

Measuring Subjective Emotional Responses: Contrasting Two Approaches to Measurement

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Abstract

We explored two different response formats for collecting data “on-line” on affective reactions. In this instance we used six different stories as our evocative stimuli. We used two stories each intended to evoke anxiety, two each to evoke enthusiasm, and two each to evoke aversion. We developed three such stories using medical topics and three such stories using terrorism as the topic. One format used was radio buttons with semantic labels that subjects would then click to select to identify their expressive response after reading each story they read (subjects read two of the six stories, selected at random). The other format was a vertical slider with semantic labels at the extreme ends with a pointer movable by the subject. Subjects moved the slider up or down to the desired position to identify their affective reaction. Subjects were assigned one of these formats at random. We also made use of a criterion variable, subject’s reported inclination to read more about the topic of the story to offer a measure of external validity. We relied on student subjects from a pool of subjects at the University of Michigan who participated as part of a course obligation. Results indicate that the slider format offered a more reliable and valid method for obtaining affective reactions.

I. Introduction

Researchers have seen the dominant means of gathering data change over time. Beginning in the 1930s with the development of random population sampling, surveys became a popular means of exploring public opinion by print media in the service of reporting the news, by research firms in the service of corporate and political clients, and scholars. The principal means of recording subject responses relied on paper questionnaires administered by interviewers going to selected homes and after identifying the designated interviewee, reading from the questionnaires and then recording verbal responses by marking on a page either a verbatim response or a selected response option. Interviewers could show materials, pictures or response options to subjects, explain any issues of confusion or complexity, as well as record features of the environment (was the home well off or not) and of the interviewer (how much interest, etc.). The local was most often the home of the subject and the interaction between survey administrator, the interlocutor, and the subject was itself a dynamic of some interest (as when the two shared, or did not, some salient social feature, e.g., gender or race).

As the telephone became increasingly widely dispersed in society and as the expense of door to door sampling and interviewing mounted relative to the cost of telephoning, telephone surveys began to augment, and to large degree, replace face-to-face surveys. Telephonic exchanges whether with a live or automated interlocutor eliminated visual stimuli but did allow audio stimuli (thus, for example, a recording of a slogan or radio ad could be presented but not a television ad or bumper sticker or lawn sign).

With the Internet's rapid diffusion it became itself a platform for collective data by research firms and by scholars. Data acquisition by the internet adds new possibilities and returns old possibilities. Visual stimuli, both static and dynamic, can be readily incorporated. Also, data can be collected without the complex interaction with an interlocutor that may complicate interpretation. Further, data acquisition can be obtained that preclude missing responses by requiring subjects to complete responses before being allowed to continue to the next query. Of course the absence of an interlocutor makes the data collection subject reliant and hence absent data on the degree of seriousness the subject applies to the task. This venue however demands that the tasks presented to subjects be clear, coherent, and readily within the task range of all subjects who may fall within the sample characteristics.

II. Measurement Formats

The data we rely on for this project was collected in the spring of 2008 at the University of Michigan (Ann Arbor, MI, USA). The sample of subjects (N=139) came from the Department of Communications participant pool. Students were able to participate more than once for added credit and 35 students did producing a total of 180 data records. Subjects were presented two stories to read, on computer screens, followed by a series of questions, also presented on screen. We treat each story and its related responses as a unit of analysis yielding an N of 360. We developed six stories, three dealt with medical matters and three dealt with the subject of terrorism. In each we developed a story meant to evoke one of the three dimensions of pre-conscious affective appraisal: enthusiasm, anxiety, and aversion (Marcus, 2003; Marcus, MacKuen, Wolak and Keele, 2006). Thus we had two stories each meant to evoke heightened

enthusiasm, heightened anxiety, or heightened aversion.¹ After reading a story, subjects began with one of the three medical stories, randomly assigned, then presented with ten affective markers we have previously used to ascertain affective reactions (Marcus et al., 2006). These markers are shown in table 1, below. The order of the ten items was randomized from story to story.

| Dimension: | ANXIETY | ENTHUSIASM | AVERSION |
|------------|---------|--------------|-----------|
| Markers: | anxious | enthusiastic | hateful |
| | worried | hopeful | angry |
| | afraid | proud | bitter |
| | | | resentful |

Table 1: Affective Markers for Three Dimensions of Preconscious Appraisal

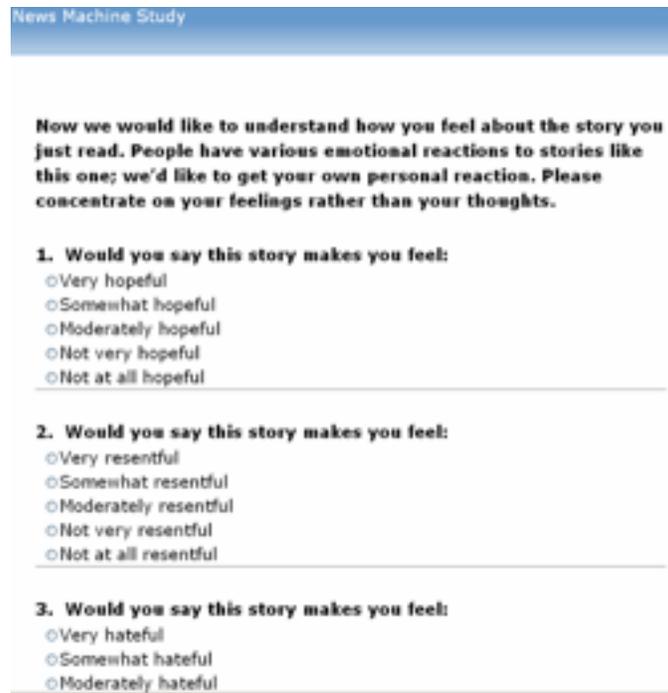
The methods of obtaining subject's responses, the focus of this paper relied on two response options. The two options were randomized among subjects and across stories. Subjects completed these ten assessments and then completed some additional questions, one of which determined whether, after reading the story, they would like to learn more about the story (the actual text: "Would you like to learn more about this story?").²

¹ We should note that we do not expect these stories to evoke only that target affective dimension. In particular prior work has shown that anxiety and aversion are often highly correlated. As a consequence a stimulus that provokes aversion is also likely to evoke anxiety as well.

² The options offered for this query: "yes, definitely", "yes, but not definitely", "maybe, if the occasion presents itself", "no, probably not", "no, definitely not". As we discuss later, we also presented the responses to this question in both radio button format, with the above response, and with our alternative format, the slider format, both described below. The two versions were randomly assigned.

Following completion of these responses the subjects then proceeded to read a second story, one of the three terrorism stories, again chosen at random, and again in one two formats, also randomized before then completing the subjective response queries in the same sequence as with the first story. The six stories used as stimuli in this study are provided in the appendix to this paper. Thus, for each subject, story, responses (in one of two format), a second story (again in one of two formats) and responses. One of the three medical stories was always presented in the first position and one of the three terror stories was always in the second position. One last feature of this project. We also presented the “learn more” criterion variable in two response formats, also randomized, using the same response formats as used for the affective responses so that we could also assess whether using common or different response formats added or detracted from the quality of the data.

The first response option, radio buttons, offered semantic labels for each valid response aligned to the right of a empty circle. Subjects could then select that semantic label which best approximated their affective response (see figure 1, below).



News Machine Study

Now we would like to understand how you feel about the story you just read. People have various emotional reactions to stories like this one; we'd like to get your own personal reaction. Please concentrate on your feelings rather than your thoughts.

1. Would you say this story makes you feel:

- Very hopeful
- Somewhat hopeful
- Moderately hopeful
- Not very hopeful
- Not at all hopeful

2. Would you say this story makes you feel:

- Very resentful
- Somewhat resentful
- Moderately resentful
- Not very resentful
- Not at all resentful

3. Would you say this story makes you feel:

- Very hateful
- Somewhat hateful
- Moderately hateful

Figure 1: Radio Buttons Format

Programming ensured that each subject could only select one of the five offered responses and precluded “double” selections and also precluded no response (going to the next page without completing each query would return the subject to the prior page with instructions to complete the missing response item). The advantage of radio buttons is that they are a familiar means widely used (as is the use of an empty box that the respondent clicks to enter an X). The semantic label gives clarity to each of the available five response options. Finally, while not fully continuous, the ordinal quality is likely to be acceptably treated as continuous for statistical analyses (Bollen and Barb, 1981).

