Psychological Reports, 2009, 105, 975-988.

EVIDENCE OF THE PROPERTIES OF AN AMBIGUITY TOLERANCE MEASURE: THE MULTIPLE STIMULUS TYPES AMBIGUITY TOLERANCE SCALE–II (MSTAT–II)[1]

DAVID L. McLAIN

State University of New York Institute of Technology, Utica

Summary.—Despite widespread interest in ambiguity tolerance and other information-related individual differences, existing measures of ambiguity tolerance are conceptually disparate and are often psychometrically weak. This paper presents evidence of reliability and validity for a 13-item measure of ambiguity tolerance (MSTAT–II) based on a definition of ambiguity tolerance as an orientation, ranging from aversion to attraction, toward stimuli that are complex, unfamiliar, and insoluble. The MSTAT–II addresses each basic type of ambiguous stimulus, contains fewer items than many other scales, and reduces references to specific contexts and objects not directly related to ambiguity. Data from three studies using diverse samples and measures, including other popular ambiguity tolerance scales, were examined, and the results suggest the MSTAT–II may improve upon other paper-and-pencil measures of ambiguity tolerance.

Frenkel-Brunswik (1948) is credited with originating the concept of intolerance of ambiguity. Originally, studies of ambiguity intolerance were motivated by a widespread belief that ambiguity intolerance helped explain such social psychological phenomena as authoritarianism and ethnocentrism (e.g., Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950). No widely accepted standard measure was employed, however, and a large number of studies produced little evidence confirming these relationships (Furnham & Ribchester, 1995). This might have ended interest in the construct, but instead renewed interest came from researchers in fields as diverse as business, nursing, and education. Those researchers shifted the theoretical perspective toward ambiguity tolerance as a basic psychological influence on the perception of situations and the making of choices (Furnham & Ribchester, 1995; Yurtsever, 2001, 2008; Van Hook & Steele, 2002; Madlock, Kennedy-Lightsey, & Myers, 2007).

Since the introduction of the concept, several measures of ambiguity tolerance, or intolerance, have been developed (e.g., Budner, 1962; Rydell & Rosen, 1966; MacDonald, 1970; Kischkel, 1984; Bhushan & Amal, 1986). However, progress in this research has been hindered because the reliability and validity of most popular measures are weak (Kenny & Ginsberg,

[1]Address correspondence to David L. McLain, School of Business, SUNY Institute of Technology, P.O. Box 3050, Utica, NY 13504-3050 or e-mail (dmclain@alum.mit.edu). The author thanks Bonnie S. O'Neill, Stephen Havlovic, Loren Kuzuhara, and anonymous reviewers for their comments on earlier drafts of this manuscript.

DOI 10.2466/PR0.105.3.975-988

1958; Norton, 1975; Kirton, 1981; Ray, 1988; Furnham, 1994; Lange & Houran, 1999). Many measures also lack the content and structure needed for the theories they test. To help address these problems, a 13-item paper-and-pencil measure of ambiguity tolerance was developed. The goal for this measure, called the Multiple Stimulus Types Ambiguity Tolerance Scale–II (MSTAT–II), was to measure concisely an individual's cognitive orientation toward several types of ambiguous stimuli with acceptable reliability and validity.

Conceptual Foundations of Prior Measures

Initially, research concentrated on ambiguity *intolerance,* which was theorized as a complex, value-laden indicator of ethnic discrimination, fascism, dogmatism, or other constructs tied to the social psychological concept of the authoritarian personality (e.g., Adorno, *et al.,* 1950; Block & Block, 1951; O'Connor, 1952; Coulter, 1953; Westie, 1953). In 1962, Budner made important advances in ambiguity intolerance research by publishing a detailed definition of the construct and providing a corresponding 16-item scale. The definition helped clarify the psychological meaning of ambiguity tolerance and the scale achieved widespread use. In his definition, Budner indicated that perceived ambiguity arises from stimuli that are complex, unfamiliar, or insoluble.

Budner's scale has proved popular in spite of some weaknesses. Budner classified scale items by the type of stimulus, but the wording of some items is a poor representation of the theory and does not clearly reflect the corresponding stimulus type. For example, two items that supposedly refer to complex stimuli are, "People who fit their lives to a schedule probably miss most of the joy of living," and "The sooner we all acquire similar values and ideals the better." Budner did not confirm whether respondents associated each item with its corresponding stimulus type. It is also unclear whether these items, or items like, "I would like to live in a foreign country for a while," evoke thoughts of ambiguity at all. Concerns about measurement extend to other ambiguity tolerance measures as well. Incomplete, inadequate, and strongly biased tapping of theoretical dimensions is common. Some scale items appear confounded by reference to specific situations that may evoke responses other than reactions to ambiguity. For example, nine of the 16 items in Budner's scale refer to persons, people, or classifications of people such as "teachers" or "experts."

