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Effects of negative keying and wording in attitude measures: A mixed-methods study

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Effects of Negative Keying and Wording in Attitude Measures:

A Mixed-Methods Study

Chris M. Coleman

A dissertation submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

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THE VOICE YOU HEAR WHEN YOU READ SILENTLY

is not silent, it is a speaking-
out-loud voice in your head; it is *spoken*,
a voice is *saying* it
as you read. It's the writer's words,
of course, in a literary sense
his or her "voice" but the sound
of that voice is the sound of *your* voice.
Not the sound your friends know
or the sound of a tape played back
but your voice
captured in the dark cathedral
of your skull, your voice heard
by an internal ear informed by internal abstracts
and what you know by feeling,
having felt. It is your voice
saying, for example, the word "barn"
that the writer wrote
but the "barn" you say
is a barn you know or knew. The voice
in your head, speaking as you read,
ever says anything neutrally- some people
hated the barn they knew,
some people love the barn they know
so you hear the word loaded
and a sensory constellation
is lit: horse-gnawed stalls,
hayloft, black heat tape wrapping
a water pipe, a slippery
spilled *chirr* of oats from a split sack,
the bony, filthy haunches of cows...
And "barn" is only a noun- no verb
or subject has entered into the sentence yet!
The voice you hear when you read to yourself
is the clearest voice: you speak it
speaking to you.

-Thomas Lux
# Table of Contents

Acknowledgments..............................................................................................................ii
Preface...................................................................................................................................iii
List of Tables.......................................................................................................................vii
List of Figures......................................................................................................................viii
Abstract...............................................................................................................................ix

I. Introduction ......................................................................................................................1
   Purpose ............................................................................................................................10

II. Review of the Literature...............................................................................................14
   Response Styles.................................................................................................................14
   Acquiescence....................................................................................................................15
   Balanced Scales and Negative Items..............................................................................19
   Psychometric Consequences of Including Negative Items on Scales .......................22
      Validation Studies ........................................................................................................23
      Manipulation Studies ..................................................................................................30
      Additional Studies .......................................................................................................39
   Cognitive/Psycholinguistic Processing of Negation .....................................................40
   Explanations for the Differential Processing of Negative and Positive Items ............42
      The Substantive Explanation .....................................................................................43
      The Method Variance Explanation ............................................................................45
      The Item Extremity Explanation ................................................................................47
      The Careless Responding Explanation ......................................................................50
      The Response Style/Personality Explanation .............................................................51
      The Individual Differences in Cognition/Reading Explanation ..................................54
List of Tables

Table 1 ........................................................................................................... 64
Table 2 ........................................................................................................... 79
Table 3 ........................................................................................................... 80
Table 4 ........................................................................................................... 83
Table 5 ........................................................................................................... 88
Table 6 ........................................................................................................... 92
Table F1 ....................................................................................................... 160
Table F2 ....................................................................................................... 160
Table F3 ....................................................................................................... 161
Table F4 ....................................................................................................... 162
Table G1 ....................................................................................................... 164
Table G2 ....................................................................................................... 164
Table G3 ....................................................................................................... 165
Table G4 ....................................................................................................... 165
Table G5 ....................................................................................................... 166
Table G6 ....................................................................................................... 167
Table G7 ....................................................................................................... 168
Table G8 ....................................................................................................... 169
List of Figures

Figure 1……………………………………………………………………………………………………71
Figure 2……………………………………………………………………………………………………72
Figure 3……………………………………………………………………………………………………73
Figure 4……………………………………………………………………………………………………74
Figure 5……………………………………………………………………………………………………107
Abstract

Researchers often collect data on attitudes using “balanced” measurement scales—that is, scales with comparable numbers of positive and negative (i.e., reverse-scored) items. Many previous measurement studies have found the inclusion of negative items to be detrimental to scale reliability and validity. However, these studies have rarely distinguished among negatively-worded items, negatively-keyed items, and items with negative wording and keying. The purpose of the current study was to make those distinctions and investigate why the psychometric properties of balanced scales tend to be worse than those of scales with uniformly positive wording/keying.

A mixed-methods approach was employed. In Study 1 (quantitative), item wording and keying were systematically varied in adaptations of two published attitude measures that were administered to a large college student sample. Reliability and dimensionality of the resulting data were examined across the measures in each of four wording/keying configurations. Study 2 (qualitative) incorporated a mix of the same four wording/keying conditions in an adapted measure that was administered individually to a small sample of college students. A think-aloud design was implemented to elicit verbalizations that were subsequently analyzed using a thematic networks approach.

Study 1 findings indicated that reliability estimates were generally highest for scales where all items were positively worded/keyed and lowest for scales with balanced keying (or balanced keying and wording). Regarding dimensionality, method variance was more evident when keying was balanced than when keying was consistent. This tended to be the case whether wording was balanced or consistent. Study 2 revealed a number of factors that could contribute to differences in the response patterns elicited by negative and positive items. These factors included the relative difficulty of processing
negatively-worded statements, respondent characteristics such as reading skill and frustration tolerance, and idiosyncratic response styles. Among previously posited explanations for the differential functioning of negative and positive items, results from the studies supported some explanations (e.g., method variance; careless responding) more than others (e.g., the substantive explanation). Overall, it appeared that the psychometric consequences of balanced keying are no less substantial than those of balanced wording. An important question raised by the findings is whether the apparent advantage of consistent keying (in terms of reliability and dimensionality) came at the expense of validity, since careless responding and other forms of satisficing may be masked when keying is not balanced.
I. Introduction

Often in the social sciences, the object of study/measurement is an attitude or trait. For example, a researcher may decide to investigate people’s opinions about taxes; or a clinician may wish to gauge the amount of anxiety being experienced by a patient. In either case, a self-report measurement instrument is likely to be used (in isolation or as part of a broader examination) to measure the target construct. On the surface, the idea of administering such an instrument seems logical and straightforward—by asking specific taxation-related questions, for example, one should be able to ascertain individuals’ attitudes about that topic in an efficient manner.