The clarity of semantic labels while often an advantage gave us sufficient concern to explore an alternative response format. Our approach to affective responses is premised on the theoretical foundation of preconscious appraisal. Other approaches, notably cognitive appraisal theories (Clore and Ortony, 2000; Gross and D'Ambrosio, 2004; Lazarus, 1984; Ortony, Clore

and Collins, 1989; Roseman, 1991), presume that a cognitive stage mediates so that the resulting affective response depends on the semantic category applied to the affective state.³ But, if as our theory holds, affective responses arise much faster than conscious awareness then a response format that makes semantic classification and application central to the respondent task may well degrade the quality of response. The work of social psychologist Timothy Wilson gives ample evidence that task of introspection often biases responses when the task demands that subjects have access to non-consciously accessible datum (Wilson and Dunn, 1986; Wilson, Dunn, Kraft and Lisle, 1989; Wilson, Kraft and Dunn, 1989; Wilson and Schooler, 1991). And, that is indeed the possible consequence of relying on radio buttons with explicit semantic labels, the decoding of each a prerequisite before then proceeding to the selection of the most apt category.

We therefor sought a response methodology that minimized semantic processing as much as possible. To that end we developed a “slider” method for obtaining the subject’s affective response. In this approach, subjects are presented with a vertical bar on which is a “slider” that has a pointer. While the top and bottom of the bar have semantic labels (see Figure 2, below) the intermediate range is unlabeled. Subjects then move the pointer, or slider, to the location, up or down, to the most apt location on the bar. That position that “feels most right” is determined more by feel than by semantic category, or so we believe.

³ Thus feeling badly becomes an emotion after the subjects determines whether h/she is the cause (hence guilt if in private, or shame if in public) or the cause is someone else’s responsibility (then anger).

Now we would like to understand how you feel about the story you just read. People have various emotional reactions to stories like this one; we'd like to get your own personal reaction. Please concentrate on your feelings rather than your thoughts.

| | | | | |
|-----------------------|-----------------------|----------------------------|-----------------------|-------------------------|
| hateful ○ | hopeful ○ | enthusiastic ○ | angry ○ | resentful ○ |
| not hateful | not hopeful | not enthusiastic | not angry | not resentful |
| afraid ○ | proud ○ | bitter ○ | worried ○ | anxious ○ |
| not afraid | not proud | not bitter | not worried | not anxious |

Figure 2: Slider Format

Additionally, this method offers continuous data (we have coded these data on a 0 to 100 range, zero marking the bottom of the range and 100 marking the top of the range). As shown in Figure 2, above, the slider format makes more economic use of screen space, see Figure 1 above for comparison to the radio button format, as we can place all ten items (in randomized order) on a single page. These advantages while apt for ascertaining preconscious affective responses are less critical in the case of our criterion variable, “learn more”, as the extent of a motivation to learn more is likely to be readily accessible to subjects.⁴

In the section that follows we consider, first, how well each format performs in collecting data that is reliable.

⁴ And, consistent with the theory of affective intelligence. One of the central assertions is that elevated anxiety shifts orientation towards learning in preparation for explicit deliberative consideration of options contemporaneously available (Marcus, 2002; Marcus and MacKuen, 1993; Marcus, Neuman and MacKuen, 2000).

III. Items and Scales Analysis

Subjects were drawn from a department pool of students in the introductory course for the Communication Studies department who, as a condition of their education, were required to participate in department research. Thus, it is not surprising that the intrinsic motivation of the subjects to engage the project's material was, at best, modest. The average time to complete reading the two stories and complete the responses for each was 5.19 minutes (the standard deviations = 2.89) and it is clear that many raced through to the end at a rapid clip. While one subject took as little as approximately one minute to complete the two stories and complete the responses for each, one took as long as 22 minutes (the median is 4.64 minutes so clearly the time interval was skewed to peak to the short side of the mean). More interesting and relevant is that the mean for those who were given the slider format for the affective measures was less than those who were given the radio button format (mean = 4.88; 2.89 standard deviation for sliders and mean = 5.47; 3.25 standard deviations for radio buttons: $t = 1.80$; $p = 0.07$). This modestly confirms that radio buttons make invoke a greater inclination to cogitate over response choice.

In order to evaluate the affective measure responses we assigned values in the following fashion. Slider format enables us to assign continuous values according to the positioning of the slider. We used a range of 1 to 100. The five responses gained by the radio button format were coded so as to match the range of the slider format possible values. Hence, those replying "not at all [marker term]" were assigned a value of 1, those who replied "not very [marker term]" were assigned a value of 25, those who replied "moderately [marker term]" were assigned a value of 50, those who replied "somewhat [marker term]" were assigned a value of 75, and, finally, those who replied "very [marker term]" were assigned a value of 100. This scoring mechanism allows

us to directly compare the values derived from each distinct response format using the same numerical range with common meanings for common values (though the range generated by the radio button format is categorical while that generated by the slider format is continuous).

The first analysis we take up is ability of the items to generate the anticipated three latent dimensions, anxiety, enthusiasm, and aversion (Marcus et al., 2006; Marcus et al., 2000). We rely on factor analysis with oblique rotation (as the empirical and theoretical expected structure presumes negative relationships with enthusiasm and the two negative factors and a positive relationship between the two negative factors, anxiety and aversion). Analysis of all cases finds the expected three dimensions (three eigenvalues greater than 1: 2.18; factor 2 1.66, and, factor 3 1.02). Table 1, below, present the rotated factor structure.

| | AVERSION | ANXIETY | ENTHUSIASM | Uniqueness |
|--------------|-----------------|----------------|-------------------|-------------------|
| anxious | 0.144 | 0.512 | 0.114 | 0.598 |
| worried | 0.061 | 0.611 | -0.064 | 0.545 |
| afraid | 0.046 | 0.248 | 0.024 | 0.811 |
| enthusiastic | -0.115 | -0.005 | 0.609 | 0.645 |
| hopeful | -0.024 | 0.111 | 0.506 | 0.664 |
| proud | 0.101 | -0.128 | 0.562 | 0.711 |
| hate | 0.498 | 0.139 | 0.052 | 0.651 |
| angry | 0.637 | 0.055 | -0.011 | 0.516 |
| bitter | 0.646 | -0.048 | -0.005 | 0.580 |
| resentful | 0.686 | 0.015 | 0.026 | 0.541 |

Table 1: Rotated factor loadings (pattern matrix) and unique variances all subjects (N=360)

The data conform the expected structure of three dimensions and the ten items generally load on the expected dimensions (the marker afraid does not load on the expected dimension of anxiety, at least not at a level sufficient to give great confidence). But the more critical question then turns to what happens when we evaluate the structure for those who used radio button format and those who used the slider format.