Budner's efforts were followed by several other attempts to measure ambiguity tolerance, but a distinctly better scale has been elusive. A variety of criticisms has been leveled at these measures (Furnham & Ribchester, 1995), but one common concern is poor psychometric properties (Norton, 1975; Ray, 1988). The reliability values reported for data collected using Budner's scale, for example, tend to be less than the values calculated for

many other popular Likert-scaled questionnaires. Budner's own research produced a coefficient alpha value of only .49. Additionally, the validity evidence for many of these scales consists of comparisons with measures of other constructs that have a tenuous theoretical relationship with ambiguity tolerance. This makes it difficult to assess the quality of a scale from the published results of validity studies. Even the definition of ambiguity tolerance underlying many of these scales is ambiguous, lacks clarity, and fails to distinguish ambiguity tolerance from its assumed correlates—cognitive, perceptual, and social (Leichsenring, Steuernagel, Steuernagel, & Meyer, 2007). Obscuring these problems is a lack of published reliability and validity evidence.

Contemporary Definition of Ambiguity Tolerance

At its heart, ambiguity is the timely absence of information needed to understand a situation or identify its possible future states. Ambiguity is therefore a lack of information beyond risk or uncertainty (e.g., Ellsberg, 1961; Pich, Loch, & DeMeyer, 2002), which requires an awareness of all possible outcomes. Usually, the response to ambiguity is aversion, but some people may be attracted to the mystery or cognitive challenge that comes from incomplete information, especially when there is no perceived threat. Ambiguity may also be attractive when there is a possibility that the situation may produce a negative outcome (Viscusi & Chesson, 1999) and when the ambiguity enables some hope of avoiding that outcome. In general, however, ambiguity is a barrier to understanding; if an ambiguous situation requires action on the part of the perceiver, it can feel threatening and cause stress. Because both aversive and attractive orientations seem possible, a definition of ambiguity tolerance should encompass the range between both possibilities, and a scale built on this definition should measure an individual's orientation across that range.

Several situational characteristics can give rise to the perception of ambiguity, but complexity, novelty, and insolubility are basic (Budner, 1962). A complex stimulus overwhelms the perceiver who must sift through a lot of information in order to understand the situation. Novelty, also called newness or unfamiliarity, presents a situation that has been experienced rarely, if at all. Even if parts of a situation are familiar, the way the parts are combined or behave together may be unfamiliar. Insoluble stimuli present conflicts in information that must be resolved if the situation is going to be understood. These conflicts may range from mild incongruities to impossible contradictions and can result in multiple interpretations of the situation (Poesio, 1996).

Reactions to ambiguity and the desire for a clearer understanding of the situation may include stress, avoidance, delay, suppression, or denial (Budner, 1962). Social orientations such as authoritarianism are out-

side the definition of ambiguity tolerance and may or may not be related. However, among those constructs that should be closely related to ambiguity tolerance are those orientations toward situations that are defined by the availability of information, such as situations of risk or uncertainty.

Multiple Stimulus Types Ambiguity Tolerance Scale–II

The proposed measure is called the Multiple Stimulus Types Ambiguity Tolerance Scale–II (MSTAT–II) because most items in the scale refer to one of the stimulus types associated with perceived ambiguity: complexity, unfamiliarity, or insolubility. In addition, items are included that refer to ambiguous stimuli in general, regardless of type. Because the 13 items in this scale are derived from the 22 items in the MSTAT–I (McLain, 1993), this scale is called the MSTAT–II.

