each respondent, whether the PER or the INT value, was further slightly transformed by the addition of a random number around 10-5. The random number ensured that the subsequent regression would not 'crash.'
6. The basic experimental design was permuted, to create a set of 300 parallel experimental designs, each with the properties of statistical independence of elements, number of times each element appear remaining at five across the 60 vignettes, and each silo comprising the same elements. This permutation strategy allowed the study to cover a wide range of different vignettes across the respondents, not just 48 carefully chosen vignettes.
7. The ratings for each respondent were analyzed using OLS (ordinary least-squares) regression, which enables the coefficients and additive constant to be interpretable. The two basic equations created, the PER model and the INT model (terms of convenience), can be expressed as: $\text{Rating} = k_0 + k_1(\text{Element A1}) + k_2(\text{Element A2}) \dots k_{36}(\text{Element D9})$. Although it is customary to run logit models on such data, the experience of thousands of such studies suggests that the conclusions are the same whether logit or OLS regression are run, and that the underlying interpretation of the results is far easier with OLS regression [30].
8. The PER model, i.e., with the dependent variable being the actual 9-point rating value, generates 37 terms, the additive constant, and 36 impact values or coefficients. The 36 impact values generate a 'vector' of numbers for each respondent. The set of vectors, 36 numbers for each respondent, is subject to cluster analysis to pull a set of mutually exclusive and exhaustive groups, mind-set segments, of individuals who show similar responses to the elements. The two criteria for accepting a segmentation (based on Euclidean distance) are parsimony (fewer segments are better than more segments), and interpretability (the strongest performing elements for each segment must 'tell a coherent story').

9. For all key groups, such as total panel, gender, age, mind-set segments, and so forth, the relevant respondent data were used to compute the average value on all 37 parameters of the INT Model, the model using the binary 0/100 values as the dependent. Thus the clustering was done using the PER model, but all data reported is based on the INT model, the binary model.

Executing the study with the panel respondents

Respondents of this study, who lived in the continental U.S were invited by email to participate in a panel of an e-solutions specialist, Open Venue Ltd., Toronto, Canada. The email simply told the respondents that they would be participating in a study on attitudes and current day issues. The respondents who clicked on the embedded link were led to a 'wall' of available studies. The actual studies were either available or hidden. When a study was made unavailable the respondent would never know that the study even existed. Through this stratagem it was possible to attract at least 100 respondents per study, since the more popular studies were filled quickly, and could then be hidden from view. Studies dealing with anxiety are in some ways intrinsically frightening because they address unpleasant issues. Unlike traditional consumer research studies dealing with food, with shopping, and the like, studies in the Deal with It!™ database, focusing on anxiety-producing topics, clearly addressed these unpleasant issues that people would rather forget.

The heart of the study is the aforementioned set of different experimentally designed concepts, which comprise the different statements from the study, mixed and matched to create vignettes. The statements for terrorism were selected to range from relatively light to severe. We see the range in Table 1, which also contains the utilities of the statements for the Total Panel along with subgroups for gender and age, respectively. The utility values are the coefficients from the INT model, i.e., estimated by OLS regression after the rating scale was transformed from the original 1-9 anchored scale to a binary 0/100 transform.

The INT model itself can be deconstructed into the additive constant and the 36 coefficients or utility values.

1. The additive constant, k_0 , is the estimate percent of respondents who would assign a test vignette the value 7-9 in the absence of elements. All vignettes comprised elements, so the additive constant is a purely estimated parameter. It can be viewed as a baseline value, e.g., of free-floating anxiety, not attached to any element.
2. Each coefficient tells us the additive conditional probability of anxiety being increased, i.e., the vignette rated 7-9, when the element is incorporated into a vignette.
3. The system is additive, beginning with the additive constant, which is incremented with the addition of elements having positive utilities, or decremented with the addition of element having negative utilities.

Previous studies in a host of different topic areas suggest that elements showing utilities above +15 as extremely strong drivers of responses (here anxiety); utility values above +10 as strong drivers, utility values above +5 as drivers, and utility values from 0-5 as irrelevant. We should look at all statements with utility values below 0 as *reducers of anxiety*.