Alas, the efficiency advantage of self-report attitude scales can be offset by a host of potential disadvantages. Some of these pitfalls stem from the fact that as objects of measurement, “attitudes” may be nebulous (i.e., multidimensional) and moving (i.e., fluctuating) targets; this problem is not unique to data collection methods that involve self-report instruments. Other potential sources of error come under the general heading of method variance—that is, variance in scores that is due to the measurement method rather than the substantive object of measurement (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

One much-discussed subcategory of method variance has been variously referred to as response sets, response styles, or response biases. The three terms have often been used interchangeably. According to Cronbach (1946), a response set involves any consistent response tendency that is independent of content. For example, the tendency to agree with the statements on an instrument, regardless of the content of the individual statements, would constitute a response set. Cronbach noted that his definition was
theoretical rather than practical, since it is not possible to truly separate an item’s content from its form. In subsequent studies, response styles were conceptualized as consistencies in responding associated with general item characteristics such as direction of wording and level of social desirability—features distinct from item content (Bentler, Jackson, & Messick, 1971, 1972). In short, a distinction was drawn between content (the “signal” in an individual’s response to an item; his or her self-perceived level of the target trait) and style (“noise” in the response attributable to an individual’s consistent response tendency—for example, the tendency to give socially desirable responses). Bentler, Jackson, and Messick (1971) opined that a response style is “…a potentially measurable personality variable or trait” (p. 188) distinct from but possibly related to the target constructs of personality/attitude measures.

During the 20th century, the response style that received the most attention from researchers and methodologists was probably acquiescence, which Cronbach (1946) initially described as a tendency to answer True rather than False (or vice versa). The concept extends to measurement instruments using Likert scales (i.e., more than two response alternatives). Although acquiescence as a measurement term is often associated with (or at least exemplified as) a respondent’s tendency to agree or say yes (i.e., yea-saying), it can also refer to the opposite tendency (i.e., nay-saying). For example, an individual who tended to agree with positively-keyed items on a happiness scale might tend to disagree with positively-keyed items on an unhappiness scale. Thus acquiescence has sometimes been referred to as “monopolar” responding (McPherson & Mohr, 2005). Some early researchers questioned the existence (e.g., Rorer, 1965; Samelson, 1972) or importance (e.g., Block, 1971) of acquiescence—or of response styles as a
phenomenon—but since that time, the idea that response styles (including acquiescence) can result in method variance has gained general acceptance (e.g., Bentler, Jackson, & Messick, 1972; Crocker & Algina, 1986; DiStefano, Morgan, & Motl, 2012; Krosnick, 1991; Podsakoff et al., 2003; Tourangeau & Rasinski, 1988).

By definition, acquiescence—a phenomenon involving the respondent and the response scale—is distinct from the object of measurement, content (i.e., the amount of the target trait the respondent possesses). Lorge (1937), as cited in Cloud and Vaughn (1970), used an example (paraphrased here) to illustrate how individuals might differ in their use of the same response scale: One participant might endorse “I like…” items for every activity he did not positively dislike, while another might endorse such items only for activities toward which he felt a strong affinity. Either style would manifest as acquiescence and result in systematic error and undesirable effects on reliability and validity (e.g., Cronbach, 1946). According to Bentler et al. (1972), “Response styles can obscure or drastically modify the observed interrelationships of content traits, and this variance ought to be identified and controlled” (p. 109). Even Block (1971), who questioned the usefulness of efforts to understand the nature of acquiescence, stated that it should be addressed by either methodological or statistical means.

Over the years, various recommendations have been made regarding identification of and/or correction for acquiescent responding. Perhaps the most-heeded advice on the matter, judging by the frequency of its application in the literature, has been the use of balanced scales—that is, scales designed to have an equal number of positive (i.e., positively-keyed) and negative (i.e., negatively-keyed) items. Negatively-keyed items can be (grammatically) negatively worded (e.g., “I am not healthy”) or (grammatically)
positively worded (e.g., “I am ill”); in the latter example, the adjective *ill* might be considered a polar opposite of *healthy*. Regardless of the manner in which items are made negative, they are reverse-scored. The purpose of balanced scales is not to dissuade or eliminate acquiescent responding (though it is possible that they have a reductive effect on another response style, careless responding). Rather, the approach is intended to ensure that on a given scale, acquiescent respondents receive a summated score near the scale mean (e.g., Cloud & Vaughn, 1970). In other words, any response tendency toward one end of the response scale (e.g., *Agree*) will “balance out” when the respondent’s score for the positive items is summed with her score for the (reverse-scored) negative items, assuming that tendency is consistent across both sets of items. As a result, the logic goes, the mean score for the overall sample will not be biased. However, the accuracy and interpretability of individuals’ scores may be affected. The balanced scales approach is not without controversy (e.g., Billiet & McClendon, 2000; McPherson & Mohr, 2005), but it continues to be recommended and used.

An implicit assumption underlying the use of balanced scales is that negative items (regardless of wording direction) are psychometrically comparable to positive items. That is, after reverse scoring, the response elicited by a negative item (e.g., “I am not healthy”) should be the same as the response elicited by the corresponding positive item (e.g., “I am healthy”). If such is not the case—for example, due to inexpert crafting of items, response sets/styles, or for other, more esoteric reasons (e.g., some have suggested that there is no such thing as a true polar reversal, due to semantic connotations and the subtle changes in meaning that can result from altered syntax)—then the
balancing method itself will introduce construct-irrelevant variance and acquiescence may appear to be present when in fact it is not (Block, 1971).

Unfortunately, evidence from a preponderance of studies calls into question the assumption that parallel positive and negative statements will elicit congruent responses. As will be explicated below, negative and positive items on attitude and personality measures tend to function differentially in terms of factor structure, internal consistency, and correlation with external variables. Forty years ago, Bentler et al. (1972) cited “…no fewer than 15 separate analyses of diverse populations [in which] a factor separating true- and false-keyed subscales has appeared” (p. 111). That trend has only continued; published findings based on a variety of populations and measures suggest that balanced scales designed to be unidimensional yield two factors rather than one, with positively- and negatively-keyed items loading onto different factors (e.g., Barnette, 2000; Lai, 1994; Marsh, 1986; Motl, Conroy, & Horan, 2000; Pilotte & Gable, 1990; Schriesheim & Hill, 1981). The differential functioning of negatively-worded items, and their tendency to exhibit lower internal consistency than positively-worded items, led one researcher to describe the word not—typically the operative agent by which reversals are accomplished—as an “insidious grammatical element” that “contaminated” scale items (Ahlawat, 1985). Some studies have found no differences between the negative and positive items within a balanced scale, but such published findings have been rare (e.g., Borgers, Hox, & Sikkel, 2004; Finney, 2001).