The MSTAT–II is intended to be a psychometrically adequate measure that avoids problems found in some existing scales, while being short enough to minimize the cognitive burden placed on respondents. Items for the MSTAT–II were selected based on the analysis of data gathered from studies that used the MSTAT–I. Starting with the original 22 items, item wording was refined using feedback both from people completing the scale and from researchers who read MSTAT–I reports. Next, items from the MSTAT–I were selected based on whether they met four criteria: contribution to the overall construct's theoretical definition, an item-to-scale correlation greater than .40 in prior research, value neutrality and context independence (i.e., not referring to specific situations but rather to stimulus types), and understandability by individuals with varied backgrounds. This resulted in the identification of three items referring to insoluble stimuli, two items each addressing unfamiliar and complex stimuli, one item referring to uncertain stimuli, and five items corresponding to ambiguous stimuli in general. The item referring to uncertainty correlated well with the scale (.49) and most highly with items referring to ambiguity in general, consistent with the idea that uncertainty is very closely related to ambiguity, which is a reaction to perceptions of the various stimulus types. The resulting 13 items appear in Table 1 and comprise the MSTAT–II. All items are designed for Likert-type responses with low scale scores indicating aversion to ambiguity and high scale scores indicating a liking for ambiguity.

Three Evaluation Studies

There are two tasks to perform when proposing a measure to improve or replace existing measures of the same construct. One such task is to gather data from the population for which the measure is designed to ascertain the measure's reliability and validity in that population. Another task is to compare the measure with existing measures to evaluate dif-

TABLE 1
ITEMS OF MULTIPLE STIMULUS TYPES AMBIGUITY TOLERANCE SCALE–II

Item	*M*[a]	*SD*	Stimulus Type[b]
1. I don't tolerate ambiguous situations well.[c]	2.66	1.09	(G1)
2. I would rather avoid solving a problem that must be viewed from several different perspectives.[c]	3.80	1.01	(I1)
3. I try to avoid situations that are ambiguous.[c]	2.97	1.10	(G2)
4. I prefer familiar situations to new ones.[c]	2.74	1.03	(N1)
5. Problems that cannot be considered from just one point of view are a little threatening.[c]	3.38	1.06	(I2)
6. I avoid situations that are too complicated for me to easily understand.[c]	3.80	1.01	(C1)
7. I am tolerant of ambiguous situations.	3.14	1.05	(G3)
8. I enjoy tackling problems that are complex enough to be ambiguous.	3.40	0.95	(C2)
9. I try to avoid problems that don't seem to have only one "best" solution.[c]	3.61	0.91	(I3)
10. I generally prefer novelty over familiarity.	3.04	0.92	(N2)
11. I dislike ambiguous situations.[c]	2.95	1.07	(G4)
12.I find it hard to make a choice when the outcome is uncertain.[c]	2.84	1.10	(U1)
13. I prefer a situation in which there is some ambiguity.	3.05	0.92	(G5)

Note.—[a]*N* = 528, Study 1. [b]Stimulus/item type: (G) ambiguous stimuli in general, (C) complex stimuli, (U) uncertain stimuli, (N) new/unfamiliar/novel stimuli, (I) insoluble/illogical/irreducible/internally inconsistent stimuli. [c]Reverse-scored item.

ferences in scale behavior and usefulness. Three studies were conducted with the MSTAT–II to partially achieve these goals. The first study was conducted with a group of university students and enabled the estimation of the scale's reliability and the number of factors that best describe the data. The second study, also conducted with university students, enabled a comparison between data obtained with the MSTAT–II, other ambiguity tolerance scales, scales measuring related constructs, and a measure of socially desirable responding. The third study was conducted in the field, extending use of the MSTAT–II beyond student samples, and enabled additional comparisons of relationships between MSTAT–II scores and measures of related constructs.

STUDY 1

Method

Study 1 data were collected using a survey form administered to 542 undergraduate business students taking a third-year organizational behavior course at a very large Wisconsin university. These students were surveyed during the part of the course devoted to the role of individual differences in organizational behavior. The students ranged in age from 19 to 42 years (*M* age = 21.2 yr., *SD* = 2.7; 32% women, 68% men).

Results

Missing or unreadable data resulted in 528 usable surveys of the 542 surveys distributed. The mean MSTAT–II score was 41.4 ($SD = 7.5$) and internal consistency reliability (Cronbach coefficient alpha; Nunnally, 1978) was .83 (Revelle's $\beta = 67$). Removing data for one item at a time indicated that no single item's data, if removed, would increase the reliability value for the scale as a whole, thus encouraging retention of all 13 items for further study.

Factor analysis of the data identified three factors with eigenvalues greater than one (4.3, 1.5, and 1.1). These factors explained 53% of the variance and an orthogonal rotation indicated the items that most strongly loaded on the first factor were those items corresponding to ambiguity tolerance in general without reference to a specific stimulus type (Items 1, 3, 7, 11, and 13). The scree plot showed a distinct first factor and no other distinct breaks. A factor that consists of items referencing nonspecific ambiguity should not be perfectly orthogonal to factors consisting of items about specific stimulus types. Therefore, an oblique rotation was also performed. The results of that rotation also suggested an interpretation of the first factor as representing ambiguity tolerance in general.