		Total	Gender		Age			
			Male	Female	31-40	41-50	51-60	61-75
	<i>Base size</i>	121	28	93	21	42	37	16
	<i>Additive constant</i>	44	38	46	37	47	44	45
Category #1 – Threats								
A3	A bomb under your car...	15	14	16	21	16	12	11
A9	A dirty nuclear bomb set off ...	15	15	16	22	15	12	10
A4	Bombs blowing up in the middle of a building...	12	7	13	18	12	8	5
A7	A deadly disease like smallpox or anthrax let loose...	10	7	11	17	13	5	3
A6	Contamination of the food supply...	9	6	10	16	10	5	5
A5	Fire raging through a building...	6	1	7	12	5	4	0
A2	A bomb threat for a building that is a false alarm...	1	0	2	7	-1	-1	-1
A1	The media talking about potential terrorism acts...	0	-1	1	3	-2	0	2
A8	A Computer virus let loose that impacts your everyday businesses...	-2	-1	-2	1	-4	-2	1
Category #2 – Location and target of the terrorism								
B3	An area crowded with children...	3	3	3	2	5	2	1
B9	During a Red alert...	3	3	3	5	3	2	4
B2	In a heavily populated area...	2	2	2	1	3	1	1
B5	An area filled with tourists...	2	0	2	2	3	-1	3
B6	You never expected it to happen to you or someone close to you...	2	2	2	2	1	2	1
B4	An area crowded with senior citizens...	1	3	0	1	1	3	-3
B7	During a Yellow alert...	1	-4	2	1	1	-1	0
B8	During an Orange alert...	1	1	1	2	1	-2	2
B1	In a non- populated area...	-2	-4	-1	-1	-2	-3	-1
Category #3 – How you respond to the threat								
C6	All the stress just builds up... you feel overwhelmed	3	1	3	5	3	3	0
C7	You experience temporary memory loss because there's just too much to take in...	2	3	2	7	0	5	3
C2	When you think about it, you just can't stop...	2	-1	3	3	2	2	4
C5	You experience it in all your senses...	2	0	3	5	1	3	-6
C4	You are scared ... inside and out	1	4	1	3	1	2	-4
C1	You think about it when you are all alone...and you feel so helpless	1	-1	2	8	0	-1	-1
C9	At a turning point in your life...	1	1	1	3	0	1	-3
C8	Family and Friends play a big role in your life...	0	1	0	0	-1	1	-3
C3	You'd drive any distance to get away from it...	0	-3	1	1	-1	1	-5
Category #4 – What might relieve the anxiety								
D2	You believe that international cooperation in the United Nations will keep you safe	13	21	11	8	11	19	16
D3	You think United Nations Forces will keep you safe	12	21	10	8	9	19	13
D5	You believe that the Center for Disease Control will keep you safe	8	10	7	6	6	10	11
D4	You believe that Homeland Defense will keep you safe	7	10	6	5	7	8	11
D7	You think that your Local hospital will keep you safe	6	7	5	2	6	6	11
D6	You think that your Local police will keep you safe	6	7	5	6	5	4	8
D8	The media will keep you informed	-3	-1	-3	0	-2	-3	-10
D9	You need to contact your friends and family to make sure they are OK...	-6	-5	-7	-13	-3	-9	-5
D1	You trust that God will keep you safe	-7	4	-10	-15	-9	-1	-4

* Strong performing statements with utilities of 10 or greater are shown in bold; strong negative statements (-5 or less) are shown in bold italics.

Table 1: Utility values for the 36 statements by total panel, two genders, and four age groups*.

Results

How and what do the data reveal using experimental design and self-profiling?

The distribution of additive constants applied to the data from the Total Panel across statements and within the same category statement across the different subgroups and is presented in Table 1.

1. The base sizes are different. There are about three times as many females as males participating, which the authors have found consistent with other studies of this type. Males tend to shy away from these Internet-studies, and indeed market researchers have found that for many studies it is easier to recruit women to participate than men.
2. There is an inverted U shaped curve for the base sizes, looking

at age versus frequency. The most number of respondents are 41-60 years old, with correspondingly lower numbers of respondents aged 31-40 or 61-75.