In short, the dominant theme among factor-analytic studies of balanced scales is the emergence of two factors that are essentially defined by item wording or keying (positive versus negative). The two-factor solution has sometimes been interpreted
substantively (e.g., as “optimism” and “pessimism” subscales within the Life Orientation Test); in other studies, it has been presumed to reflect the presence of a method effect or measurement artifact. Regarding the former (substantive) interpretation, the implied conceptual stance—that, say, optimism and pessimism are separable constructs or dimensions rather than opposite ends of a continuum—seems neither intuitive nor parsimonious. Spector, Van Katwyk, Brannick, and Chen (1997) explicitly cautioned against such claims. Regarding the latter (artifactual) interpretation, fundamental questions remain about the nature of the variance associated with negative items. To what extent might such variance be a function of individual characteristics or response styles, either stable or transient? On the other hand, to what extent might such variance reflect general cognitive or psycholinguistic phenomena—for example, that disagreeing with a negated reversal may not be the same as agreeing with its affirmative equivalent? It seems likely that these possibilities (respondent-related and item-related characteristics) are not mutually exclusive (e.g., Kuncel, 1977; Holden, Fekken, & Cotton, 1991; Tourangeau & Rasinski, 1988).

One posited explanation for the differential functioning of negative and positive items is item extremity (e.g., Simpson, Rentz, & Shrum, 1976). Stated simply, some items are worded more strongly than others. Spector et al. (1997) demonstrated that if scale items are extreme (e.g., “I loathe my job”; “I am in love with my job”) relative to where most respondents fall on the underlying construct, people will vary in the consistency with which they (validly) respond to items on opposite ends of the spectrum (i.e., positive and negative): “If a scale contains only extreme items…some people might disagree with all items because the items are too far from the people on the continuum of
interest” (Spector et al., p. 662; emphasis added). For example, respondents who are not particularly satisfied or dissatisfied with their jobs might well disagree with both “I loathe my job” and “I am in love with my job,” yielding seemingly incongruent responses after reverse scoring. Such respondents will likely have consistent responses within item types (positive and negative), but not across them. The presence of such respondents within a larger participant sample (at least some of whom respond to oppositely-keyed items in a seemingly congruent manner) means that “[c]orrelations between items at opposite ends of the continuum will be attenuated, while correlations between items at the same end will be relatively strong. As a result, artifactual [CFA] factors would appear based on the response patterns to these items” (Spector et al., p. 664). A related issue involves the reversal of items; some have argued that creating true (i.e., semantically parallel) reversals is difficult if not impossible (e.g., Samelson, 1972). To the extent that any lack of comparability between types of items is systematic within a balanced scale (e.g., as written, the negative items are consistently harder to disagree with), artifactors (i.e., method effects) are likely to result.

Another phenomenon that could contribute to wording-related method variance is careless responding, or a lack of attention to item content/polarity. Studies have shown that if at least 10% of a sample were to respond carelessly to negative items (i.e., respond as if the items were not negatively keyed) on a balanced scale measuring a unidimensional construct, the resulting data would likely yield a two-factor solution rather than the (true) one-factor solution (Schmitt & Stults, 1985; Woods, 2006). Such a scenario is not implausible, given that research data are often collected from participants who may have minimal interest in the research and little incentive to give thorough
attention and consideration to individual items. The term “satisficing” has been used to
describe response strategies that are characterized by less-than-optimal engagement in the
stages of the cognitive response process (e.g., Krosnick, 1991). For instance, a satisficing
respondent might expend suboptimal effort in reading/interpreting the items, searching
her memories/feelings related to the target construct, and/or responding with precision.
Careless responding would constitute a strong (i.e., extreme) form of satisficing.

Cognitive or psycholinguistic factors have also been indicated as possible
contributors to observed differences between negative and positive items. In other words,
there may be language-based reasons for differential positive/negative responding across
respondents. For example, it is well-established that relative to affirmative statements,
grammatically negative statements take longer to process and are more likely to be
misinterpreted (e.g., Peterson & Peterson, 1976; Wason, 1959, 1961). Thus it has been
suggested that the differential functioning of negatively-worded items may be attributable
to the cognitive/linguistic processing demands inherent in such items (e.g., Ahlawat,
1985; Schuman & Presser, 1981). In short, method effects result because, holding other
things equal (or as equal as possible), responding to an affirmative statement is not the
same as responding to a negatively-worded reversal. Although etiologically distinct from
the “careless responding” hypothesis described earlier, the cognitive/psycholinguistic
mechanism could have the same consequence: differential correlations within and
between subsets of items, leading to factors defined by wording direction.

In a related explanation, Marsh (1996) found that reading ability was associated
with a “negative wording” method factor. Specifically, children and adolescents with less
well-developed reading skills tended to have difficulty responding accurately to
negatively-worded items. Other studies involving adults have reached similar conclusions—that respondents with lower levels of education or cognitive ability are more likely to respond to negative items in a way that seems inconsistent with their responses to positive items (e.g., Cordery & Sevastos, 1993; Juni, Hanson, & Ottomanelli, 1996; Krosnick, Narayan, & Smith, 1996; Melnick & Gable, 1990). Thus it seems probable not only that negative items are processed differently by the general population, but that individuals may vary in their ability to respond accurately to those items. Such a combination of potentially interacting mechanisms exemplifies the complexity entailed in the cognitive processing model proposed by Tourangeau (e.g., Tourangeau & Rasinski, 1988), a model that will be described in detail in the next chapter.

Most of the published research studies on balanced scales and negative items have used a quantitative methodology. Empirical studies are extremely valuable because they allow for direct testing of theories about factor structure and wording effects based on item-level response data. As noted above, such research has established that, in general, the positive and negative items on balanced scales do not elicit equivalent responses. Quantitative research has also contributed to our understanding of the possible mechanisms underlying that lack of equivalence (e.g., respondent characteristics; psycholinguistic factors). However, there is as yet no consensus regarding the nature of the differential functioning of positive and negative items. In short, although several explanations have been offered, the mechanisms that drive differential responses to positive and negative items on self-report scales are not completely understood. We do
not know for sure why individuals tend to respond differently to positive items than to negative items on self-report scales.

Given that many of the hypothesized explanations for wording effects involve the behavior of respondents, surprisingly little research has been published (excluding hypothetical illustrative examples and anecdotal asides) in which respondents were given the opportunity to provide their own opinions/insights related to response processes and styles. A think-aloud protocol, which entails individuals talking through their response process as they complete a self-report measure, has been used to investigate phenomena such as item context effects (i.e., item responses being affected by the content of preceding items) (Harrison, McLaughlin, & Coalter, 1996) and construct validity or the extent to which score-based inferences are justifiable (Gadermann, Guhn, & Zumbo, 2011). However, a search revealed no published qualitative studies specifically related to negative wording/keying of self-report items. In the absence of qualitative research about response processes and balanced scales, a fuller understanding of the nature of negative wording effects may prove elusive. It is entirely possible, for example, that an individual suspected (based on observed responses) of being a “careless” or “acquiescent” respondent (i.e., giving invalid responses due to satisficing) has in fact given earnest and valid responses—we simply do not understand the process/logic by which those responses were generated.