Confirmatory factor analysis of a one-dimensional theoretical model was performed using AMOS 6. The χ^2 and other fit statistics for the model, without correlated error terms, were 377 ($p < .001$), NFI = .78, TLI = .78, RFI = .74, and RMSEA = .10. The significant χ^2 value suggests rejection of the model; but the χ^2 is sensitive to sample size, so for a large sample such as this ($N > 500$), it is not especially informative (e.g., Gerbing & Anderson, 1993). The literature concerning fit indices (e.g., Hu & Bentler, 1999) alternatively suggests that a good fit is shown by index values of at least .90 if not .95 and an RMSEA value less than .06. Taken together, these several statistics suggest the data are not a good fit to the model.

Modification indices were examined to seek improvements to the model. These indices suggested that freeing error terms to covary between the general ambiguity items and items associated with specific stimulus types would improve the fit. This makes theoretical sense for a scale that contains some items focused on specific types of ambiguous stimuli and some items which refer to the common perception that theoretically links those perceptions. Once these error terms were allowed to covary, fit improved substantially. The chi-squared value ($\chi^2 = 50$, $p < .01$) and other goodness-of-fit statistics improved (NFI = .97, TLI = .95, RFI = .91, RMSEA = .05), suggesting the one-dimensional theoretical model is an acceptable fit to the data (Hu & Bentler, 1999). The 13-item MSTAT–II was therefore considered acceptable for use, as designed, in Studies 2 and 3.

Study 2

Method

Study 2 had three primary goals: (a) to compare scores collected using the MSTAT–II and two other widely used ambiguity tolerance scales; (b) to compare MSTAT–II scores with scores from a measure of risk-taking orientation, a construct closely related to ambiguity tolerance according to the definition on which the MSTAT–II is based; and (c) to assess whether MSTAT–II scores are vulnerable to socially desirable responding.

Two well-known ambiguity tolerance scales, the Budner (1962) and MacDonald (1970) scales, were employed for comparison with the MSTAT–II. Items in the Budner scale have been previously described. At the core of MacDonald's AT–20 scale are the 16 items of the Rydell and Rosen (1966) ambiguity tolerance scale plus four items added to increase scale reliability. The resulting 20 true-false items are believed to have better psychometric quality than Budner's scale (Kirton, 1981). Example items include, "A problem has little attraction for me if I don't think it has a solution," "I get pretty anxious when I'm in a social situation over which I have no control," and "I would rather bet 1 to 6 on a long shot than 3 to 1 on a probable winner." The five responses for both scales range from 1: Strongly disagree to 5: Strongly agree.

An individual's orientation toward risk taking is theoretically associated with ambiguity tolerance because risk taking also requires tolerance of incomplete information about the future. A favorable disposition toward risk taking implies a tolerance for the imperfect information such risk taking entails (e.g., Johanson, 2000). A 13-item version of the sensation-seeking scale by Zuckerman (1984) was used to measure each individual's risk-taking orientation. Risk comes in many forms, including risks to personal safety; sensation seeking refers to that form of risk. Scale items consist of forced-choice pairs with the riskier choice in each pair being scored 1 and the less risky choice being scored 0.

The 33-item Marlowe-Crowne Social Desirability Scale was included to check for the transparency of MSTAT–II items and any associated tendency by individuals to provide responses that are considered desirable by others rather than personally truthful (Crowne & Marlowe, 1960). The five Likert-type responses range from 1: Strongly disagree to 5: Strongly agree.

Study 2 participants were 121 undergraduate students enrolled in a third-year business course at a historically Black university. This sample extends the demographic range of the population sampled in Study 1.[2]

[2]This goal responds to a suggestion made by a reviewer who wanted to know how different groups might differ in response to the wording of scale items.

The participants' average age was 22 yr., 74% women and 25% men, with two (1.7%) not providing complete data.