We turn first to the radio format results. The structure of responses when reliant on the radio button format poses some immediate concerns. First, the structure does not duplicate the expected three dimensions (only the first eigenvalue is greater than 1, factor 1 = 1.49; the second falls to 0.47, and the third to .14). And, when we examine the rotate factor solution, Table 2, below, the pattern of loadings only dimly generates the expected structure and markers load at best weakly on expected dimensions.

| | ANXIETY | ENTHUSIASM | Factor 3 | AVERSION | Uniqueness |
|--------------|----------------|-------------------|-----------------|-----------------|-------------------|
| anxious | 0.290 | 0.123 | 0.084 | 0.086 | 0.759 |
| worried | <u>0.342</u> | 0.073 | -0.082 | 0.171 | 0.792 |
| afraid | -0.033 | -0.149 | -0.058 | 0.003 | 0.887 |
| enthusiastic | 0.064 | 0.380 | -0.015 | 0.013 | 0.815 |
| hopeful | -0.011 | 0.506 | 0.052 | -0.045 | 0.719 |
| proud | 0.016 | 0.006 | 0.425 | 0.033 | 0.784 |
| hate | 0.228 | 0.152 | 0.242 | -0.076 | 0.767 |
| angry | 0.090 | -0.053 | 0.047 | 0.430 | 0.761 |
| bitter | -0.027 | 0.008 | 0.059 | 0.443 | 0.777 |
| resentful | -0.052 | 0.274 | 0.358 | 0.126 | 0.687 |

Table 2: Rotated factor loadings (pattern matrix) and unique variances - Radio Button format (N=190)

When we turn to the data obtained reliant on the slider response format the results are more compliant with the expected structure (first eigenvalue, factor 1 = 4.10; factor 2 = 1.74; and factor 3 = 0.76). Table 3 displays the item loadings obtained with the same factor analysis settings (i.e., rotated oblique solution). And, here, the pattern of loadings and the magnitude of the factor loadings confirm, and confirm, the expected pattern of item-factor structure.

| | AVERSION | ANXIETY | ENTHUSIASM | Uniqueness |
|--------------|-----------------|----------------|-------------------|-------------------|
| anxious | 0.061 | 0.594 | 0.102 | 0.417 |
| worried | -0.024 | 0.847 | -0.141 | 0.232 |
| afraid | 0.137 | 0.737 | 0.063 | 0.340 |
| enthusiastic | -0.151 | -0.006 | 0.715 | 0.370 |
| hopeful | 0.016 | 0.073 | 0.767 | 0.458 |
| proud | 0.089 | -0.010 | 0.808 | 0.356 |
| hate | 0.641 | 0.116 | -0.025 | 0.364 |
| angry | 0.872 | 0.082 | -0.035 | 0.192 |
| bitter | 0.772 | -0.054 | -0.007 | 0.334 |
| resentful | 0.866 | -0.001 | 0.021 | 0.272 |

Table 3: Rotated factor loadings (pattern matrix) and unique variances - Slider format (N=170)

The poor performance of the radio button format in defining the expected scales is reflected in the internal reliability of the resulting three scales. The slider format produces

acceptable coefficient alpha reliability values (all above .80) while none of the three scales using radio button format data produces reliable scales (all below .50).

| Measurement Format | Sliders | Radio Buttons |
|--------------------|-----------------|-----------------|
| Anxiety Scale | $\alpha = 0.85$ | $\alpha = 0.26$ |
| Enthusiasm Scale | $\alpha = 0.83$ | $\alpha = 0.22$ |
| Aversion Scale | $\alpha = 0.90$ | $\alpha = 0.47$ |

Table 4: Reliability of Summated Scales (Coefficient Alpha) for Slider and Radio Button Formats

But before we come to any firm conclusions, let us turn to how well the scales, the three dimensions of Anxiety, Enthusiasm, and Aversion, perform in each of the six stories. Figure 3, below, shows box plots (in the appendixes we show the same data in another format, histograms). Figure 3 shows the distributions and means for the six stories. The stories evoked the intended emotional responses. The two anxiety stories, one medical one terror, generated higher means for anxiety than for either of the two other emotional factors. The same pattern holds for the two enthusiasm evoking stories, and for the two aversion evoking stories. This confirms the essential qualities of the stories as having the desired evocative content. Each of the pairs have the capacity to evoke the principal emotional of interest (the anxiety stories generate greater anxiety, the enthusiasm stories greater enthusiasm, and the aversive stories greater aversion).

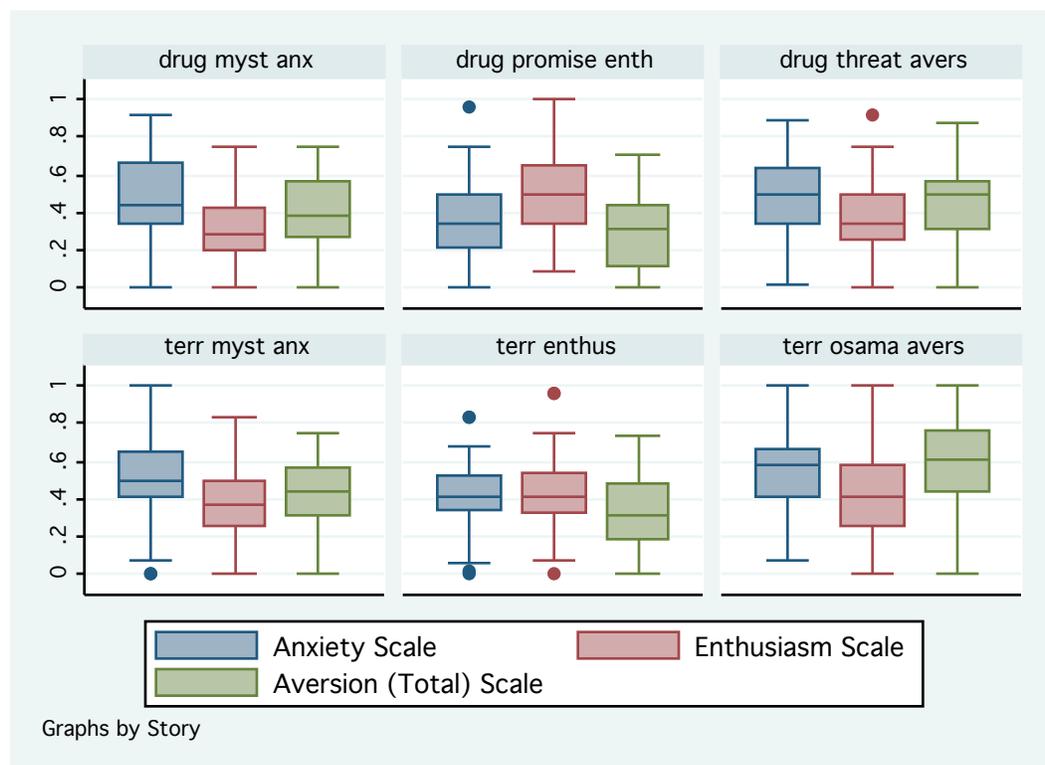


Figure 3: Box Plots for Scales by Story

However, what happens when we turn to the data when divided into response formats? Let us again begin with the more conventional methodology, radio buttons format. Figure 4, below, displays the same box plots as those in Figure 3. Here the pattern is far more muted and far less convincing.