**Purpose**

The purpose of the current project is to investigate, using a mixed-methods approach, the functioning of negative and positive items on self-report attitude scales. In the quantitative part of the project (Study 1), the wording of two attitude scales will be
systematically varied to investigate the effects of negative keying and negative wording on scale dimensionality and internal consistency. In previous CFA studies of balanced scales, a two-factor solution (or a correlated traits-correlated uniquenesses model) has usually been found to provide a better fit than a one-factor model to data collected on instruments designed to measure a unidimensional construct (e.g., Corwyn, 2000; Marsh, 1986; Pohl & Steyer, 2010; Tomás & Oliver, 1999). Prior studies in which wording schemes have been systematically varied across parallel versions of the same measure have generally found that scale versions characterized by consistent wording (all positive or all negative items) yield better-fitting one-factor models and/or higher internal consistency than do versions in which wording direction is balanced (e.g., Barnette, 2000; Benson & Hocevar, 1985; Greenberger, Cheng, Dmitrieva, & Farruggia, 2003; Pilotte & Gable, 1990), although there have been exceptions (e.g., Finney, 2001).

The use of multiple measures in Study 1 will constitute an advantage over studies whose findings have been based on a single instrument. Because the two measures selected for this project vary in length (8 items versus 19 items) and substantive dimensionality (one substantive factor versus four), it will be possible to examine measurement trends over those conditions. The design will also allow for the testing of factorial models in which method effects related to negative wording/keying are hypothesized to be evident across measurement instruments. Prior studies have found evidence in support of the stability of response styles across measures and over time (e.g., Billiet & McClendon, 2000; Horan, DiStefano, & Motl, 2003; Marsh, Scalas, & Nagenast, 2010; Pohl & Steyer, 2010).
Regarding wording, at least one novel condition will be explored in the current study: a version of the scales in which all items are negatively keyed (i.e., reverse-scored), but only half are negatively worded. This condition is important because it has the potential to yield insight into the heretofore unaddressed question of whether the well-documented psychometric effects of “negative items” are a function of wording rather than keying. Dimensionality and reliability will be investigated for that condition as well as for three others: (1) all positive wording/keying; (2) half positive wording/keying and half negative wording/keying; and (3) half positive wording/keying and half positive wording/negative keying. In addition, the association between method effects related to negative keying will be estimated across instruments.

In the qualitative part of the project (Study 2), a think-aloud protocol will be used to explore the response processes of a small subsample of participants. Of particular interest is the question of why negative items tend to elicit non-parallel responses to their positively-keyed equivalents, even when such pairs have been carefully crafted to be opposite in meaning. As noted earlier, qualitative information about this question is sorely lacking in the literature. It is expected that the think-aloud method will yield insight into the way respondents process and respond to different types of items (e.g., positively worded and keyed; negatively worded and keyed) and shed light on the nature of the positive and negative “artifact” issue. For example, do reading/attentional errors lead to different response distributions for negative and positive items? Does the reversal of positively-worded items alter meaning/extremity and thereby elicit non-parallel responses? It is likely that the answers to such questions will vary by individual. It should be noted that the think-aloud format may preclude the detection of certain response
behaviors that might occur in other, more typical data collection conditions (e.g., participants in large-group sessions responding to items without reading them).

Regarding participants, the availability of a large sample of matriculating college freshmen entails both limitations and advantages. Factors such as education level and age are essentially controlled, limiting generalizability but also decreasing within-group (error) variance. For variables related to cognitive ability, ranges may be relatively restricted since all participants are incoming freshmen at the same institution. In an effort to ensure a range of cognitive ability in the qualitative study sample, participants will be randomly selected within two categories based on SAT Critical Reading scores (average and high). As noted earlier, previous research has indicated that individuals with lower verbal/reading skills may be more likely to respond differentially to positive and negative self-report items. It is hoped that the think-aloud approach will reveal some organic examples of this phenomenon and elicit respondent insights into why it might happen. Finally, it is expected that college students, regardless of verbal ability, may have greater potential than other populations (e.g., children) to provide insight into their own response processes.
II. Review of the Literature

This section will begin with brief summaries of the measurement literature on response styles in general and acquiescence in particular. Terminology related to balanced measurement scales and negative items will be delineated. Previous studies of balanced scales and reversed items will then be reviewed with an emphasis on the psychometric consequences of including negative (i.e., reverse-scored) items on measurement instruments. Finally, posited explanations for observed differences in the functioning of negative and positive items will be discussed in turn.

Response Styles

Podsakoff et al. (2003) defined method variance as “...variance that is attributable to the measurement method rather than to the constructs the measures represent” (p. 879). According to some estimates, more than 25% of the observed variance in a typical study might be attributable to systematic method variance (Cote & Buckley, 1987; Williams, Cote, & Buckley, 1989). Response styles—also referred to synonymously as response sets or response biases—constitute one form of systematic method variance. Cronbach (1946) defined a response set as “...any tendency causing a person consistently to give different responses to test items than he would when the same content is presented in a different form” (p. 476). Examples of hypothesized response styles include socially-desirable responding, extreme responding, and acquiescent responding (Holden & Troister, 2009). Several researchers have suggested that such response styles may be stable and related to personality characteristics (e.g., Cronbach, 1946, 1950; Jackson et al., 1971; Weijters, Geuens, & Schillewaert, 2010). Perhaps the best place to begin is
with a discussion of acquiescence, which has been much debated and has led to the prevalent use of balanced scales in modern measurement practice.

**Acquiescence**

When a respondent encounters an item on an attitude scale with constrained answer choices (e.g., a Likert scale), how exactly does he or she arrive at a response? The cognitive process model proposed by Tourangeau provides a framework for understanding the response process. As described in Tourangeau and Rasinski (1988), the theoretical model concerns attitudes or “...networks of interrelated beliefs. ...[W]e use this term [beliefs] loosely to encompass memories of specific experiences, general propositions, images, and feelings” (p. 299). The model includes four stages:

1. interpretation of the attitude question;
2. retrieval of relevant beliefs/feelings from memory;
3. rendering of a judgment based on the retrieved information; and
4. mapping the judgment onto one of the response choices.

According to Krosnick et al. (1996), satisficing occurs when respondents give suboptimal effort in one or more of the above stages. For example, a respondent might proceed through the entire sequence of stages but be less than thorough in some of them (e.g., searching for relevant memories); this approach would be a “weak” form of satisficing. “Strong” satisficing would involve the skipping of one or more response stages (e.g., random responding). *Acquiescence* may constitute a weak form of satisficing in which a respondent tends to lean in a certain direction (e.g., “Agree”) when mapping judgments onto the response choices (Krosnick et al., 1996).