Results

Means, standard deviations, correlations, and reliabilities are presented in Table 2. The correlation between scores from the MSTAT–II and Budner's scale (1962) was not significant ($r = .09$). Because of theoretical differences underlying the MSTAT–II and Budner scales, the reliability of the Budner scale, and other authors' criticisms of popular ambiguity tolerance measures (Kenny & Ginsberg, 1958; Norton, 1975; Kirton, 1981; Ray, 1988; Furnham, 1994; Lange & Houran, 1999), the low correlation does not necessarily detract from the MSTAT–II. A low alpha value can also suppress correlations with related measures. In these data, Budner scores had a coefficient alpha value of .47, much lower than that for MSTAT–II scores (.79) but consistent with other reported values for that scale (MacDonald, 1970; see Table 2 for Revelle's betas). This value is low relative to the values for many published scales that have seen far less widespread use, and is low if ambiguity tolerance is a unitary theoretical construct (Pedhazur & Schmelkin, 1991). Interitem correlations among Budner item scores were also generally low, rarely exceeding .20 and with none greater than .28. The correlation between MacDonald's AT–20 scores and those of the MSTAT–II was higher than that with the Budner scores ($r = .41$, $p < .01$), and the reliability of the MacDonald scores was slightly better (alpha = .57; see Table 2 for Revelle's betas).

TABLE 2

Study 2: Means, Standard Deviations, Correlations, and Reliabilities ($N = 121$)

Scale Construct	*M*	*SD*	*r*				
			1	2	3	4	5
1. MSTAT–II Ambiguity Tolerance	41.7	7.6	(.79/.36)				
2. Zuckerman Sensation Seeking	6.0	2.6	.27†	(.65/.42)			
3. Budner Ambiguity Intolerance	43.3	7.0	.09	–.07	(.47/.12)		
4. MacDonald AT–20 Ambiguity Tolerance	9.0	3.2	.41†	.13	.27†	(.57/.00)	
5. Marlowe-Crowne Social Desirability	101.6	13.1	.17	–.12	.14	.15	(.75/.59)

Note.—Multi-item measure reliability values (Cronbach α/Revelle's β) appear in parentheses along the diagonal. *$p < .05$. †$p < .01$, two-tailed tests.

The low correlation between Budner and MSTAT–II scores prompted closer examination of the data. A factor analysis of the Budner scores revealed seven factors with eigenvalues greater than 1. A scree plot suggested the Budner scores have a multidimensional structure, consistent with Budner's description of the construct as multidimensional and complex. This differs from the theory which is consistent with the data collected for

the MSTAT–II, that ambiguity tolerance describes a perception common to multiple types of stimuli. Concerns about item wording in the Budner scale have already been mentioned. If a respondent agrees that, "An expert that doesn't come up with a definite answer probably doesn't know too much," or that, "A good job is one where what is to be done and how it is to be done are always clear," then that respondent is scored as ambiguity intolerant. Agreement with the statement, "Teachers or supervisors who hand out vague assignments give a chance for one to show initiative and originality," is scored as ambiguity tolerant. The first of these three items is said to reflect insolubility, and Budner associated the second two items with complexity. It is uncertain whether respondents indeed associate these items with these forms of ambiguity, and it is possible that responses to these items could be influenced by attitudes toward the situations or occupations mentioned rather than reflecting only the individual's orientation toward ambiguity.

MSTAT–II scores and risk orientation scores were also positively correlated ($r = .27$, $p < .01$). Table 2 shows a positive but nonsignificant relationship between ambiguity tolerance and social desirability ($r = .17$). The findings of Study 2 generally support the MSTAT–II.

Study 3

The third study had two goals: (a) to collect data with a nonstudent sample, further expanding the population sampled in MSTAT–II tests, and (b) to add information about the construct validity of the MSTAT–II by comparing MSTAT–II scores with those of related constructs. Because of ambiguity's close relationships with risk and uncertainty, the related constructs in Study 3 included risk-taking propensity, perceived risk, health insurance adequacy (one indicator of perceived uncertainty), and job stress (a consequence of chronic exposure to an information-deficient work environment).

Method

Two-hundred and seven firefighter-emergency medical technicians serving in four Wisconsin communities completed a survey that included the MSTAT–II and measures of the related constructs. Their jobs exposed them to a wide variety of health and safety risks. Survey respondents ranged in age from 21 to 64 years (M age = 37.2, $SD = 7.9$) and had been firefighters from as few as 2 mo. to as many as 37.5 years ($M = 11.9$ yr., $SD = 8.5$). The sample was 187 men and 12 women, with eight respondents not answering the item; this composition is typical for firefighters in general and somewhat more male dominated than most other hazardous occupations. Most recent data on ethnicity for one fire department indicate 85% Euro-American, 9% African American, 4% Latino American, and 2%

Other. This sample approximated that distribution, although exact data were not available.