3. The additive constant differs by gender and by age.
4. Figure 1 demonstrates the distribution of the additive or baseline constant for the respondents. The abscissa has been truncated to the range -100 to +100, so that some of the respondents lying slightly outside the range do not appear in this distribution. Baselines above 0 suggest a free floating anxiety about terrorism; baselines above 50 suggest a much stronger free floating anxiety. Baselines lower than 0 suggest little free floating anxiety. More than two thirds of the respondents appear to have free-floating anxiety regarding terrorism. We see this fact by looking at the

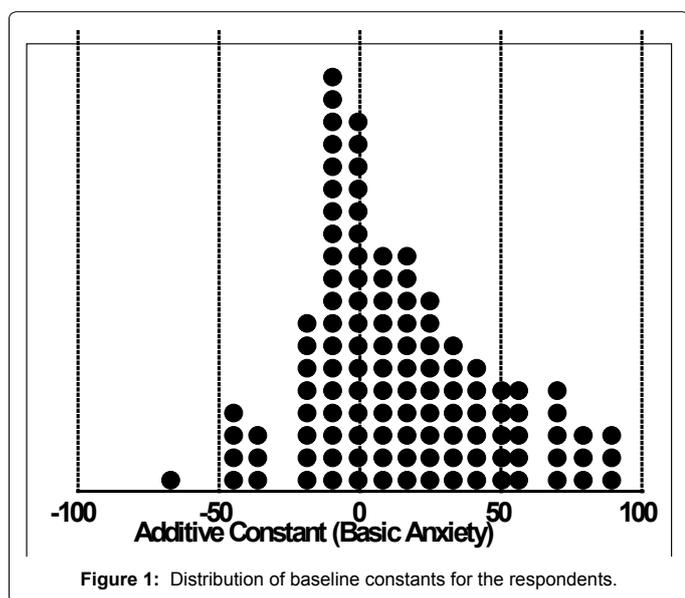


Figure 1: Distribution of baseline constants for the respondents.

distribution of the additive constant in Figure 1 across the 121 respondents. Although the respondents were not directly asked about such free-floating, low visibility anxiety, the additive constant shows the expected level of anxiety in the absence of elements.

We learn more when we look at the actual elements themselves. The data are rich, enabling a deep understanding for either the total panel or for any key subgroup with sufficient number of respondents. To get a sense of what can be learned, we now look for a moment at variations in utility traceable to where the respondent lives (Table 2). The average utility for the first category (threats) is much higher for individuals who live in an urban area (+11) than it is for individuals who live in a rural area (+6). Individuals in the urban area are simply more anxious when they read about various possible ‘threats.’

Mind-sets: Beyond the total panel and standard grouping of people

At deeper level beyond dividing respondents by standard criteria, one can divide respondents by the pattern of their 36 utilities, using cluster analysis, and the 36 coefficients of the PER model, whose dependent variable is the 9-point rating scale. Clustering by patterns of responses, with these clusters parsimonious (the fewer the better) and interpretable (the clusters are homogeneous with respect to what makes them anxious) opens up a new way to understand differences across groups. Now we have differences due to mind-sets for a particular topic, the basis for what Moskowitz and colleagues have called ‘Mind Genomics’ [27].

The dramatic differences emerging from the clustering appear in Figure 2. Figure 2 presents scatterplots of the 36 utilities. Each filled circle corresponds to one of the 36 elements. The scatterplot of the matched groups shows a more or less 45 degree line for gender, and a less easy to interpret results when we plot the utilities of the two segments which emerge from cluster. The left panel shows the scatterplot directed by gender. There are a few random-looking differences across the two

Text		City/ Urban	City/ Suburban	Midsize Suburban	Small Suburban	Rural
Mean by category						
	Category #1 – Threats	11	9	8	6	6
	Category #2 – Location and Target of terrorism	4	1	0	1	2
	Category #3 – How you respond to the threat	3	3	1	1	1
	Category #4 – What might relieve the anxiety	1	5	2	2	9
Utility values of statements in category #4 (presumed anxiety relievers) ... statements that actually relieve stated anxiety						
D9	You need to contact your friends and family to make sure they are OK...	-10	-11	-8	-6	-1
D1	You trust that God will keep you safe	-3	-4	-1	-11	-13
Utility values of statements in category #4 (presumed anxiety relievers) ... statements that actually increase stated anxiety						
D2	You believe that international cooperation in the United Nations will keep you safe	2	15	7	13	22
D3	You think United Nations Forces will keep you safe	5	15	6	10	22
D4	You believe that Homeland Defense will keep you safe	3	6	6	6	15
D5	You believe that the Center for Disease Control will keep you safe	2	13	8	5	15
D6	You think that your Local police will keep you safe	2	8	1	4	13
D7	You think that your Local hospital will keep you safe	2	4	6	4	13

* Strong performing statements with utilities of 10 or greater are shown in bold; strong negative statements (-5 or less) are shown in bold italics.

