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DOES PROVIDING ACCURATE INFORMATION ABOUT SLOT MACHINES ALTER HOW PARTICIPANTS PLAY THEM?

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It is a commonly held belief that irrational thoughts held by gamblers can promote gambling behavior and ultimately pathological gambling. Some evidence exists to support this view, but little experimental work demonstrates that confronting these beliefs will lead to a decrease in gambling behavior. Eighteen non-pathological participants were given the option to play a slot machine for money. After gambling in two sessions, they were given accurate information about the independence of turns programmed by a slot machine, the negative rate of return of a slot machine over time, or both. Participants were then given the option to gamble in two subsequent sessions. Results showed that the introduction of the accurate information significantly decreased gambling, but did not eliminate it. Furthermore, no significant differences were observed across groups that received the different types of information. The results support the idea that gambling behavior is at least partially rule governed, but also indicate that information alone is unlikely to get individuals to stop gambling.

Keywords: Rule-governed behavior; Slot Machine; Gambling

Within the United States, gambling is a very popular activity. Nearly every state has some form of legalized gambling (MacLin, Dixon, & Hayes, 1999) and estimates suggest that over 90% of the population will engage in some type of gambling behavior within their lifetime (Petry, 2005). Although this behavior can be entertaining, it leads to serious problems for some. Petry (2005), for instance, estimated that between 1 – 3% of the population suffers from pathological gambling.

Although the percentage of individuals who suffer from gambling problems is quite small compared to the percentage of individuals who gamble without such problems, the absolute number of people who suffer from pathological gambling is not. Given the large number of people who suffer, it behooves the field to try to determine why these individuals come to display problem behavior (while other gamblers do not). The research literature on gambling is relatively large, suggesting that researchers have not ignored the study of gambling. However, no universally accepted explanation of pathological gambling currently exists (see Petry, 2005 for a review).

Perhaps the most popular approach to understanding and treating pathological gambling currently comes from the cognitive perspective. This approach espouses that pathological gamblers operate under false or faulty beliefs that lead them down the road to pathology (e.g., see Ladouceur, Sylvain, Boutin, & Doucet, 2002). These fallacious thought patterns can include the illusion of control (i.e., the idea that the person's actions influence the outcome of the game when in fact they do not; Langer, 1975), the failure to understand the independence of outcomes (i.e., the fact that, in most games of chance,

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the outcome of any one play is independent of the outcome of the previous or subsequent play), and the failure to recognize the games' negative rate of return (i.e., nearly every game of chance programs a long-term rate of return below 100%, meaning that the longer one plays, the more likely it becomes that one will lose money). Theoretically, people who operate under these fallacies are prone to become pathological gamblers. To successfully treat that pathology, one must eliminate or alter these fallacious thoughts.

From a behavior-analytic perspective, the underlying assumption of this view is that gambling behavior is largely rule governed. Although behavior analysis has long treated gambling behavior as being under the control of contingency-driven factors (see Weatherly & Dixon, 2007 for a discussion), an increasing number of behavior analysts are suggesting that verbal behavior plays a key role in the maintenance of gambling behavior (e.g., Dixon & Delaney, 2006; Dymond & Whelan, 2007; Weatherly & Dixon, 2007). This view has some support. For instance, Dixon (2000) was able to demonstrate that the behavior of roulette players could be altered by the introduction of inaccurate instructions even after the players had come into contact with the programmed contingencies of the game. Dixon, Hayes, and Aban (2000) demonstrated that the best predictor of when participants ceased gambling was the instructions the participants were provided, not the outcomes (e.g., winning or losing) the participants experienced while playing. More recently, Derevensky, Gupta, and Baboushkin (2007) were able to demonstrate that different winning contingencies altered children's' reported cognitions about gambling. That study focused on how risk taking affected cognitions, however, not how cognitions affected gambling behavior.

These demonstrations are informative, but they are not abundant in the literature. Furthermore, as pointed out by Petry (2005), although it is possible to demonstrate that pathological gamblers hold irrational beliefs about the game of chance they might be playing, it is also the case that non-pathological gamblers hold similar beliefs. Thus, these irrational rules may be necessary for the disorder, but they do not appear to be sufficient for it.