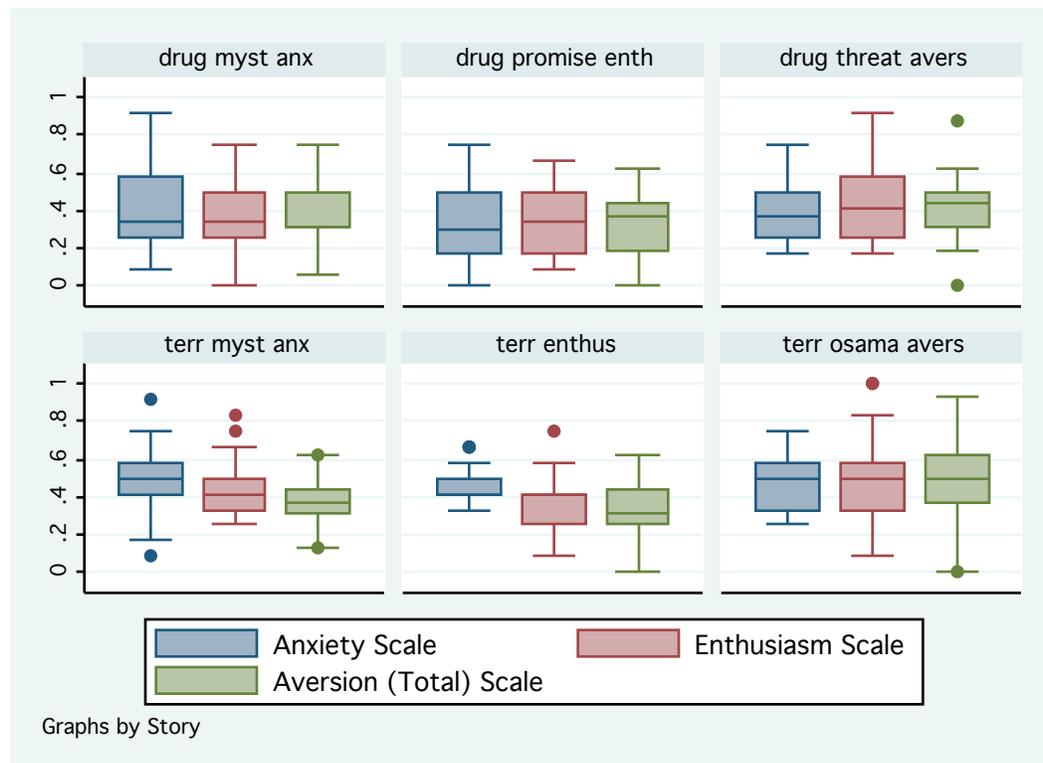


Figure 4: Box Plots for Scales by Story with Radio Button Format

The box plots for the slider format, shown in Figure 5 below, show - not unexpectedly after the results displayed in Figures 3 and 4, very clear and sharply differentiation across stories and between emotional factors. In the case of the anxiety stories, the slider format produces higher means than the radio button format. Drug story mean = .55 and .41, respectively, and Terror story, means = .56 and .48 respectively; $t = 2.55$, $p = .01$ in the Drug story and not significant in the Terror story. In the case of the enthusiasm stories, the slider format also produces higher means than the radio button format. Drug story means = .68 and .35, respectively, and Terror story, means = .48 and .38; $t = 7.15$, $p = .001$ in the Drug story and $t = 2.20$, $p = .03$ in the Terror story. In the case of aversive stories, the slider format again produced higher means than the radio button format. Drug story means = .51 and .40, respectively, and Terror story, means = .71 and .50; $t = 2.24$, $p = .03$ in the Drug story and $t = 4.01$, $p = .001$ in the Terror story.

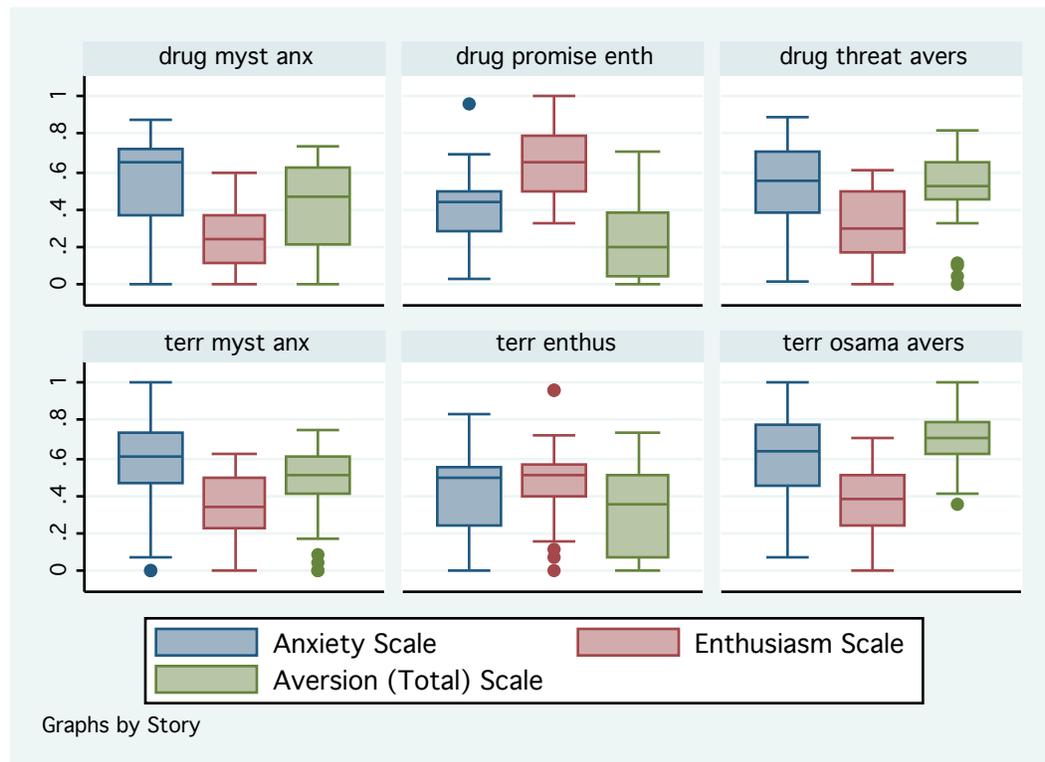


Figure 5: Box Plots for Scales by Story with Slider Format

On balance then, the slider response format offers a clearer and more sharply defined portrait of emotional responses than does the radio button format. However, while these analyses suggest a clear advantages for the slider format over the radio button format, among them less time to complete, more reliable scales for each of the three dimensions of affective response, and sharper delineation between affect dimensions and sharper ability to discriminate between different evocative stories, we turn to the critical issue of external validity before coming to a firm conclusion. We turn to that topic in the section that follows.

IV. Criterion Analysis

As we noted above, the work driven by the theory of affective intelligence began with showing that the anxiety response has a robust capacity to initiate an inclination to learn more

about the circumstance that evokes anxiety (Marcus and MacKuen, 1993; Marcus et al., 2000).

We included a measure, called “Learn More” to ascertain whether either response format generated such an inclination and, if so, whether there was any advantage, one format to the other. Footnote 3 (and the text to which it is attached) provide the wording of the item.

| | | | | | | |
|----------|-------|-----|-----|----------------------|--|--|
| Source | SS | df | MS | Number of obs = 360 | | |
| Model | .58 | 3 | .19 | F(3, 356) = 5.28 | | |
| Residual | 13.0 | 356 | .04 | Prob > F = 0.001 | | |
| Total | 13.68 | 359 | .04 | R-squared = 0.0426 | | |
| | | | | Adj R-squared = 0.03 | | |
| | | | | Root MSE = .19 | | |

| <u>Learn More</u> | <u>Coef.</u> | <u>Std. Err.</u> | <u>t</u> | <u>P> t </u> | <u>[95% Confidence Interval]</u> | |
|-------------------|--------------|------------------|----------|-----------------|----------------------------------|------|
| ANXIETY | .096 | .056 | 1.73 | 0.084 | -.013 | .206 |
| ENTHUSIASM | .124 | .049 | 2.55 | 0.011 | .023 | .220 |
| AVERSION | .071 | .054 | 1.32 | 0.189 | -.035 | .178 |
| Constant | .417 | .033 | 12.71 | 0.000 | .352 | .481 |

Table 5: Regress Learn More on ANXIETY ENTHUSIASM AVERSION

As Table 5, above, shows, for the full data of 360 observations, Anxiety does have a marginal effect of increasing the subjective inclination to learn more among subjects, but even more so does Enthusiasm. But, as with our other analyses the critical empirical results are those obtained when we focus on each response format. We begin with the Radio Button format. The results are displayed in Table 6, below.

| | | | | | |
|----------|------|-----|-----|-----------------|-------|
| Source | SS | df | MS | Number of obs = | 190 |
| Model | .56 | 3 | .19 | F(3, 186) = | 4.65 |
| Residual | 7.47 | 186 | .04 | Prob > F = | 0.004 |
| Total | 8.03 | 189 | .04 | R-squared = | 0.07 |
| | | | | Adj R-squared = | 0.06 |
| | | | | Root MSE = | .20 |

| Learn More | Coef. | Std. Err. | t | P> t | [95% Confidence Interval] | |
|------------|-------|-----------|------|-------|---------------------------|------|
| ANXIETY | .055 | .091 | 0.60 | 0.547 | -.013 | .235 |
| ENTHUSIASM | .142 | .086 | 1.65 | 0.101 | -.028 | .313 |
| AVERSION | .205 | .093 | 2.21 | 0.028 | .022 | .388 |
| Constant | .289 | .050 | 7.83 | 0.000 | .291 | .487 |

Table 6: Regress Learn More on ANXIETY ENTHUSIASM AVERSION - Radio Button Format

As Table 6, above, shows, there is no relationship between anxiety, when measured by the radio button format, and reported interest in learning more about the subject of the story. Indeed, the other factors, enthusiasm and aversion, each have significant relationships (though enthusiasm at the marginal level of $p = .10$). While those relationships maybe significant they are not plausible as validation for radio format measurement for preconscious affective responses. If, as our finding on time to complete their response suggests, that subjects introspect when responding, then perhaps those who are most angry and introspect wish to learn more about the focus of their anger but that does interpretation, at best, would suggest that the radio button format is perhaps useful for those scholars using cognitive appraisal theories of affect.