Risk-taking propensity was measured with a 7-item sensation-seeking scale used by MacCrimmon and Wehrung (1986) and derived from the 34-item sensation-seeking scale used by Zuckerman, Kolin, Price, and Zoob (1964). Perceived risk was measured using the 6-item perceived danger scale by McLain (1995). Example items are, "I encounter personally hazardous situations where I work," "I am exposed to physical danger on the job," and, "My job is dangerous to my emotional well being." The five responses range from 1: Always to 5: Never and higher scale scores indicate less perceived risk. Budner (1962) described ambiguity as a source of stress. The less tolerant an individual is of the ambiguities associated with a high-risk occupation such as firefighting, the greater the stress experienced by that individual. MSTAT–II scores should reflect this. Each firefighter's stress experience was assessed with a 6-item "somatic tension" measure developed by Caplan, Cobb, French, Harrison, and Pinneau (1975), and refined by Latack (1986). Each item begins with the stem, "I feel . . ." [for example, "I feel fidgety" and "I feel calm" (reverse-scored)] and asks respondents to choose a response, from 1: Never to 5: Always, which best expresses their experience of stress-related symptoms. Concern about uncertainty was measured as the perceived adequacy of the firefighter's health insurance. This was measured by directly asking the firefighters, "How would you describe your health and life insurance protection?" Each participant responded by choosing 1: Not enough, 2: Just enough, or 3: More than enough.

Results

The means, standard deviations, correlations, and reliabilities for Study 3 appear in Table 3. Less than 9% of the data were missing from

TABLE 3

Study 3: Means, Standard Deviations, Reliabilities, and Correlations Among Constructs ($N = 207$)

Construct	*M*	*SD*	*r*					
			1	2	3	4	5	6
1. Ambiguity Tolerance, MSTAT–II	44.0	7.18	(.82/.42)					
2. Risk Taking Propensity, Sensation-seeking	2.6	1.74	.33‡	(.59/.42)				
3. Perceived Risk	21.8	3.90	.13†	.17*	(.79/.54)			
4. Stress, Somatic Tension	12.9	2.81	–.23†	–.03	.07	(.71/.62)		
5. Perceived Uncertainty, Insurance Adequacy	1.7	0.63	.19†	–.14	–.08	–.10	(na)	
6. Time in a Hazardous Job	11.5	8.44	–.05	.00	.26‡	.05	–.16	(na)

Note.—Multi-item measure reliability values (Cronbach α/Revelle's β) appear in parentheses along the diagonal. *$p < .05$. †$p < .01$. ‡$p < .001$, two-tailed tests.

any analysis. The pattern of correlations among the collected data is as expected for a valid measure of ambiguity tolerance and generally supports the MSTAT–II. MSTAT–II scores were positively related to the scores for risk orientation, perceived risk, and perceived uncertainty. Also, MSTAT–II scores were negatively correlated with stress scores. Because familiarization with the ambiguities of hazardous work can also influence the relationship between ambiguity tolerance and the other Study 3 constructs, regression analyses were run with time spent in a hazardous job entered as the first independent variable, followed by MSTAT–II scores. Because ambiguity tolerance is just one of many influences on the dependent variables, the magnitude of the R^2 values is small. But, even when controlling for participants' time in a hazardous occupation, the results tabulated in Table 4 continue to support the MSTAT–II with each relationship being significant.

TABLE 4

Study 3: Summary of Regression Analyses ($N = 207$)

	Risk Taking Propensity		Perceived Job Risk		Perceived Uncertainty (Insurance Adequacy)		Stress	
	β	*t*	β	*t*	β	*t*	β	*t*
Control Variable								
Time in a Hazardous Job	.00	.02	.27	3.91†	–.15	–2.03	.04	.61
Independent Variable								
Ambiguity Tolerance	.35	5.03‡	.14	2.00†	.20	2.84†	–.23	–3.16†
Model R^2	.12		.09		.07		.05	
Adjusted R^2	.11		.08		.06		.04	
F	12.56‡		9.27‡		6.50†		5.28†	

*$p < .05$. †$p < .01$. ‡$p < .001$, two-tailed tests.