More germane to the current investigation is whether or not providing accurate information or rules will benefit the gambler. That is, both Dixon (2000) and Dixon et al. (2000) demonstrated that the introduction of inaccurate rules altered the gambling behavior of the participants. Neither study showed that participants' behavior could be altered by accurate rules. This point is an important one because it represents the foundation of the cognitive approach for the treatment of pathological gambling (e.g., Ladouceur et al., 2002). Namely, if one can get the pathological gambler to follow accurate rules, not inaccurate ones, then the factor leading to the pathology should be eliminated (but see Petry, 2005).

For the present study, we recruited non-pathological individuals to play a slot machine in four different sessions. In the first two sessions, the participants were allowed to play (or not play) a slot machine. Prior to the third session, participants were provided with accurate information about slot machines. One group was informed about the independence of outcomes from play to play. Another group was informed of the diminishing returns one can expect when one continues to play the slot machine. The final group received information on both the independence of outcomes and diminishing returns. The participants then played (or did not play) in two additional gambling sessions.

If gambling behavior is largely rule governed, then one would predict that the introduction of this information would lead to a decrease in participants' gambling behavior. If participants' beliefs in dependence of turns or positive outcomes over time differ in how much they control behavior, then one would predict that information countering these beliefs would have a differential effect between groups. Finally, if both beliefs are governing behavior, then one would predict the greatest decrease in gambling behavior for the group that receives information countering both beliefs.

METHOD

Participants

The participants were 18 (8 females, 10 males) individuals who were recruited from the psychology department's participant pool at the University of North Dakota. To participate, individuals had to be 21 years of age or older and score less than 5 on the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). The mean age of the participants was 22.61 (SD=2.20) years. All but one participant was single (or divorced). All participants were Caucasian and all but two reported making $10,000 or less per year in annual income. No participant reported an annual income above $25,000.

Materials and Apparatus

Participants completed a series of forms that included an informed consent form, a demographic questionnaire, the SOGS (Lesieur & Blume, 1987), and the Gambling Functional Assessment (GFA; Dixon & Johnson, 2007). They completed these forms prior to participating in any gambling sessions.

The demographic questionnaire asked for five pieces of information: sex, age, marital status, race/ethnicity, and annual income. Each of these pieces of information was obtained because each is a known risk factor for pathological gambling (see Petry, 2005).

The SOGS is a self-report questionnaire that contains 20 items. The questionnaire asks respondents about their gambling history and is a widely used measure for screening for the possible presence of pathological gambling (Petry, 2005). A score of 5 or above on the SOGS suggests that the respondent may be a pathological gambler. For the present study, potential participants who scored 5 or more on the SOGS were not allowed to participate in the gambling sessions to assure that individuals who might be suffering from pathology were not allowed to engage in their pathology. No participants had to be excluded because of their score on the SOGS.

The GFA (Dixon & Johnson, 2007) is a self-report questionnaire that contains 20 items. The questionnaire asks respondents about the environments in which they gamble so as to potentially identify the consequences that might be maintaining their gambling behavior. The GFA supposedly identifies four possible reinforcing consequences: sensory experiences, escape, attention, and tangible rewards (i.e., money). Five questions are asked pertaining to each consequence, which respondents can score between 0 and 6, making the top score for any category on the GFA 30. The category with the highest score is theorized to be the primary consequence maintaining the individual's gambling.

Gambling sessions took place in a windowless room that contained three slot machines. All participants played the same one machine in each session. It was an IGT "Red, White, and Blue" (wild) machine. The machine allowed the participant to bet up to three coins per spin. The machines were programmed to accept tokens, which participants were informed were worth $0.05 each. Outcomes on the machine were programmed by a computer chip designed to provide an 87% return rate over an indefinite period of time. The machine was equipped with a series of counters (unobservable to the participant) that recorded the number of coins put into the machine and the number of coins dispensed. All "wins" were paid in tokens (vs. being accumulated on the machine as credits) to ensure an accurate count of the number of coins won.

The number of plays (i.e., spins) was not recorded by the slot machine; therefore the researcher monitored this measure manually.