Let us now turn to the results for the slider format. The results are displayed in Table 7, below.

| | | | | | |
|----------|------|-----|-----|-----------------|-------|
| Source | SS | df | MS | Number of obs = | 170 |
| Model | .28 | 3 | .10 | F(3, 166) = | 2.95 |
| Residual | 5.33 | 166 | .03 | Prob > F = | 0.035 |
| Total | 5.62 | 169 | .03 | R-squared = | 0.05 |
| | | | | Adj R-squared = | 0.03 |
| | | | | Root MSE = | .18 |

| Learn More | Coef. | Std. Err. | t | P> t | [95% Confidence Interval] | |
|------------|-------|-----------|-------|-------|---------------------------|------|
| ANXIETY | .184 | .071 | 2.69 | 0.010 | .044 | .324 |
| ENTHUSIASM | .063 | .060 | 1.05 | 0.297 | -.056 | .183 |
| AVERSION | -.046 | .069 | -0.66 | 0.510 | -.182 | .091 |
| Constant | .432 | .044 | 9.78 | 0.000 | .345 | .519 |

Table 7: Regress Learn More on ANXIETY ENTHUSIASM AVERSION - Slider Format

As shown above, Table 7, the relationship between anxiety, when recorded using the slider format does have a significant relationship with inclination to learn more about the story subjects have just read. And, consistent with the theory of affective intelligence, neither of the other two dimensions of affective response show significant relationships with inclination to learn more (MacKuen, Wolak, Keele and Marcus, 2005).

The findings as to which format best confirms to the expected relationship between anxiety and inclination to learn more are fairly straightforward. The slider format shows a fairly robust relationship, the radio button format does not.

V. Common or Different Format: Emotional Response and Dependent Variables Analysis

We randomly assigned the Learn More variable to have two versions, one reliant on the radio button format and one reliant on the same slider format as we developed for use with the affective response items. We did so to see whether the relationships in Section IV above are enhanced or diminished when subjects are presented with the same format (e.g., slider for affective response and slider for Learn More or radio button format for both) as contrasted with

different formats (e.g., radio buttons for the affect measures and slider format for Learn More, and the reverse).

We focus here on the findings reliant on the slider format for affective response (the findings when pairing the radio button format for affective response with either slider format or radio button format for Learn More show no significant findings in either condition). Since we focus on the slider format for affective response, what is of interest is whether it matters how other variables are measured, in this instance Learn More.

I. Common Format: Slider - Slider formats

| | | | | | |
|----------|------|----|-----|-----------------|-------|
| Source | SS | df | MS | Number of obs = | 86 |
| Model | .51 | 3 | .17 | F(3, 82) = | 2.93 |
| Residual | 4.80 | 82 | .06 | Prob > F = | 0.038 |
| Total | 5.31 | 85 | .06 | R-squared = | 0.10 |
| | | | | Adj R-squared = | 0.06 |
| | | | | Root MSE = | .24 |

| <u>Learn More</u> | <u>Coef.</u> | <u>Std. Err.</u> | <u>t</u> | <u>P> t </u> | <u>[95% Confidence Interval]</u> | |
|-------------------|--------------|------------------|----------|-----------------|----------------------------------|------|
| ANXIETY | .342 | .124 | 2.54 | 0.013 | .074 | .609 |
| ENTHUSIASM | .136 | .119 | 1.14 | 0.257 | -.101 | .372 |
| AVERSION | -.103 | .132 | -0.78 | 0.435 | -.365 | .159 |
| Constant | .289 | .085 | 4.60 | 0.000 | .221 | .557 |

II. Different Formats: Slider - Radio Button formats

| | | | | | |
|----------|------|----|-----|-----------------|-------|
| Source | SS | df | MS | Number of obs = | 84 |
| Model | .000 | 3 | .00 | F(3, 82) = | 3.00 |
| Residual | .00 | 80 | .00 | Prob > F = | 0.036 |
| Total | .00 | 83 | .00 | R-squared = | 0.10 |
| | | | | Adj R-squared = | 0.07 |
| | | | | Root MSE = | .01 |

| Learn More | Coef. | Std. Err. | t | P> t | [95% Confidence Interval] | |
|------------|-------|-----------|--------|-------|---------------------------|------|
| ANXIETY | .005 | .003 | 1.76 | 0.083 | -.000 | .010 |
| ENTHUSIASM | .001 | .002 | 0.43 | 0.667 | -.003 | .005 |
| AVERSION | .002 | .002 | 0.82 | 0.415 | -.003 | .007 |
| Constant | .485 | .002 | 301.85 | 0.000 | .482 | .488 |

Table 8: Regress Learn More on ANXIETY ENTHUSIASM AVERSION - Slider Format for Both Affective Response items and for Different formats for Learn More Measure

The results displayed in Table 8, above, recommend using the same slider format across items. Though the Adjusted R^2 is somewhat higher for the mixed formats results, the coefficient depicting the relationship of anxiety on Learn More is clearly more robust when subjects rely on the same response format across measures than when using different response formats. That statistical significance holds, even when using different response formats (though marginal at $p = .08$) adds a measure of confidence to the usefulness of the slider format in this sort of on line data gathering.

VI. Conclusions and Recommendations

In this study we relied on a sample pool of undergraduate students in an introductory course that had their research participation obligated as part of the course work. That requirement did not, of course, demand their seriousness of purpose. This offers a relatively unforgiving context for assessing the viability of affective response measures. It is our contention that

affective responses may be of two sorts. The first are preconscious, the second are the result of introspective consideration. Each sort is of interest as each may play a role in both decision-making and action. Our interest is in developing a methodology for ascertaining the former with adequate reliability and validity.

To that end we contrasted two response formats, radio buttons wherein subjects use semantic cues to identify and report their affective circumstances of the moment and sliders wherein subjects move sliders up or down to a location that best identifies their feeling state. The latter format reduces the expressed and explicit role of semantic involvement in the subject's determination of a suitable response. As such, we hope that slider formats use will reduce the engagement of thoughtful consideration.

The statistical findings we report in this paper find that slider formats take less to for subjects to complete than radio buttons. Further, the data obtained by reliance on the slider format reproduce the expected relationships between affect terms previously used to identify three dimensions of preconscious appraisal: Anxiety, Enthusiasm, and Aversion. On the other hand, the data obtained reliant on radio buttons did not. Not surprising in light of that result, the internal reliability of the affect scales thereafter constructed demonstrate more than acceptable reliability for the slider format data but not for the radio button format.

Using a measure of the subject's reported inclination to learn more about the story just read by the subject as a criterion variable for validation purposes also support the superiority of the slider format over the radio button format. Lastly, the findings therein also, marginally, recommend the common use of the slider format across measures.

These findings should not be taken to mean that radio button formats, and like methods, have no place in on-screen questionnaires. But in the application to the measurement of subjective emotional response the clear superiority of the slider format recommends their use over the radio button format.

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Appendix I: Measurement Stimuli - Medical Stories

A. Positive - Enthusiasm Evoking Story

The New York Times

Miracle Drug Shows Great Promise



Dateline: Kenilworth, N.J: Pharmaceutical giant Schering-Plough Inc. has demonstrated a medical breakthrough in an area that will likely prove to be of interest to just about all of us – the field of analgesics, in everyday language – pain killers.

“We have identified a unique compound we’ll be marketing under the trade name Verasic”, reports Dr. William Peterson, the director of the company’s research institute, “which has ten times the power of aspirin to fight headaches, body aches and pain

associated with injuries, and most remarkably it promotes faster healing.” The announcement has pushed Schering-Plough shares up 18% on the New York Stock Exchange.

The breakthrough derives from recent research on the human genome as scientists probed why younger organisms typically heal faster and more successfully than older ones. The FDA, of course, will have to complete its review of the drug’s long-term safety before Verasic will be available at your corner drug store. Testing is currently underway and preliminary results are reported to be promising for expedited review and early approval. “Ordinarily a drug this powerful and effective would require a doctors prescription,” Peterson noted in a press

conference at the company's headquarters, "but given its character as a natural organic building block in the healthy human body, we expect a green light for over the counter distribution."