General Discussion

The findings regarding the psychometric properties of the MSTAT–II are encouraging. The reliability values are higher than those found using some alternative measures, and they exceed values considered acceptable for a research scale. The pattern of relationships in the three studies provides partial evidence of the potential of the MSTAT–II to measure ambiguity tolerance validly. The data, and the face meanings of the scale items, are consistent with the theory that ambiguity tolerance is a trait describing the individual's general aversion or attraction to perceived ambiguity, and that ambiguity tolerance is related to orientations toward other forms of perceived information inadequacy such as risk and uncertainty. The findings of this research also suggest MSTAT–II scores provide a satisfac-

tory fit to a one-dimensional structural model of ambiguity tolerance. This does not suggest that perceptions of complexity or novelty cannot be distinguished or measured using other measures, but rather that the MSTAT–II may be appropriate to use for testing theories that include what is similarly perceived about these stimulus types.

The findings advance previous attempts to obtain valid measurement of ambiguity tolerance in a wide variety of theoretical contexts beyond social psychology. The data from Study 2 compare the MSTAT–II and two other popular ambiguity tolerance scales, revealing differences in how those measures perform. The pattern of correlations suggests that the choice of a measure can significantly influence research findings. Confidence in research findings increases when there is assurance that the results are adequate tests of hypothesized relationships and not measurement artifacts. The findings reported here, at a minimum, point out the importance of careful scale selection. The findings of Study 3 further suggest the MSTAT–II can be used in field research and that it performs as predicted when administered with measures of related constructs.

In practical terms, the MSTAT–II is a promising measure for inclusion in surveys where space is limited or there is a concern of potential respondent fatigue. Additionally, because items in the MSTAT–II are worded so as to reduce the confounding influences of references to contexts, the MSTAT–II may be especially useful in studies where such references in alternative scales may confuse respondents or bias responses. This may help to reduce some measurement problems that may have contributed to the equivocal findings or failures to confirm hypothesized relationships in previous studies.

The results of these studies encourage further exploratory use of the MSTAT–II. Suggestions for research include gathering additional evidence for nomological networks and sampling more diverse populations. Future studies should also confirm the internal consistency and test-retest reliabilities, given that the concerns about the quality of other ambiguity-tolerance measures include low reliabilities and inconsistent patterns of correlations with measures of other constructs (Norton, 1975; Ray, 1988; Lange & Houran, 1999).

Although the avoidance of references to specific contexts or objects unrelated to ambiguity has potential benefits, this avoidance also results in MSTAT–II items having somewhat abstract wording. Abstract concepts like novelty and complexity that are mentioned in the MSTAT–II may be difficult to understand and may not mean the same things to all people. Initial evidence suggests individuals from varied backgrounds respond well to the MSTAT–II but additional research is needed to increase confidence in this conclusion.

REFERENCES

Adorno, T. W., Frenkel-Brunswik, E., Levinson, D. J., & Sanford, R. N. (1950) *The authoritarian personality*. New York: Harper Brothers.

Bhushan, L. I., & Amal, S. B. (1986) A situational test of intolerance of ambiguity. *Psychologia*, 29, 254-261.

Block, J., & Block, J. (1951) An investigation of the relationship between intolerance of ambiguity and ethnocentrism. *Journal of Personality*, 19, 303-311.

Budner, J. (1962) Tolerance of ambiguity as a personality variable. *Journal of Personality*, 30, 29-40.

Caplan, R. D., Cobb, S., French, J. R. P., Jr., Harrison, R. V., & Pinneau, S. R., Jr. (1975) *Job demands and worker health: main effects and occupational differences*. Washington, DC: U.S. Government Printing Office. (HEW NIOSH No. 75-160)

Coulter, T. (1953) An experimental and statistical study on the relationship of prejudice and certain personality variables. Unpublished manuscript, Univer. of London.

Crowne, D. P., & Marlowe, D. (1960) A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, 24, 349-354.

Ellsberg, D. (1961) Risk, ambiguity, and the Savage axioms. *Quarterly Journal of Economics*, 75, 643-669.

Frenkel-Brunswik, E. (1948) Tolerance of ambiguity as a personality variable. *American Psychologist,* 3, 268. [Abstract only]

Furnham, A. (1994) A content, correlational, and factor analytic study of four tolerance of ambiguity questionnaires. *Personality and Individual Differences*, 16, 403-410.

Furnham, A., & Ribchester, T. (1995) Tolerance of ambiguity: a review of the concept, its measurement and applications. *Current Psychology*, 14, 179-199.

Gerbing, D. W., & Anderson, J. C. (1993) Monte Carlo evaluations of goodness-of-fit indices for structural equation models. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models*. Newbury Park, CA: Sage. Pp. 40-65.