Procedure

All aspects of the procedure were approved by the Institutional Review Board at the University of North Dakota. Participants were run individually. When a participant arrived for the first session of the experiment, the researcher checked his/her identification to ensure the participant was 21 years of age or older. The participant then went through the process of providing informed consent. Next, the participant completed the SOGS, followed by the demographic questionnaire and the GFA. The researcher scored the SOGS while the participant was completing the final two questionnaires to ensure that the participant did not score 5 or more on the SOGS. No participant did. The researcher then seated the participant in front of the slot machine and read him/her the following instructions:

> You will now be given the opportunity to play on a slot machine. You will be given 100 tokens worth 5 cents each. Thus, you are being given $5 to play with. You may bet as many credits per play as the machine allows. Your goal should be to end the session with as many tokens as you can. You may end the session at any time by informing the researcher that you would like to end the session. The session will end when a) you quit playing, b) you run out of tokens, or c) 15 minutes have elapsed. At the end of the experiment you will be paid in cash for the number of tokens you have left or have accumulated. Do you have any questions?

Questions were answered by repeating the above instructions. The researcher then gave the participant a plastic cup that contained 100 tokens and the participant played the slot machine until one of the three criteria for ending the session was met. When participants arrived for the second gambling session, the researcher informed them that the session was the same as the first. The participant was again given 100 tokens and the session proceeded as did the first session.

Prior to the third gambling session, the participant was pseudo-randomly assigned to one of the three groups (n = 6). The groups differed as to the information they received prior to the third session. The pseudo-random nature of the procedure was that we attempted to keep the distribution of females and males similar across groups (i.e., 2, 3, & 3 females in groups 1, 2, & 3, respectively).

Participants in group one (Independence of Turns) were read the following instructions prior to beginning their third session:

> Slot machines are programmed to pay out on what are known as random-ratio schedules, meaning that each play is independent of another. In other words, the outcome of your next play has absolutely no connection to the outcome of the previous or following play. Furthermore, the machine does not "keep track" of how you are playing. Each time you play, the outcome is randomly determined according to a set probability. There is nothing you can do to increase the chances that a winning combination of symbols will fall on the "win" line.

Participants in group two (Diminishing Returns) were read the following instructions prior to their third session:

> Slot machines are programmed to pay back players a certain percentage of the money that they play. For instance, say a machine is programmed to pay back at 98%. That means that, over a long period of time, that machine will return $98 for every $100 that is put into it. Because the payback percentage is always less than 100%, it is never to the player's advantage to play for a long period of time. Furthermore, few slot machines provide a payback percentage as high as 98%. Some may program payback percentages as low as 83% or lower. Because one cannot tell the payback percentage by simply looking at the machine, it may take some time to determine that you are playing a machine with a low payback percentage.

By that point, you have likely lost a lot of money.

Participants in group three (Both) were read the information provided to both groups one and two. Participants in all three groups were then given 100 tokens and the third session proceeded similarly to the first two. When participants returned for their fourth session, they were again given 100 tokens (but were not read additional instructions). At the completion of the fourth gambling session, the researcher summed the total number of credits the participant had accumulated across the four sessions, paid the participant the equivalent in cash, debriefed the participant as to the nature of the study, and dismissed the participant.

Design and Analysis

Two main dependent measures were taken from the gambling sessions. The first was the number of trials (i.e., plays of the slot machine) participants played per session. This dependent variable served as a measure of persistence or duration of play. The second measure was the total number of credits bet per session. This dependent variable served as a measure of risk taking. These two measures are positively, but not perfectly, correlated. That is, because it was possible for participants to bet one, two, or three credits per trial, it was possible for a participant who played half the number of trials played by another participant to bet more credits than that other participant.

The data from individual subjects on these measures were subjected to a three-way (Group by Condition by Session) mixed model analysis of variance (ANOVA). In these analyses, group (Independence of Turns, Diminishing Returns, Both) served as a between-subjects variable. Condition (Baseline vs. Post Treatment) and session (First vs. Second) were repeated measures. Results for these and all following analyses were considered significant a $p<.05$.

Secondary analyses were conducted by correlating participants' scores on the SOGS and GFA with their behavior in the gambling session. Because these scores could not be assigned causal roles and because there was no theoretical reason to believe that they would be correlated with behavior in specific gambling sessions (e.g., session 2), the correlations were calculated using the average number of trials played and credits bet per session across all four gambling sessions. Gender was also correlated with these measures because the literature suggests that females and males differ in terms of their gambling behavior (e.g., prevalence of pathological gambling, types of games of chance they prefer; see Petry, 2005). Furthermore, research from our laboratory suggests that gender differences sometimes (Dannewitz & Weatherly, 2007; Weatherly, Austin, & Farwell, 2007), but not always (e.g., Weatherly, McDougall, & Gillis, 2006), exist. Correlations were determined by calculating Pearson product-moment coefficients.