Cronbach (1946) defined acquiescence as follows: “When students are offered two alternatives, as ‘True’ versus ‘False,’ ‘Like’ versus ‘Dislike,’ ‘Agree’ versus
‘Disagree,’ etc., some use one more than the other” (p. 479). Extending this idea to a Likert scale, the acquiescent respondent is one who, regardless of item content, favors one side of the response scale. Cronbach (1946) noted that the respondent might or might not be aware of the tendency, which would be most likely to manifest in “ambiguous or unstructured situations” (p. 483)—for example, in response to unclear or difficult items—and would compromise reliability and validity. Thus his recommendations for controlling response sets included maximizing clarity in instructions and items. Cronbach (1950) later stated that a response set such as acquiescence could be conceptualized as stemming from three respondent-related sources, combined in some proportion: “1. Chance variance; resulting from purely random excess of choice of one or another alternative. 2. Internally consistent but momentary response tendencies; sets operating throughout one testing, but shifting on a retest at another time. 3. Stable response tendencies; sets operating consistently even when the same test is given at different times” (p. 17). Subsequent acquiescence research has focused on response patterns that are consistent within or across measures.

Bentler et al. (1971) suggested that there might be two possible kinds of acquiescence: agreement and acceptance. They defined agreement acquiescence as the tendency to agree with items, regardless of content; they defined acceptance acquiescence as “…individual differences in the tendency to consider characteristics as descriptive” (p. 190). Either category (agreement or acceptance) might manifest in either direction. Regarding acceptance acquiescence, for example, individuals might be extreme accepters (agreeing with all affirmative items describing personality characteristics) or extreme rejecters (disagreeing with all items denying personality characteristics). The
acquiescence subtypes proposed by Bentler et al. (1971) were inferred through observed correlations in Minnesota Multiphasic Personality Inventory (MMPI) data. The distinction between agreement and acceptance acquiescence is not central to the current review, but it was debated rather contentiously in the field during the 1960s and 1970s.

Not all accepted the notion of acquiescence as a measurement phenomenon. There has been debate about the extent to which response distributions are a function of the measurement items, the respondent, or both. Rorer (1965) drew a distinction between response sets (conscious or unconscious attempts to portray oneself a certain way via response choices) and purported response styles such as yea-saying or nay-saying (the tendency to favor a certain response category). He argued that response styles, being a test-specific function of item ambiguity and having nothing to do with item content, were “of no more than trivial importance” as response mechanisms. Samelson (1972) criticized Bentler et al.’s (1971) operational definitions of acquiescence/response styles as being unclear and ill-conceived. He argued that their conceptions of acquiescence were based on a false premise (that oppositely-keyed items are equal in strength) that led to an erroneous analysis of seemingly inconsistent response patterns: “The root of the problem seems to be that the experimenters mistake their own interpretation, based on an oversimplified model, for the (actual or functional) item content and then define all discrepant responses as acquiescence” (p. 13).

Block (1971) took issue with Bentler et al.’s (1971) theory of acquiescence subtypes, dismissing it as mere “post hoc conjecture” (p. 209). While he did not dispute the existence of response styles, he doubted that acquiescence could have an appreciable effect on responses to personality inventories. Thus Block concluded that, “[f]or most
purposes of psychological assessment, it is not necessary to study why certain response
tendencies obscure relationships—the reasons may be uninteresting or trivial or
idiosyncratic ones” (p. 210). Rather, he advocated for addressing the issue via preventive
strategies (e.g., better instrument design/administration) or statistical adjustment of
scores. In their response, Bentler et al. (1972) countered that response styles were worth
researching; in the absence of efforts to understand them, “…attempts at identification
and control of response styles will flounder, content will remain difficult to verify, and
controversy will persist” (p. 112).

Although there remain naysayers, the existence of acquiescence as a measurement
phenomenon seems to have gained general acceptance (e.g., Crocker & Algina, 1986;
Holden & Troister, 2009; Podsakoff et al., 2003; Tourangeau & Rasinski, 1988) and its
nature continues to be investigated (e.g., DiStefano, Morgan, & Motl, 2012). Theory and
research suggest that a number of factors, and interactions among these factors, may
contribute to acquiescence and other response styles. Trott and Jackson (1967), for
example, observed that acquiescence can be experimentally manipulated. They found it
to be “elicited more readily” when item saturation (an item characteristic) was weak and
when respondent exposure to items (a respondent characteristic) was reduced,
presumably leading to decreased attention/comprehension (p. 278). Many researchers
have suggested that the propensity for acquiescent responding may vary based on person
characteristics such as individual differences in education (e.g., Krosnick et al., 1996),
personality (e.g., Cronbach, 1946, 1950), or other variables. Recent research has
indicated that response styles such as acquiescence may be more/less prevalent among
different countries or cultures (e.g., Lindwall et al., 2012; Yang, Harkness, Chin, &
Villar, 2010). Thus researchers have suggested that apparent response styles may stem from item-related characteristics, person-related characteristics, culture-related characteristics, and/or characteristics specific to the testing context.

Various suggestions for dealing with the potential measurement problems posed by response styles have been offered since the 1940s or earlier. Some suggestions involve design strategies intended to minimize method variance; others are statistical in nature and pertain to identifying or adjusting for response styles. Cronbach (1946, 1950), for example, advised scale developers to anticipate potential response sets and discourage them by reducing ambiguity in items, response scales, and instructions (e.g., encouraging respondents to give an answer even when in doubt). He also recommended the use of post-hoc control strategies as needed, including the weighting of scores (to adjust for response tendencies) and the removal of data generated by individuals demonstrating extreme response sets. Other suggested approaches have involved partialing out acquiescence from substantive scores based on separate (e.g., Bass, 1956; Couch & Keniston, 1960) or embedded (e.g., Watson, 1992) acquiescence measures. Interestingly, in one of his recommendations for reducing or eliminating acquiescence, Bass (1956) advised researchers to employ “more intelligent and critical subjects” (p. 299). By and large, however, reviews of the literature indicate that the most pervasive advice on controlling acquiescence has been the recommendation to use balanced scales (Finney, 2001; McPherson & Mohr, 2005).