Table 2: Average utility of statements by nature of the area in which a respondent lives, and the utility values for individual statements of Category 4.

genders, but these differences are rather small. The right panel shows the scatterplot directed by clustering and segmentation, based in turn on dividing the respondents into two groups whose patterns of utilities are most different from each other.

The best way to describe the segments is to see which specific statements do best for each segment (Table 3). Table 3 presents most anxiety producing statements for the total panel, and for the two concept-response segments. The most anxiety producing statements for each group (“agitating messages”) are shown in bold. The least anxiety producing statements for each group (“calming messages”) are shown in italics.

Strongest statements for Segment 1 - Anxiety from outside contact with a government agency (national or international)

Strongest statements for Segment 2 - Anxiety from actual terrorist acts

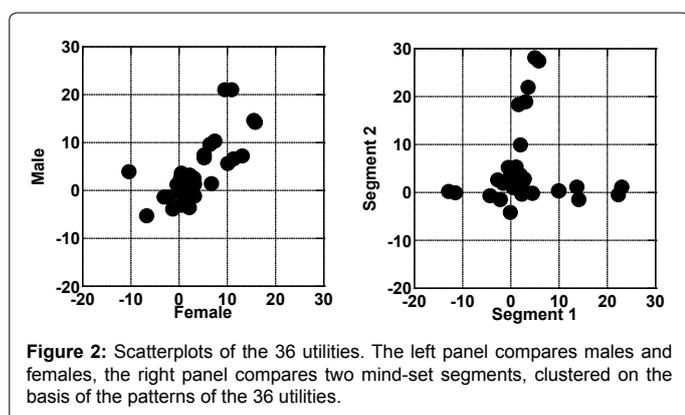


Figure 2: Scatterplots of the 36 utilities. The left panel compares males and females, the right panel compares two mind-set segments, clustered on the basis of the patterns of the 36 utilities.

Looking at individuals – the power of individual-level modeling

The analysis suggests that there is a hierarchy of terrorist incidents in terms of anxiety, and a relatively poorly defined set of actions that a government can do in order to reduce the anxiety. *Indeed, when presented in vignettes, many of these so-called ‘remedies’ to reduce anxiety in fact increase anxiety.* Respondents, not knowing that they should feel less anxious, actually say that the inclusion of these remedies make them feel even more anxious.

Analyzing individual-level data allows us to see which individuals are sensitive to specific terrorist actions, and to what specific communications, if any, these individuals respond. Since the regression modeling was done at the individual level, we can now look at the individual data in the following way:

1. The second category (where terrorism occurs/among whom) and third category (response to the threat) are both irrelevant (the respondents did not react strongly to either of them).
2. We will consider only utilities to the first category (terror incidents), and at the fourth category (presumed remedies).
 b). Classify each person as ‘anxiety-prone’ for a specific terrorism incident (category #1) if the utility for the incident from the INT model for that respondent exceeds a certain criterion value. Empirically, we choose the utility of +10, a strong level of incremental anxiety. Any other cut-off can do as well; the +10 is simply an arbitrary threshold. If the person shows a utility > +10 for that terrorism incident, then classify the person as ‘1’, i.e., the person is demonstrably anxious. If the person shows a utility < +10 for that terrorism incident, then classify the person as ‘0’ denoting the fact that the incident is not anxiety provoking, i.e., the person may