RESULTS

The ANOVA conducted on the number of trials played yielded a non-significant main effect of group, $F(2, 15) = 0.92$, $p=.421$, Eta Squared = .109, suggesting that the three groups did not differ in the number of trials they played. The main effect of condition was significant, $F(1, 15) = 4.87$, $p=.043$, Eta Squared = .245, indicating that providing information about slot machines altered the number of trials played. The top graph of Figure 1 displays this effect, demonstrating that the information decreased the number of trials participants played. The main effect of session was not significant, $F(1, 15) = 0.52$, $p=.484$, Eta Squared = .033, indicating that the number of trials played did not change significantly between sessions one and two. The interactions between group and condition, $F(2, 15) = 0.08$, $p=.925$, Eta Squared = .010, between group and session, $F(2, 15) =$

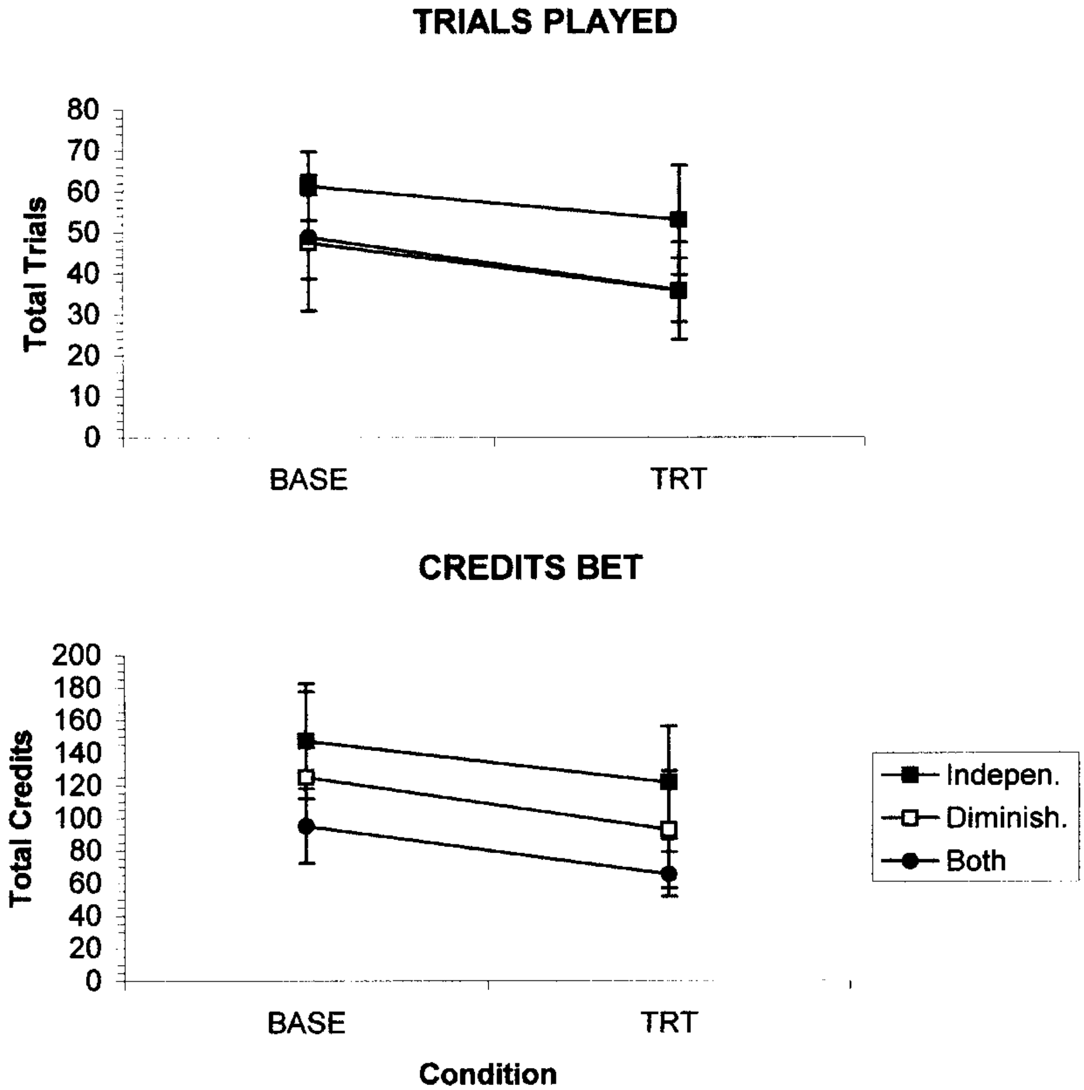

Figure 1. Presented are the number of trials played (top graph) and credits bet (bottom graph) for the mean for all participants in each group in the two sessions before (BASE) and after (TRT) information about slot machines were provided. The error bars represent one standard error of the mean across participants in that particular group in those particular sessions.

.20, p=.820, Eta Squared = .026, between condition and session, $F(1, 15) = 2.60$, p=.128, Eta Squared = .148, and across group, condition, and session, $F(2, 15) = 1.14$, p=.347, Eta Squared = .132, all failed to reach significance, indicating that these measures did not vary systematically as a function of the other(s).

The ANOVA conducted on the number of credits bet also yielded a non-significant main effect of group, $F(2, 15) = 0.78$, p=.478, Eta Squared = .094, suggesting that the three groups did not differ in the number of credits they risked. The main effect of condition was significant, $F(1, 15) = 6.50$, p=.022, Eta Squared = .302, indicating that providing information about slot machines systematically altered the number of credits participants bet. The bottom graph of Figure 1 displays this effect, again demonstrating that providing the information decreased participants' gambling. The main effect of session was not significant

Table 1
Presented are the Pearson product-moment coefficients between SOGS score, gender, GFA scores, and the mean of the two dependent measures from across the four gambling sessions.