**Balanced Scales and Negative Items**

Acquiescence involves the tendency to give responses that are biased toward one end of the response scale, regardless of item content and wording direction. Imagine, for
example, an attitude scale with ten items—all worded positively—and a response scale ranging from 1 (Disagree) to 5 (Agree). A yea-saying acquiescent respondent would tend to agree with all statements, leading to an artificially inflated total score (close to 50) that would also distort the group mean score. A long-established practice for addressing this problem is the use of item reversals. Continuing with the above example, five of the ten items on the attitude scale could be rewritten so as to be “reversed” in polarity (e.g., “I like cookies” might be rewritten as “I do not like cookies”). This version of the measure would be a balanced scale—that is, it would consist of equal numbers of positively-keyed and negatively-keyed items. After reverse scoring of the negatively-keyed items, the yea-saying respondent (who would tend to agree with positive and negative items alike) would receive a total score near the middle of the scale (~30), and the mean score for the overall sample would not be biased. Thus the purpose of balanced scales is not to prevent acquiescent responding, but to identify and control for it (Cloud & Vaughn, 1970; Crocker & Algina, 1986; Grove & Geerken 1977; Nunnally, 1978).

At this juncture, some clarification of terminology is warranted; as noted by Finney (2001), descriptors related to item wording/polarity have been used inconsistently in the literature and at times confounded with aspects of social desirability. Most notably, many studies have used “keying” and “wording” interchangeably. Relevant terms in the literature (all referring to items or item stems) include the following:

- **negatively keyed**: written to be reverse-scored. For example, on an anxiety scale where higher ratings/scores indicate greater anxiety, an item such as “I feel calm” would be negatively keyed. Throughout this document, the descriptor “negative” (where otherwise undifferentiated) refers to negative keying.
• *positively keyed:* written to be scored directly. An item such as “I feel anxious” would be positively keyed on a scale where higher ratings/scores indicate greater anxiety. Throughout this document, the descriptor “positive” (where otherwise undifferentiated) refers to positive keying.

• *negatively worded:* containing a grammatically negative marker that negates or reverses the meaning a sentence would otherwise convey. Most commonly in item writing, negation is accomplished by the insertion of *not* or *do not.* Note that negatively-worded items may be keyed positively (e.g., “I do not feel calm”) or negatively (e.g., “I do not feel anxious”).

• *positively worded:* grammatically affirmative or unmarked; containing no negative syntactic (sentence-level) markers (e.g., “I feel calm”; “I feel anxious”; “I feel free of anxiety”).

• *polar opposites:* adjectives/sentences thought to be precisely opposite in semantic value (e.g., “I am happy” versus “I am sad”). Problematically, language is not like math, where +6 and -6 are true opposites identical in absolute value. Due to the connotations inherent in words/phrases and individual differences in lexical representations, paired adjectives or statements “intended” to be opposite in meaning may well lack equivalence (e.g., Biber, 1988; Chang, 1995a; Pinker, 1994; Samelson, 1972).

The above descriptors are not the only ones encountered in the literature. For example, Chang (1995a, 1995b) proposed classifying items as “connotatively consistent” or “connotatively inconsistent” rather than positive or negative. On a given scale, the keying direction shared by the majority of items would define the connotatively consistent category, while the remaining items would be connotatively inconsistent. It
was not clear, however, how the labels should be used for equally balanced scales. Some researchers (e.g., Holden, Fekken, & Jackson, 1985) have made distinctions between syntactic negations using “not,” syntactic negations using adverbs such as “never,” and reversals accomplished via “implicit negatives” or words containing prefixes such as “im-“ or “-un” (e.g., “I am unhappy”).

Balanced scales have been the focus of two primary types of research studies. In the first type (validation), the dimensionality, validity, and/or reliability of a balanced scale (e.g., the Life Orientation Test or the Rosenberg Self-Esteem Scale) is investigated using data from one or more convenience samples. Often, one of the goals of such a study is to determine the presence or absence of method effects associated with item wording or keying. In the second type of study (manipulation), the item wording within a measure is systematically manipulated to create different versions (e.g., all items positive keyed; all items negatively keyed) whose psychometric properties can be compared based on participant responses. Representative examples of both kinds of studies (and variations on them) will be reviewed in the following section. It should be noted that in some studies, the manner of balancing scales and reversing items has been either lopsided (e.g., highly discrepant numbers of negative and positive items) or unspecified. Additionally, as noted earlier, descriptors related to item wording have not always been used clearly. Thus the accuracy and generalizability of some reported findings may be questionable.

**Psychometric Consequences of Including Negative Items on Scales**

As suggested by Steinberg (2001), it may be impossible to know what form of an instrument (with regard to response scale, item wording, item order, etc.) will do the best job of eliciting a respondent’s “true” level of the target construct. However, the literature
strongly suggests that the inclusion of negative items can be detrimental to scale
reliability/validity and introduce method variance that is largely or entirely unrelated to
the object of measurement. Regarding balanced scales, Trott and Jackson (1967)
observed that “…the method of scoring used pits acquiescence against content” (p. 285).
Research has indicated that the inclusion of even one (scored) negative item can be
detrimental to scale functioning (Horan, DiStefano, & Motl, 2003; Ibrahim, 2001).

Evidence of differences between negative and positive items has been provided in
the form of internal consistency estimates (e.g., Barnette, 2000), item-total correlations
(e.g., Juni et al., 1996), predictive validity (e.g., Lai, 1994), and factor-analytic solutions
(e.g., Ebesutani et al., 2012; Pilotte & Gable, 1990). Regarding the latter area, earlier
studies tended to focus on a limited number of competing models (e.g., one factor versus
two); more recently, researchers have begun to compare a wider range of models—for
example, multiple variants of correlated trait, correlated methods (CTCM) and correlated
trait, correlated uniquenesses (CTCU) models. Several CFA studies have used CTCM
models to explore potential relationships between response style and measures of
reading/cognitive ability (e.g., Marsh, 1996) and personality (e.g., DiStefano & Motl,
2006). Selected validation and manipulation studies (and additional studies using
alternative or hybrid designs) that have shed light on the psychometric properties of
balanced scales are reviewed below.

Validation Studies. The Life Optimism Test (LOT), a measure of dispositional
optimism, was first introduced by Scheier and Carver (1985). The LOT uses a 5-point
Likert scale (Strongly Disagree to Strongly Agree) and includes eight substantive items
plus four “filler” items whose intended purpose was “…to disguise (somewhat) the
underlying purpose of the test” (p. 224). Of the eight substantive items, half are positively keyed and half are negatively keyed. Of the four reversed items, three are negated via adverbs (e.g., “I hardly ever expect things to go my way”) and the other contains no negative markers (“If something can go wrong for me, it will”). Using data collected from 624 undergraduates, Scheier and Carver (1985) performed an exploratory factor analysis (EFA) that yielded two factors defined by keying direction. They then used confirmatory factor analysis (CFA) techniques on the same data to test the fit of a one-factor model versus a two-factor model. In both models, correlated error terms were apparently included (a) among the positive items and (b) between the affirmatively-phrased negative item noted above and one of the positive items. Results indicated an acceptable fit for both models, with a nested $\chi^2$ test favoring the two-factor solution. However, the authors argued that the LOT could “just as reasonably be considered unidimensional” for the following reasons: in the EFA, all items had loadings of at least .50 on the first unrotated factor; and in the two-factor CFA solution, there was a “high positive correlation” of .64 between the factors (p. 227). Ignoring for the moment concerns about the authors’ analytic methods and interpretations, the study provided evidence of differential functioning across the negatively-keyed and positively-keyed LOT items.