EL	Text	Tot	Seg 1	Seg 2
Strongest statements for Total panel				
A3	A bomb under your car...	15	6	27
A9	A dirty nuclear bomb set off ...	15	5	28
D2	You believe that international cooperation in the United Nations will keep you safe	13	23	1
D3	You think United Nations Forces will keep you safe	12	22	-1
A4	Bombs blowing up in the middle of a building...	12	4	22
A7	A deadly disease like smallpox or anthrax let loose...	10	3	19
D1	<i>You trust that God will keep you safe</i>	-7	-13	0
Strongest statements for Segment 1 - Anxiety from outside contact with a government agency (national or international)				
D2	You believe that international cooperation in the United Nations will keep you safe	13	23	1
D3	You think United Nations Forces will keep you safe	12	22	-1
D4	You believe that Homeland Defense will keep you safe	7	14	-2
D5	You believe that the Center for Disease Control will keep you safe	8	14	1
D7	You think that your Local hospital will keep you safe	6	10	0
D9	<i>You need to contact your friends and family to make sure they are OK...</i>	-6	-12	0
D1	<i>You trust that God will keep you safe</i>	-7	-13	0
Strongest statements for Segment 2 - Anxiety from actual terrorist acts				
A9	A dirty nuclear bomb set off ...	15	5	28
A3	A bomb under your car...	15	6	27
A4	Bombs blowing up in the middle of a building...	12	4	22
A7	A deadly disease like smallpox or anthrax let loose...	10	3	19
A6	Contamination of the food supply...	9	2	18
A8	<i>A Computer virus let loose that impacts your everyday businesses...</i>	-2	0	-4

Table 3: Strongest performing (most anxiety producing) statements for total panel, and for the two concept-response segments.

be anxious, but we deem the level of anxiety to be less than demonstrably so.

3. Step 2 generates a new matrix of 1's and 0's for each person, for the nine terrorism incidents. In fact, a person can be sensitive to some incidents, and not others.
4. Change the focus to the presumed 'remedies' listed in Category #4. However, the rules have to change for the re-coding. We are looking for those statements with utilities less than -10, which mean that the presence of the statement in a concept reduces anxiety. All utilities for this category across respondents with a value less than -10 are recoded as '1' to denote them as anxiety-relievers and the remaining utilities which are greater than -10 are recoded as 0.
5. With this new data set, comprising 1's and 0's, let's look at the correlation between the different terrorism incidents and their remedies. Can we discover combinations where the terrorism incident increases anxiety and the remedy decreases anxiety for that specific incident? We correlate nine terrorism incidents, coded 1 or 0, with nine remedies, coded 1 or 0 using the appropriate correlation statistic for 'binary data'.
6. When we look at the total panel many of the correlations are quite low, which makes sense since the respondents fall into two clear segments.
7. Segment 1 shows very low correlations, near 0, because they are not as responsive to terrorism situations. Furthermore, to respondents in Segment 1 the attempts at reducing anxiety do the opposite - they increase anxiety. Segment 2 is strongly responsive to the different terrorism events as anxiety-increasers (Table 4). The correlations greater than 0.30 are shaded; these are the combinations of terrorism incident and remedy where the remedy actually decreases anxiety in more than 30% of the cases.
8. Some terrorism incidents, such as a 'dirty bomb' or a 'car bomb',

can be addressed by government actions. Not all remedies work, but a number do. For these situations, either the terrorism incident is tractable, or perhaps so distant in the respondent's mind that there is no problem quelling the anxiety. Thus *just because a terrorism incident is perceived to cause a lot of anxiety (e.g., bombing) does not mean that this anxiety is intractable.* Table 3 suggests that the bombing causes the greatest anxiety, whereas Table 4 demonstrates, in turn, that the anxiety caused by the bombing can be reduced by many remedies.

9. However, some reasonably serious terrorism events, such as a contaminated food supply generate anxiety that can be only reduced by a limited number of government activities, such as a better local hospital.

Discussion

Lower response rates than those of traditional consumer studies (i.e., food, shopping) indicate that studies dealing with anxiety may be intrinsically frightening as they address unpleasant, threatening issues that are difficult to emotionally contain. This provides us with a sense of the relative 'anxiety' produced by this topic even ahead of the actual study through the completion rate analysis of how many respondents logged in to participate in the study versus the number of those who actually completed the survey. The degree of free-floating anxiety was evident in the total panel and varied across people.

Men were slightly less anxious than women. This validates findings of [22] who found that female contributed to higher anxiety and stress. Similarly to findings of [22] findings of this study showed heterogeneous responses. Younger respondents (ages 31-40) were slightly less anxious than older respondents (ages 41+). Most of the positive utilities occurred in the threats category. However, the threats were not all equally anxiety-provoking. The most threatening were "A bomb under your car" and "A dirty nuclear bomb set off". Both significantly increased anxiety. These two threats produce anxiety among all of the different groups. Most of the threats produced more anxiety among the younger respondents