	SOGS	Gender	GFA Sensory	GFA Escape	GFA Attention.	GFA Tang.	Trials Played	Credits Bet
SOGS	1.00	-.090	.420	.332	.270	.540*	.355	.023
Gender		1.00	-.356	-.340	-.451	-.368	-.396	-.575*
GFA Sensory			1.00	.788**	.781**	.617**	.678**	.654**
GFA Escape				1.00	.412	.344	.482*	.466
GFA Attent.					1.00	.768**	.524*	.595**
GFA Tang.						1.00	.610**	.510*
Trials Played							1.00	.850**
Credits Bet								1.00

* *p*<.05
** *p*<.01

F(1, 15) = 0.46, *p*=.507, Eta Squared = .030, indicating that the number of credits bet did not change significantly between sessions one and two. The interactions between group and condition, *F*(2, 15) = 0.03, *p*=.973, Eta Squared = .004, between group and session, *F*(2, 15) = .92, *p*=.420, Eta Squared = .109, between condition and session, *F*(1, 15) = 3.49, *p*=.082, Eta Squared = .189, and across group, condition, and session, *F*(2, 15) = 0.88, *p*=.436, Eta Squared = .105, all failed to reach significance, indicating that these measures did not vary systematically as a function of the other(s).

Table 1 presents the correlations between the SOGS scores, participants' gender, GFA scores, and the behavioral measures from the gambling sessions. Participants' SOGS scores were significantly correlated their score on the "tangible" questions of the GFA, but not with actual gambling behavior. Females tended to bet fewer credits than males, but the correlation between gender and trials played was not significant. Scores on the GFA were nearly all significantly correlated with participants' gambling behavior, and also with other scores on the GFA. As suggested above, the number of trials played and the total number of credits bet per session were significantly correlated.

DISCUSSION

The present experiment was designed to determine whether providing players with accurate information about slot machines would lead to a decrease in their gambling on them. Participants in the present study were provided information about the independence of outcomes, the negative rate of return, or both after playing a slot machine for two sessions. The introduction of this information led to a significant decrease in gambling behavior in the subsequent two sessions. These results therefore support the idea that gambling behavior is at least partially rule governed.