Similar findings were reported by Lai (1994), who administered the LOT to a sample of 202 undergraduates in Hong Kong (the English language proficiency of the participants was not discussed). An EFA based on the data yielded two factors, one associated with positively-keyed items and the other with negatively-keyed items. The correlation between the factors (.18) was much lower than that found by Scheier and
Carver (1985). Lai also found that the positive and negative “subscales” differed in terms of both internal consistency estimates (coefficient alpha = .71 and .66, respectively) and correlations (unadjusted for reliability) with scores on health-related symptom checklists (e.g., -.31 versus .12).

Using archival data from two samples (1,967 male US Air Force trainees; 415 high school students), Bernstein and Eveland (1982) investigated the factor structure of the State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushener, 1970). The 20-item STAI was designed to measure two distinct constructs: state (i.e., transitory) anxiety and trait (i.e., stable or chronic) anxiety. The STAI is a balanced scale, as half the items are negatively keyed. Based on an oblique multiple-groups (OMG) CFA approach, Bernstein and Eveland advocated for a four-factor solution defined by the two hypothesized substantive constructs and keying (State+, State-, Trait+, Trait-). The pattern of correlations between factors was of interest. In both samples, the strongest relationship was between State+ and State- (.59 to .65); the relationship between Trait+ and Trait- factors was considerably weaker (.27 to .49) and, in fact, less strong than the correlations between factors with the same keying direction (positive: .58 to .61; negative: .49 to .55).

In another CFA study, Magazine, Williams, and Williams (1996) administered Meyer and Allen’s (1984) Affective and Continuance Commitment Scales (ACS and CCS) to a sample of library and bank employees (N = 333). Both the ACS and the CCS contain eight items. On the ACS, four items are negatively keyed (three of which are negatively worded); on the CCS, two items are negatively keyed (both negatively worded). Of the four competing (theory-based) models the authors fit to the combined
data (two- and three-factor models with and without method factors), none exhibited acceptable fit based on $\chi^2$ and Comparative Fit Index (CFI) statistics. However, the models with “reverse coding” method factors fit significantly better than the models without them. Based on the results, Magazine et al. (1996) raised the question of whether it might be beneficial to replace the negative ACS and CCS items with positively-keyed equivalents.

In a study based on a 7-item version of the Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1989), Marsh (1996) investigated the lingering question of its factor structure. He tested the fit of six competing CFA models to data collected in 1988 (nominal $N = 8,764$) and 1990 (nominal $N = 4,251$) as part of the National Education Longitudinal Study of 1998 (the response scale was not specified, but historically the RSE has been operationalized with a four-point Likert scale). For both data sets, the best fit was obtained with a one-factor model that included method effects (correlated errors among all three negatively-keyed items and between two of the four positively-keyed items). In addition, Marsh conducted follow-up analyses involving a two-factor model (positive versus negative items) and concurrent measures of verbal/reading ability. The positive and negative “factors” became less distinct as reading ability increased, lending support to the hypothesis that “…the underlying separation between two empirically identified [RSE] factors may reflect method effects…” rather than substantively meaningful differences (p. 817). In his conclusions, Marsh (1996) proposed (as he had in 1986) an alternative way to control/screen for response biases in attitude and personality questionnaires: Include a small number of negative items, but do not count them (or, alternatively, weight them less) in calculating scale scores. This approach, he argued,
would serve to “…disrupt potential response biases…” (p. 817). It was not clear in Marsh’s argument whether the disruption of potential response biases would result from encouraging respondents to pay attention to item wording (through the intermittent inclusion of negative items), screening out aberrant response patterns post hoc, or both mechanisms.

In a similar study, Corwyn (2000) investigated the factor structure of the full, 10-item RSE based on five data sets. This form of the RSE was balanced (five negatively-keyed items, two of them negatively worded) and included a four-point Likert scale (Strongly Agree to Strongly Disagree). Consistent with prior studies of the RSE, all models incorporating method effects related to keying direction fit the data better than did models without method effects. The best-fitting model was a full bifactor model that included one substantive factor (self-esteem) and two method factors (positive and negative keying). In this model, (standardized) substantive factor loadings were consistently higher for the positive items whereas uniquenesses (i.e., error variances) were consistently higher for the negative items. This pattern would suggest that the positive items were of higher quality and validity than the negative items as indicators of the target construct (self-esteem).

Motl and colleagues have published several studies of method effects associated with negative items. In Motl, Conroy, and Horan (2000), the dimensionality of the 12-item Social Physique Anxiety Scale (SPAS; Hart, Leary, & Rejeski, 1989) was examined. The studied version of the SPAS used a 5-point response scale (Not At All to Extremely). It appeared that seven of the 12 items were positively keyed (i.e., higher responses reflecting higher levels of anxiety) while the other five were negatively keyed (e.g., “I
never worry about wearing clothes that might make me look too thin or overweight”).

Eight competing CFA models, including CTCM and CTCU variants, were tested with archival data from four samples \( (N = 1,053) \). Results favored models with a single, global substantive factor and (substantively irrelevant) method effects (modeled as correlated uniquenesses, a positive method factor, or a negative method factor). In their conclusions, the authors emphasized the need to model method effects for personality scales on which the direction of item wording (keying) varies.

Horan, DiStefano, and Motl (2003) used National Educational Longitudinal Sample (NELS 1988-1994) data to investigate the factor structure of the RSE (the same 7-item version used by Marsh [1996]), an Attitude toward School scale (10 items, 7 positively keyed and 3 negatively keyed) and a Locus of Control scale (6 items, one positively keyed and 5 negatively keyed). Each measure had a four-point response scale (Strongly Disagree to Strongly Agree), and negative items were reverse-scored prior to analyses. For all scales, models that included method effects (method factors or correlated uniquenesses) for either positive or negative items fit the data better than models that did not; the best-fitting variants were those that modeled method effects for negative items.