Hu, L., & Bentler, P. M. (1999) Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.

Johanson, J. C. (2000) Correlations of self-esteem and intolerance of ambiguity with risk aversion. *Psychological Reports*, 87, 534.

Kenny, D. T., & Ginsberg, R. (1958) The specificity of intolerance of ambiguity measures. *Journal of Abnormal Social Psychology*, 56, 300-304.

Kirton, M. J. (1981) A reanalysis of two scales of tolerance of ambiguity. *Journal of Personality Assessment*, 45, 405-414.

Kischkel, K-H. (1984) A scale for the measurement of ambiguity tolerance. *Diagnostica*, 30, 144-154.

Lange, R., & Houran, J. (1999) Scaling MacDonald's AT–20 using item-response theory. *Personality and Individual Differences*, 26, 467-475.

Latack, J. C. (1986) Coping with job stress: measures and future directions for scale development. *Journal of Applied Psychology*, 71, 377-385.

Leichsenring, F., Steuernagel, E., Steuernagel, J., & Meyer, H. A. (2007) Tolerance of ambiguity: text analytic vs self-report measures in two nonclinical groups. *Perceptual and Motor Skills*, 104, 855-869.

MacCrimmon, K. R., & Wehrung, D. A. (1986) *Taking risks: the management of uncertainty*. New York: The Free Press.

MacDonald, A. P. (1970) Revised scale for ambiguity tolerance: reliability and validity. *Psychological Reports*, 26, 791-798.

Madlock, P. E., Kennedy-Lightsey, C. D., & Myers, S. A. (2007). Employees' communication attitudes and dislike for working in a group. *Psychological Reports*, 101, 1037-1040.

McLain, D. L. (1993) The MSTAT–I: a new measure of an individual's tolerance for ambiguity. *Educational and Psychological Measurement*, 53, 183-189.

McLain, D. L. (1995) Responses to health and safety risk in the work environment. *Academy of Management Journal*, 38, 1726-1743.

Norton, R. W. (1975) Measure of ambiguity tolerance. *Journal of Personality Assessment*, 39, 607-619.

Nunnally, J. C. (1978) *Psychometric theory*. New York: McGraw-Hill.

O'Connor, P. (1952) Ethnocentrism, 'intolerance of ambiguity', and abstract reasoning ability. *Journal of Abnormal and Social Psychology*, 47, 526-530.

Pedhazur, E. J., & Schmelkin, L. P. (1991) *Measurement, design, and analysis: an integrated approach*. Hillsdale, NJ: Erlbaum.

Pich, M. T., Loch, C. H., & DeMeyer, A. (2002) On uncertainty, ambiguity, and complexity in project management. *Management Science*, 48, 1008-1023.

Poesio, M. (1996) Semantic ambiguity and perceived ambiguity. In K. van Deemter & S. Peters (Eds.), *Semantic ambiguity and underspecification.* Stanford, CA: Center for the Study of Language and Information. Pp. 159-201.

Ray, J. J. (1988) Cognitive style as predictor of authoritarianism, conservatism, and racism: a fantasy in many movements. *Political Psychology*, 9, 303-308.

Rydell, S. T., & Rosen, E. (1966) Measurement and some correlates of need-cognition. *Psychological Reports*, 19, 139-165.

Van Hook, C. W., & Steele, C. (2002) Individual personality characteristics related to suggestibility. *Psychological Reports*, 91, 1007-1010.

Viscusi, W. K., & Chesson, H. (1999) Hopes and fears: the conflicting effects of risk ambiguity. *Theory and Decision*, 47, 153-178.

Westie, F. R. (1953) A technique for the measurement of race attitudes. *American Sociological Review*, 18, 73-78.

Yurtsever, G. (2001) Tolerance of ambiguity, information, and negotiation. *Psychological Reports*, 89, 57-64.

Yurtsever, G. (2008) Negotiators' profit predicted by cognitive reappraisal, suppression of emotions, misrepresentation of information, and tolerance of ambiguity. *Perceptual and Motor Skills*, 106, 590-608.

Zuckerman, M. (1984) Sensation seeking: a comparative approach to a human trait. *Behavioral & Brain Sciences*, 7, 413-471.

Zuckerman, M., Kolin, E. A., Price, L., & Zoob, I. (1964) Development of a sensation-seeking scale. *Journal of Consulting Psychology*, 28, 477-482.

Accepted October 27, 2009.