Ladouceur et al. (2002) suggested that two of the primary fallacious thought patterns that lead to pathological gambling are the person's inability to recognize that one outcome of a game of chance (i.e., spin of the reels on a slot machine) is independent of the other outcomes and the person's thinking that, sooner or later, the person must win. Participants in the current study were either provided with information meant to confront one of these beliefs or both. The analyses did not find a main effect of group, indicating that information on one type of fallacy did not influence gambling behavior differently than information on the other type. The results also suggest that there was no cumulative effect of providing information on both types of fallacies. Thus, although the present results support the idea that gambling can be decreased by providing accurate information about these beliefs, it does not provide evidence that one type of information is better than the other or that more information is better than less. In fact, it is quite possible that the introduction of the accurate information served to establish a general rule such as "don't trust slot machines" rather than altering the targeted beliefs (i.e., independence of turns, diminishing returns).

It is also worthy of note that although the introduction of accurate information regarding slot machines significantly decreased gambling behavior, it did not eliminate it. In fact, in the 72 gambling sessions that were conducted, in only one did a participant choose not to gamble and thus keep the $5 she had been staked. Interestingly, this outcome occurred in the second session of the experiment, prior to the introduction of information about slot machines. Thus, the present results suggest that information alone is not enough to get non-pathological gamblers to choose not to gamble. It would seem reasonable to assume that pathological gamblers would be more motivated to gamble than non-pathological gamblers, which would lead one to predict that information alone may have less of an impact on the behavior of pathological gamblers than observed in the present study.

One could potentially argue that the observed decreases in gambling were not due to the presentation of accurate information, but rather represent a systematic decrease in gambling over consecutive sessions (e.g., habituation to the procedure). However, results from the statistical analyses can rule out this possibility. The above analyses failed to produce a main effect of session. This result indicates that gambling did not systematically vary from the first to the second session. Furthermore, none of the possible interactions involving session were significant, indicating that changes from the first to second session were not altered as a function of other variables. Neither result should have been observed if gambling behavior was changing as a function of time.

Another argument could be made that the present results are of limited value because the participants were gambling with money that they had been staked, rather than with their own money. This argument cannot be completely countered and will always be one that can be made against gambling research conducted in a laboratory setting. However, existing research has demonstrated that when people are gifted an item, such as the money staked to them in the current experiment, they treat it as if they owned it (e.g., Kahneman, Knetsch, & Thaler, 1990). Furthermore, research from our laboratory has demonstrated that participants gambling with actual (staked) money gamble more conservatively than when they are playing with credits that have no monetary value (Weatherly & Brandt, 2004; Weatherly & Meier, 2007). These results support the idea that the money staked to participants does have value.

If the present procedure was to be replicated, several variations might be warranted. For instance, the participants were presented with the accurate information only once. Although its effect was still present in the second, post-information session, repeating that information may have had a cumulative effect. Next, it is also possible that, had more than two post-instruction sessions been conducted differences in the impact of the different types of information may have emerged. Furthermore, it is possible that the effect of accurate information is, in fact, short lived. Additional sessions would be required to determine whether or not this possibility is a valid one. Finally, in the present procedure, the researcher was present during the sessions to record the number of trials played. Because this situation occurred in every session, it is not possible to tell the impact of having the researcher present.

In terms of the correlation data in the present study, there were several interesting associations between self reports and actual behavior. The SOGS, which is a widely used but sometimes criticized measure (see Petry, 2005), did not correlate with participants' gambling behavior. It did, however, correlate with another self-report measure, namely the "tangible" consequences category of the GFA. This result is of interest because Weatherly and Dixon (2007) postulated that pathological gambling occurs when money becomes the main reinforcing consequence driving the person's gambling. The present result is consistent with that view.

The fact that scores on the GFA were nearly all significantly correlated with the participants' actual gambling behavior suggests that the GFA has value, perhaps for both research and treatment purposes. However, it is also the case that some of the different consequences the GFA was designed to measure were significantly correlated with the other consequences. This result would suggest that the different categories of the GFA may not in fact be measuring separate factors, a finding that is consistent with recent research on the GFA (Miller, Meier, Muehlenkamp, & Weatherly, in press). Thus, although the screen appears to have value, it would seem that it needs to be honed so that the separate categories are in fact measuring separate contingencies.

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