Analysts at the public health service reported that if the early results hold up, this could have a very positive effect on reducing illness and reducing health care costs for patients young and old. "I think the medical implications of these research studies are truly profound," explained Dr. Robert Ford from the Office of the United States Surgeon General.

Cyrus Magnusson, a stock analyst at Bear Stearns, added to the excitement when he reported a most promising additional property of the drug not yet publicized by Schering-Plough – enhancing weight loss and the maintenance of lower weight levels typical of the young. "Perhaps not the Fountain of Youth," Magnusson noted, "but clearly a step in the right direction. If it doesn't extend an individual's life span it will contribute to a much longer health span." Researchers emphasized that these results were preliminary and that sustained weight loss typically requires a healthy and balanced diet and at least modest levels of regular exercise.

The genomic research behind the development of Verasic was conducted at the US Center for Disease Control laboratories in Atlanta and the results of this federally sponsored research have been shared as well with drug makers Pfizer Pharmaceuticals, Bristol-Myers Squibb and AstraZeneca who are reportedly working on related breakthroughs. Although, none of these firms have yet announced the results of their in-house research, the recent Schering-Plough press conference is likely to stimulate new announcements from their competitors in the near future. "Multiple vendors competing on price means lower drug costs to the public," Dr. Ford emphasized in a public address yesterday at the US Department of Health and Human Services.

B. Negative - Anxiety Evoking Story

The New York Times

Drug Study Mystery



Dateline: Kenilworth, N.J: Pharmaceutical giant Schering-Plough Inc. has reversed itself and will continue to market their Verasic brand pain reliever for children after all. Only two weeks ago they had sent an advisory to pharmacies and physicians warning of potentially life-threatening side effects.

“It’s a false alarm,” reported Dr. William Peterson, the director of the company’s research institute. Because the health of our patients comes first, we have been extremely cautious in this case. However,

our extensive testing which complied with all FDA requirements lead us to conclude that our pain reliever for children sold under the trade name Verasic is perfectly safe. If we had any doubts we wouldn’t put this medication on the market.” The product is prescribed for relieving headaches, body aches and pain associated with injuries in children.

Industry analysts and government researchers, however, did have doubts. The proprietary research study that motivated the advisory has not been publicly released. But physicians at the Centers for Disease Control in Atlanta reported that the study documented cases of serious side effects including fatigue, nausea, vomiting, diarrhea and body sores among children taking the drug raised red flags. Critics have speculated that Schering-Plough has had this side-effect information for 18 months but delayed making it public to protect sales. Peterson scoffed at the charges and said the data on the prevalence of these side effects remains unclear and that further analysis of the data was currently underway. Industry researchers noted these effects could result from interactions with other drugs taken without doctors’ review and approval. The advisory and subsequent reintroduction of the product has pushed Schering-Plough shares down 18% on the New York Stock Exchange.

"The medical implications of this case are truly profound," noted Dr. Robert Ford from the Office of the United States Surgeon General; "I can not recall a single case of a withdrawal and virtually immediate reintroduction of a prescription drug in recent medical history. Our staff hopes to review this mysterious side-effects study as soon as possible." Reportedly the physicians at Cedars Sinai Hospital in Los Angeles had been paid large sums by Schering-Plough to conduct the clinical side effects studies and there was a question of whether negative findings may have been underplayed.

Cyrus Magnusson, a stock analyst at Bear Stearns, said yesterday that Schering-Plough must be pretty sure about the data because they are putting their company's reputation on the line. "This is a make-it or break-it call for the senior management," Magnusson noted referring to CEO Ross McDonald and research chief William Peterson. "The market hit the Merck Pharmaceuticals stock hard during the Vioxx arthritis medication scandal" Magnusson said. Merck yanked the medication off drug store shelves after a study found a higher rate of heart attacks and strokes in patients taking Vioxx than in those on a placebo.

C. Negative - Aversion Evoking Story

The New York Times

Sales of Painkiller Verasic Suspended



Dateline: Kenilworth, N.J: Pharmaceutical giant Schering-Plough Inc. has warned pharmacies to remove all of their Verasic brand pain reliever for children from their shelves because of recently revealed and potentially life-threatening side effects.

“Despite extensive testing which complied with all FDA requirements we have decided in the best interests of safety to discontinue marketing our pain reliever for children sold under the trade name Verasic”, reported Dr. William Peterson, the director

of the company’s research institute. The product had proven effective in relieving headaches, body aches and pain associated with injuries in children. But recently documented cases of serious side effects including fatigue, nausea, vomiting, diarrhea and body sores among children taking the drug raised red flags. Gene Kimmelman an attorney with the Consumers Union testified in recent congressional hearings that Schering-Plough has had this side-effect information for 18 months but delayed making it public to continue sales of the profitable drug for as long as possible. Peterson scoffed at the charges and said the data on the prevalence of these side effects remains unclear. Industry researchers noted these effects could result from interactions with other drugs taken without doctors’ review and approval. Peterson reported that further analysis of the data was currently underway. The announcement has pushed Schering-Plough shares down 18% on the New York Stock Exchange.

Kimmelman testified that the breakthrough pain reliever was rushed through field tests in the interests of getting the product to market ahead of competitors Pfizer Pharmaceuticals, and Bristol-Myers Squibb who were reportedly working on related compounds. "The medical implications of the new side effects data are truly profound," noted Dr. Robert Ford from the

Office of the United States Surgeon General; “we need to fundamentally reevaluate the FDA testing protocols with special attention to medications designed for use by children.” Verasic’s expedited FDA review was completed in two years, approximately one-third of the usual required testing period leading industry analysts to raise questions of an insensitivity to the side effects issues on the part of physicians that had been paid large sums by Schering-Plough to conduct the clinical studies.

The compounds used in Verasic are derived from recent research on the human genome as scientists probed why younger organisms typically heal faster and more successfully than older ones. The research was conducted at the US Center for Disease Control laboratories in Atlanta and the results of this federally sponsored research had generated great enthusiasm before the side-effects findings stimulated new controversy in the public health field.

I am particularly concerned about the reports of vomiting and diarrhea because the resulting dehydration in children can be life-threatening Dr. Ford noted in a public address yesterday at the US Department of Health and Human Services.

Cyrus Magnusson, a stock analyst at Bear Stearns, predicted yesterday that Schering-Plough CEO Ross McDonald and research chief Peterson who had championed the benefits and profitability of the pain reliever would resign in a management shake-up probably before week’s end. “The market hit the Merck Pharmaceuticals stock hard during the Vioxx arthritis medication scandal” Magnusson said. Merck yanked the medication off drug store shelves after a study found a higher rate of heart attacks and strokes in patients taking Vioxx than in those on a placebo.

Appendix II: Measurement Stimuli - Terror Stories

Positive - Enthusiasm Evoking Stories

The New York Times

Good News on Border Security



Dateline: Washington DC: Department of Homeland Security Senior Director Robert Moczynski testifying before Congress reported that tests on new border security technologies provided evidence of dramatically improved capacity to detect potential terrorists at US ports of entry. “We have installed three new technical systems and each has already increased our capacity to catch the bad guys,” he testified. “Advanced digital technology will be our first line of defense.”

Moczynski demonstrated a new data system that collects up-to-the-second data on lost and stolen passports from 188 countries around the world so that if a malevolent individual attempts to use someone else’s passport to avoid detection silent alarms alert border officials immediately. “You can buy genuine recently stolen passports on the streets of Cairo for less than \$20,” Moczynski reported, “But now it will serve as a passport directly to our detention facility.”

There are 304 land, sea and air travel ports of entry in the United States each maintained by DHS’s uniformed immigration and customs inspectors. Each will be fully operational with the new Triple-Safe system within six to eight weeks.