	A dirty nuclear bomb set off ...	A bomb under your car...	Bombs blowing up in the middle of a building...	Contamination of the food supply...	A deadly disease like smallpox or anthrax let loose...	A bomb threat for a building that is a false alarm...	Fire raging through a building...	The media talking about potential terrorism acts...	A Computer virus let loose that impacts your everyday businesses...
Serious terrorism event ←=====→ Not serious event									
You believe that the Center for Disease Control will keep you safe	0.41	0.39	0.33	0.27	0.33	0.22	0.20	0.18	0.12
You think that your Local hospital will keep you safe	0.41	0.39	0.33	0.31	0.31	0.20	0.20	0.18	0.08
You believe that Homeland Defense will keep you safe	0.41	0.37	0.37	0.29	0.29	0.20	0.18	0.16	0.10
The media will keep you informed	0.41	0.37	0.33	0.29	0.24	0.27	0.18	0.14	0.12
You trust that God will keep you safe	0.39	0.33	0.33	0.24	0.29	0.20	0.20	0.20	0.08
You need to contact your friends and family to make sure they are OK...	0.41	0.35	0.31	0.31	0.29	0.14	0.12	0.16	0.12
You think that your Local police will keep you safe	0.37	0.33	0.31	0.27	0.20	0.16	0.14	0.14	0.08
You believe that international cooperation in the United Nations will keep you safe	0.37	0.33	0.29	0.24	0.20	0.16	0.12	0.14	0.14
You think United Nations Forces will keep you safe	0.27	0.29	0.20	0.20	0.20	0.12	0.10	0.12	0.04

*Shaded boxes show specific terrorism events whose ensuing anxiety can be ameliorated. The correlation was run only with the respondents in Segment 2, who showed anxiety resulting from specific terrorism acts.

Table 4: Correlation between different types of terrorism actions (columns) and anxiety reduction by remedies*.

than among the older respondents. However, the differences by age were not always the same. Older respondents were equally less anxious about all the threats. We see threats such as “Contaminated food supply” or “A fire raging through a building” far more threatening to younger respondents than to older respondents.

Some of these threats were seen as less probable by the older respondents than by the younger respondents, whereas all ages are exposed to news about bombings every day. Cyber threats were virtually irrelevant to respondents. The category of location and target of the terrorism was also virtually irrelevant for respondents. Location and those affected by terror was mostly informational. The category of responses to the threat was also virtually irrelevant. Category of anxiety alleviation was the most surprising. Statements intended to be anxiety-reducers, for example, in the United States the Center for Disease Control, a well-known government body, generated much anxiety by merely mentioning it in the vignette statements. Government related bodies generated substantial anxiety among the total panel, among males, and among respondents aged 51 and older.

While one might have thought that mentioning a government body would reduce anxiety, it increased it. The same deleterious effect of government bodies appeared when the vignette talked about the United Nations. It's primarily trust in God and in friends that reduced anxiety. Furthermore, trust in God and in friends worked more strongly to reduce the anxiety as experienced by the younger respondent than by the older respondent. This coincides with previous findings of [22] who found that a sense of social support contributed to anxiety and stress alleviation. Trust in God actually increased a man's anxiety, whereas it strongly decreased a woman's anxiety.

Rural respondents were most concerned about government intervention. Urban individuals were not particularly responsive to government intervention. The urban respondents feel much better when the message is about family. Specifically: “You need to contact your friends and family to make sure they are OK...” which was virtually irrelevant among rural respondents. The urban respondents feel indifferent when the utility talks about God, specifically: “You trust that God will keep you safe”. This was irrelevant among urban respondents but a very strong anxiety reliever among rural respondents.

Findings highlight the need to enhance the ability of individuals and societies to withstand the psychological stress of ongoing terror, especially as terror is becoming a worldwide affliction.

Findings suggest that self-confidence and abilities are not undermined by terror and may even be bolstered by it. External threat can indeed increase aspects of resiliency and sense of purpose but at the same time there seems to be some disparity between the respondents' optimism about their personal ability to cope and the sense of threat to themselves or to people close to them. This may reflect the human ability to compartmentalize.