The second element of Triple-Safe helps legitimate travelers get through border control faster. “Our Terrorist Watch list included many common names that required many tourists and American citizens with identical or similar names to suspect individuals be designated as No-fly status, until a lengthy background review could be completed.” The Boston Globe reported that even Senator Ted Kennedy had be delayed multiple times until his identity was cleared from the watch list. “Our new system includes further information on birthdates and even biometrics to help us focus the search where it needs to be.” The exact number of false alarms resulting from

identical or similar names is classified, but one estimate reported in the Los Angeles Times was as many as 32,000 incorrect matches per year.

The third element of the Triple Safe Program is a high-tech x-ray inspection of air, sea and land cargo. “We can’t inspect every single package, truck and shipping container by hand, that would bring international trade and shipping to a stand still,” Mocny reported. Typically only 2 percent of incoming cargo has been visually inspected. “But with a combination of x-ray, gamma ray and ultrasound technologies, we will be up to 100% inspection of incoming cargo by the summer and it is more accurate and dependable,” he reported. DHS had originally be planning to double the number of customs inspectors, but the remarkable progress in high resolution imaging technologies may make that costly and time-consuming recruitment effort unnecessary.

Senate Homeland Committee Chairman, Joseph Lieberman in concluding remarks commented: “All in all, this is bad news for the bad guys, and good news for Americans.”

E. Negative - Anxiety Evoking Story

The New York Times

Sleeper Cell Mystery



Dateline: Dearborn MI: FBI Special Agent Francis X. Sullivan announced the discovery of what may be an Al Qaeda-linked sleeper cell in Dearborn Michigan, a suburb of Detroit. “Our evidence is sketchy at the moment,” he reported. “But we have information from reliable sources that a group of from six to eight young Muslim men from Yemen, Lebanon and possibly Saudi Arabia have been planning a terrorist attack.” One of the men had reportedly served in Afghanistan in the US Army in 2005 but was dishonorably discharged. Sullivan refused to identify the suspected terrorists by name and did not respond to questions about whether any were currently in custody.

“This is a curious case,” commented former Attorney General John Ashcroft. “If the FBI knew the whereabouts and was tracking these suspects, it certainly wouldn’t go public like this.” The Los Angeles Times reported that this sleeper cell had originally been recruited to disrupt Super Bowl 30 held in Detroit on February 6th 2006, but failed complete the task. It is not clear what they were planning at that time and why they failed or cancelled their plans. Sources in the Detroit Police Department reported that they had been alerted to the possibility that the new target of this group was the Ambassador Bridge a heavily traveled international crossing connecting Detroit Michigan and Windsor Ontario. Security at the bridge has been heightened. The bridge carries 15,000 vehicles a day and is responsible for an estimated \$13 billion in trade between the US and Canada which represent each other’s largest trading partners. “Successfully hitting the Ambassador could easily equal or exceed the loss of life and economic impact of the World Trade Center attack,” according to Richard Falkenrath, an anti-terrorism expert based in New York. “My guess is that these guys are jihadists dissatisfied with American policy in the Middle East who are working on their own

without direct instructions or financial support from Al Qaeda. What is most disturbing is that there could be a dozen homegrown terrorist cells like this spread across the country.”

The Ambassador bridge is privately owned and operated, and a spokesman for the International Bridge Company which manages the structure scoffed at the prospect that even a full sized truck bomb could succeed in bringing the bridge down. Falkenrath, however, indicated a water-borne attack on the seldom traveled Detroit River was more likely.

Dr. Rabab Abdulhabi, Director of the Center for Arab American Studies in Dearborn expressed skepticism about the estimate of dozens of sleeper cells. “There are five and a half million Arab Americans in this country and the great majority of them are hardworking, taxpaying, patriotic and loyal American citizens.”

F. Negative - Aversion Evoking Story

The New York Times

Where Did Osama bin Laden Come From?

Osama bin Laden was born in Riyadh, Saudi Arabia 50 years ago to Mohammed Awad bin Laden an illiterate immigrant from Yemen who worked his way up from construction jobs to become one of the wealthiest men in Saudi Arabia as the favored road and building contractor of the Saudi royal family. Osama was the 17th of 55 children borne by Mohammed's 22 wives. Abiding by local custom Mohammed had no more than four wives at a time although some were married and divorced in the same day as divorce was a simple matter of the husband declaring "I divorce you."



Osama was born the only son of Mohammed bin Laden's tenth wife, Alia Ghanem, a fourteen year old citrus farmer's daughter from Syria. She briefly occupied the position of fourth wife or 'slave wife' because she had less tenure and influence than the others. Mohammed divorced Osama's mother and married her off, as was his custom, to one of his employees. As a result Osama grew up in a very modest house with his stepbrothers and sisters. He saw his father very rarely and only in large family gatherings and tried to impress his idolized father by reciting poems he had composed. Mohammed bin Laden died in a plane crash in 1967



Osama became intensely pious and anti-Western as a teenager and criticized his siblings for their interest in music and dancing. As a young man after working briefly in the family construction business he migrated to Afghanistan to help the local tribesmen with their war against the Soviets. His support through his inherited wealth was welcomed but it is not clear that Osama contributed measurably to the military effort. After the Afghan war it appears he turned his anger and frustration against the West especially Americans in their support for Israel. He denounced the royal Saudi family which was the source of his wealth and his Saudi citizenship was revoked in 1995.

He founded al-Qaeda in 1988. Although he does not bear the religious authority to issue an edict known as a fatwah, he has nonetheless done so declaring that it is the individual duty of Muslims to kill Americans, both civilians and military, in every country where such killing may be possible and to continue doing so until Israel is in Arab hands. He focused on America because it was seen as the center of Christian power and a threat to Islam. He later revised the fatwah to legitimate the killing of Muslims as well if they associated with, did business with, or were in the vicinity of Christians.

Al Qaeda helped to fund the World Trade Center bombing of 1993 in which 6 were killed and 1,042 were injured. The carbomb, however, failed to collapse the tower.

In November 1995 al Qaeda was associated with a truck bombing at the US-operated Saudi National Guard training center in Riyadh killing five Americans and two Indian nationals. Bin Laden denied involvement but praised the attack.

In 1996 19 American servicemen died in the truck bombing of Khobar Towers military barracks Saudi Arabia. It is not clear if bin Laden was responsible, although he was seen being congratulated by colleagues the day of the attack.



In August of 1998 al Qaeda car bombs next to two American embassies in East Africa were detonated simultaneously. In Nairobi, Kenya the downtown embassy explosion killed 213 and injured 4000; in Dar es Salaam, Tanzania the more remote embassy attack resulted in 11 killed and 85 wounded. Although the attacks were intended to kill



employees of the United States government, almost all of the victims were African civilians. In 1999 bin Laden is quoted as saying “If the instigation for jihad against the Jews and the Americans in order to liberate ...shrines in the Middle East is considered a crime, then let history be a witness that I am a criminal.”

An al Qaeda attack on a munitions ship the USS Sullivan was unsuccessful, the overloaded suicide motorboat sank before detonating, but a similar attack against the U.S. Navy destroyer USS Cole visiting a Persian Gulf port in October 2000 was more successful killing 17 sailors and nearly sinking the warship.

The most well known and dramatic example of bin Laden’s livid obsession with the United States, of course, has become known by the date 9/11 2001 when 19 terrorists under bin Laden’s command hijacked four commercial passenger jet airliners crashing two into the World Trade Center towers in New York and a third into the Pentagon. In total 2,992 souls lost their lives that day as an immediate result of the attacks. The FBI later released a report that 11 of hijackers apparently had not been informed that they were on a suicide mission.



Appendix III: The Three Affect Scales as Histograms

For Enthusiasm: expecting a normal distribution when a story evokes an enthusiastic response. See (Marcus et al., 2000) for the rational and evidence bearing on the distribution of affect dimensions (particularly with respect to anxiety and enthusiasm).

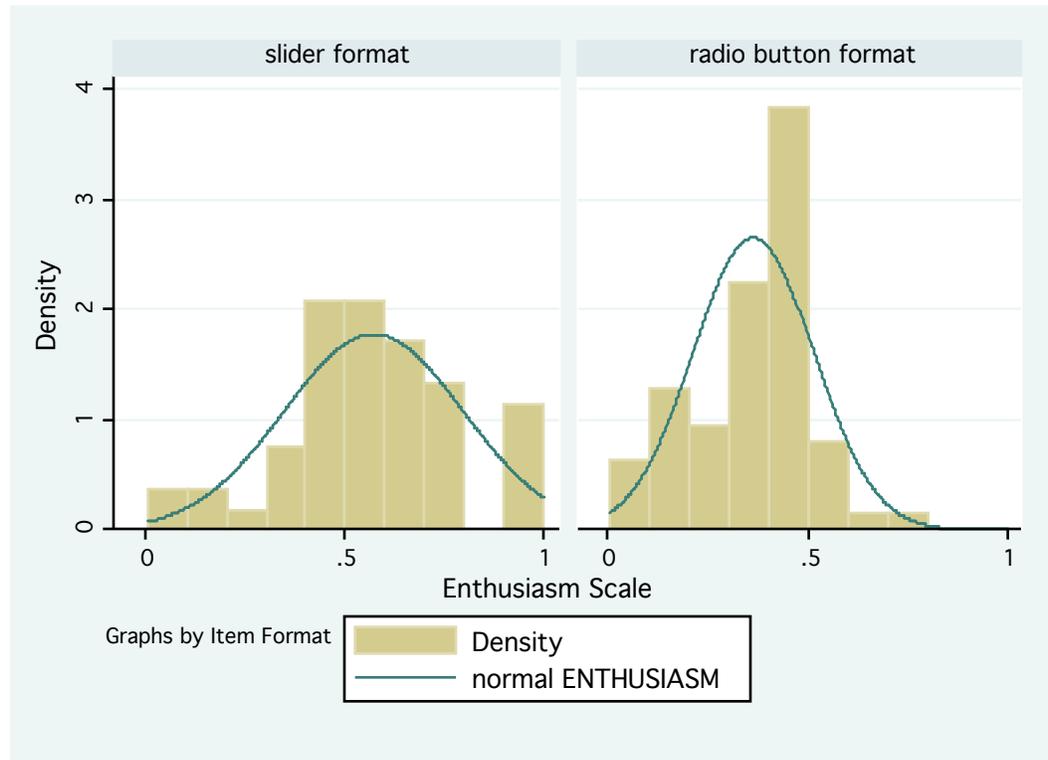


Figure A1: Distributions of Enthusiasm Scores for Slider and Radio Button Formats

The Slider format does a better job of generating the expected normal distribution than does the Radio Button format.

For Anxiety: expecting a skewed distribution when a story evokes an anxious response

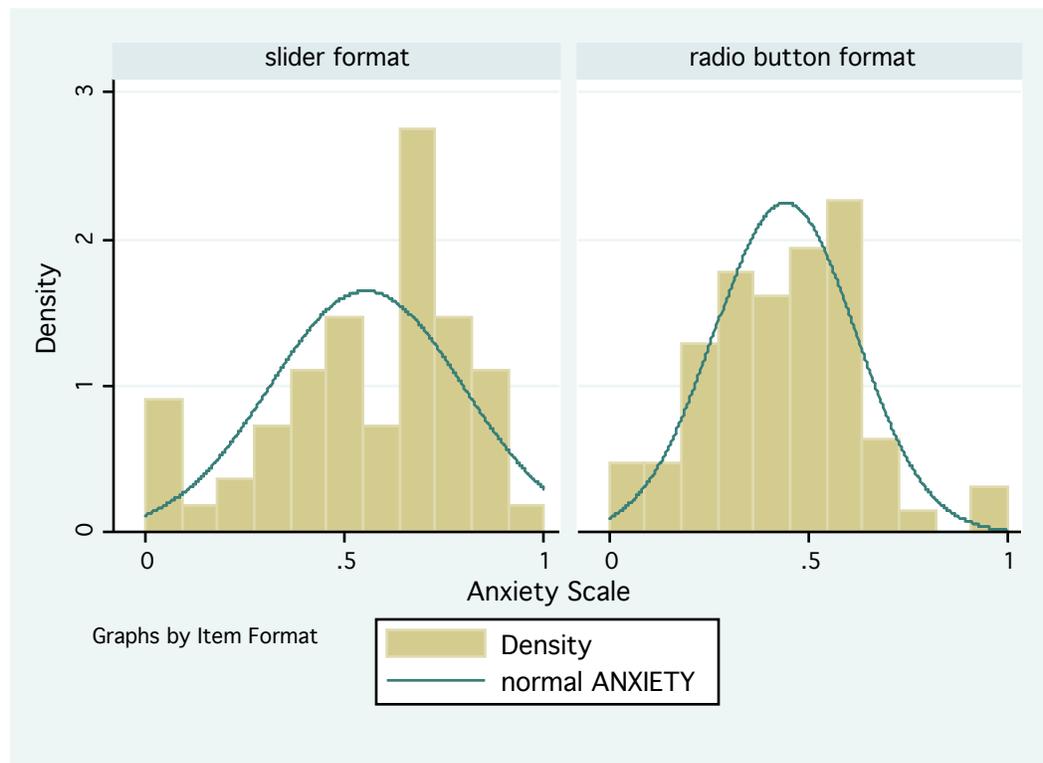


Figure A2: Distributions of Anxiety Scores for Slider and Radio Button Formats

The expected departure from normality (anxiety is most often highly skewed) shows up clearly in the slider format but seem largely missing when data is obtained reliant on radio button format methodology.

For Aversion: expecting a normal distribution - when story evokes an aversive response it, like enthusiasm, is governed by the Disposition System and, like enthusiasm, is most likely to be a normal distribution. Here, Figure A3 below, shows that both format options generate near normal distributions.

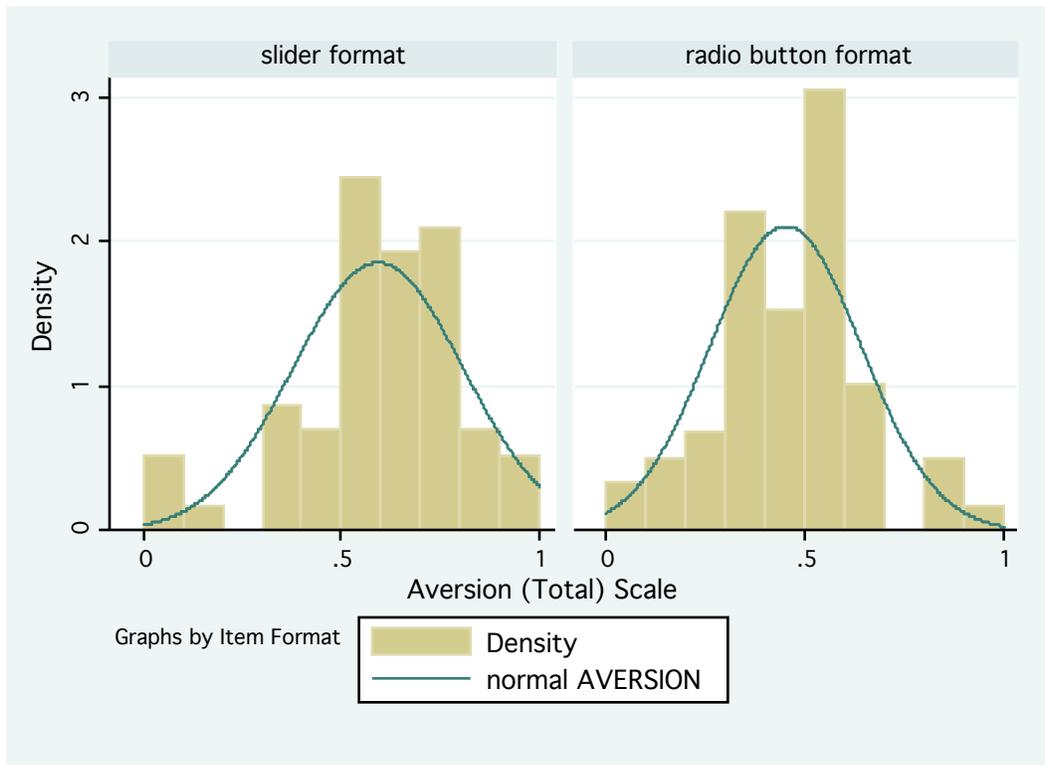


Figure A3: Distributions of Aversion Scores for Slider and Radio Button Formats