Findings on societal concerns are also equivocal. On the one hand, respondents marked the terror attacks or the security situation as anxiety provoking yet the greatest concern with terrorism-related issues did not prevent respondents from being concerned by more mundane social problems. These findings suggest that, for all the tension created by the ongoing terrorism, people still invested energy in other concerns. It is possible that the tension created by terrorism threats augmented the distress about other matters. The analysis suggests that there is a hierarchy of terrorist incidents in terms of anxiety, and a relatively poorly defined set of actions that a government can do in order to reduce the anxiety. *Indeed, when presented in vignettes, many of these so-*

called 'remedies' to reduce anxiety in fact increase anxiety. Respondents, not knowing that they should feel less anxious, actually say that the inclusion of these remedies make them feel even more anxious.

As in previous studies [1] demographics, other than gender and age, did not explain the variance in anxiety related to terror. The conventional methods for grouping consumers based on easy-to-acquire ‘exogenous information’ such as demographics or self-profiled behaviors or attitudes is not applicable for the issue at hand. Beneath the average of the total panel, different cross-currents, sometimes acting together, sometimes acting separately were evident. The general patterns of the utilities divided the respondents into two different mindsets. Respondents in Segment 1 were mostly afraid of external intervention. *That is surprising when what one might have thought would reduce the anxiety of this segment, actually enhances the anxiety.* Respondents in segment 2 are most anxious about actual terrorist actions, far more than one might have thought from the results generated by the total panel. Thus, these results suggest that there are at least two mindsets in the population; those afraid of terrorist acts, and those afraid of government relief. The latter group is unexpected, although their existence is not counter-intuitive. This division to mindset is critical as it allows the understanding of how the population divides into perceptions and allows to quickly type each citizen into one mindset. The division into mindset, however, does not provide us with a sense of which responses alleviate the emotional responses for each mindset and how they are counteracted by specific government measures. These might be directions for future studies.

Conclusions

Psychophysics can make a new contribution to the field of terrorism and anxiety. Using Psychophysics, we looked not only for relations between variables that are established by statistical analyses but for relations that are engineered by experimental design. By importing and modifying psychophysics to public opinion research, we moved from descriptive science to an experimental science. Direct thinking about relations between variables may be a hallmark of today's ‘modern psychophysics. The psychophysical methods allowed the respondent to act as a measuring instrument. Psychophysics comes in when there is an objective physical continuum against which these responses can be regressed, to develop a quantitative relation or ‘model’. The key advance in the present study is that the independent variables are not necessarily related to each other, but rather represent qualitatively different alternatives, so the relation is not between two variables but rather between one dependent variable (e.g., level of anxiety) and the presence/absence of the different qualitative variables (e.g., different statements or messages about terrorism acts, feelings, situations, and attempts at anxiety reduction). Despite the change in the nature of the model, from a continuous model to a discrete model, the psychophysical way of thinking still applies.

Calder BJ; Krueger RA and Casey MA [31,32] state that public opinion and consumer researchers are accustomed to relatively large-sized samples with which to work, although the use of focus groups for political research has been gaining acceptance. Rarely, however, do researchers talk about the very small samples of respondents, such as base sizes of one or two. The history of public opinion and consumer research focuses on the so-called nomothetic rules, rules that apply to large numbers of people, rather than on the idiographic rules, rules that apply to one person. Ethnography and clinical psychology deal with small numbers of people, even with as few as one person, trying by observation to weave a story that applies to that one person, but at the same time has the potential to apply to many. Such small samples

are perfectly acceptable in these two fields, and in most observational research, simply because these observational methods do not purport to have quantitative results. The research approach presented here lies between the nomothetic and idiographic approaches. The base size can be down to an 'N of 1'. However, the approach is not observational but rather quantitative. The experimental design applies to that N of 1, and the rules are every bit as quantitative as if the base size were 100 or 1,000 or 1,000,000 or more. The coefficients in the model represent the numerical impact of the specific phrase as a driver of anxiety for that one person. Adding more people is not to obtain a percentage, but rather to refine that numerical estimate of the impact of the element.

Prospects and Opportunities

We'd like to end this paper with the prospect of creating a public policy 'data and actions' shelf of knowledge. Based upon the approaches presented here, we see that psychophysical thinking changes the way we think about social issues, moving us from looking at patterns to looking in a more engineering-oriented way to relations between variables. The tools for social research are already available. The use of experimental design, Internet-based research, and automatic analyses make the electronic bookshelf of data already feasible. The execution of the whole program is reasonable, feasible, and has already been done in part. So to answer the question – we end up looking at new worlds of knowledge about social science, society, the citizen and the person. More importantly, we end up with the prospect of new technology-enabled sciences about each of the foregoing.

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