To investigate the relationships of wording/keying effects across the three instruments, Horan et al. (2003) tested additional CFA models that included three substantive factors and (a) no wording effects, (b) three correlated negative-wording factors, and (c) a single negative-wording factor operating across all measures. Results favored the second model, which was deemed to have adequate fit statistics. Correlations among the three substantive factors ranged from .38 to .76, while correlations among the
method factors ranged from .31 to .43. Thus although the model with a single method
effect (across all measures) was not supported, there was evidence of similarity in the
differential functioning of negative and positive items across measures. The presumed
“negative wording” effect was present across measures but manifested differently on
each. A structural model based on RSE data from three time points suggested that the
method effects were also stable over time.

Method effects associated with negatively-keyed items have been reported in
numerous other validation studies using different scales and populations. For example,
Hazlett-Stevens, Ullman, and Craske (2004) investigated the factor structure of the Penn
State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) using
data from two college samples. Their results indicated the presence of a single
substantive factor (worry) plus a method factor to account for differential responding to
negative items. Chen, Rendina-Gobioff, and Dedrick (2010), using data from two
Taiwanese elementary school samples, found evidence of method effects associated with
negatively-worded items on a Chinese measure of self-esteem. Similar results were
reported by Ebesutani et al. (2012), who investigated the factor structure of the
Loneliness Questionnaire (LQ; Asher, Hymel, & Renshaw, 1984) using data from U.S.
children in grades 2-12.

Few published validation-type studies of balanced (or mixed) scales have reported
a lack of method variance associated with wording/keying. In one such example,
Bernstein and Garbin (1985) used an OMG CFA approach to test various proposed
subscales of MMPI Scale 2 (Depression); data came from a small outpatient sample ($N = 76$) and a large job applicant sample ($N = 3,808$). It should be noted that the MMPI has a
dichotomous response scale (True/False). None of the proposed structures, including subscales based on keying, adequately reproduced the observed inter-item correlation matrix. Thus there was no evidence that positive and negative items were functioning differentially, though there was also no evidence that they were functioning comparably.

In a more recent example, Borgers, Hox, and Sikkel (2004) analyzed internet-based survey responses to a simplified Dutch version of the RSE and another well-being scale from 202 children (aged 8-16). Contrary to expectations, there was no effect of negatively-keyed items on the internal consistency of the responses. In discussing these results, the authors suggested that their analytic approach (the use of reliability estimates as dependent variables) may have obscured differences between responses to negative and positive items. They noted that for more than half of all possible comparisons, significant mean differences were found between oppositely-keyed items.

**Manipulation Studies.** Benson and Hocevar (1985) examined the effects of item wording on the responses of elementary schoolers (grades 4-6, N = 522) to an attitude measure. The study was designed to test two assumptions implicit in recommendations to use “balanced” scales: (1) that positive and negative items measure the same construct; and (2) that balancing yields a more valid index of the target construct. Each student was administered one of three versions of a 15-item scale assessing attitudes about school integration: all positively worded; all negatively worded; and mixed (8 and 7 items, respectively). Item order was consistent across forms, and all negative items were created by adding the word “not.” The all-positive and all-negative forms were shown to have different item means, item variances, and factor loadings. The pattern of means suggested that it was “…difficult for the students to indicate agreement by disagreeing with a
negative statement” (p. 231). Factor analyses of the mixed-form responses supported a two-factor solution defined by item wording.

In a study of the effects of “negative valence” items, Ahlawat (1985) analyzed the responses of 501 Jordanian teenagers (grades 8-9) to a version of the STAI that had been expanded and then translated into Arabic. The measure included a 5-point Likert scale and 92 items—23 each of four types that were classified as semantically and grammatically positive (e.g., “I feel happy”), semantically positive and grammatically negative (e.g., “I do not feel happy”), semantically negative and grammatically positive (e.g., “I feel sad”), and semantically and grammatically negative (e.g., “I do not feel sad”). The data were found to have good overall internal consistency (.90), but patterns of means, standard deviations, and correlations suggested marked differences in the functioning of the four types of items within each of four sample subgroups (rural girls, urban girls, rural boys, and urban boys). In interpreting the results, the author concluded that some types of items “…were contaminated by the introduction of an insidious grammatical element, the negative” (p. 97). It should be noted that Ahlawat’s (1985) use of item descriptors (“positive” and negative”) seemed to confound semantics and social desirability.

Schriesheim and colleagues conducted several studies involving the systematic manipulation of wording/keying (Schriesheim & Eisenbach, 1995; Schriesheim, Eisenbach, & Hill, 1991; Schriesheim & Hill, 1981). Each study investigated psychometric consequences of using different proportions of item reversals on two subscales from the Leader Behavior Description Questionnaire (LBDQ; Stogdill, 1963). Items from the Initiating Structure (IS) subscale were alternated with items from the
Consideration (C) subscale, yielding an instrument with 16-20 items; the response scale had five options (Always to Never). The research design addressed a perceived weakness in other wording-related studies of attitude scales: “…there was no known referent or objective standard against which subject responses could be compared; the validity of subjects’ responses could, as a consequence, be only inferred” (Schriesheim et al., 1991, p. 70). Thus in each study, participants were asked to carefully read a one-page description of behaviors displayed by a fictitious supervisor; after they had finished reading, they were asked to turn the description face down and (from memory) rate the supervisor’s behaviors. Through substitution of adverbs, two versions of the description were created: one in which the IS behaviors were high, and one in which they were low (Consideration behaviors were neutral across both versions). Different variations of the response instrument were used in each study.

In Schriesheim and Hill (1981), three versions of the 20-item response instrument were created: one in which all items were positively worded; one in which all items were reversed (usually this was accomplished by the insertion of “not” or a prefix like “un-”); and one in which half of the items on each subscale were reversed (“mixed”). Participants ($N = 150$ undergraduates) were randomly assigned to one of the six (2x3) conditions. The focus of analysis was the IS subscale, on which participants were expected to give extreme responses (because they read descriptions in which these behaviors were either frequent or rare). Internal consistency, as estimated by coefficient alpha, was highest when all survey items were positively worded (.96) and slightly lower in the all-negative (.91) and mixed (.89) conditions; in the latter condition, the subset of five negative items was much less reliable than the subset of five positive items (.70 versus .91). To equate
responses from the high- and low-IS conditions, the authors calculated accuracy scores for each response (1 for perfect accuracy, 5 for extreme inaccuracy). For example, the fictitious supervisor in the high-IS script should have received the highest possible scores from respondents (5) on IS items. Similarly, the supervisor in the low-IS script should have received the lowest possible score on each IS item. Accuracy scores were computed as the difference between expected and observed IS item scores (i.e., 5 - X for the high-IS condition and X - 1 for the low-IS condition). Descriptive statistics for these scores suggested that the mixed and negative item wording conditions resulted in about 50 percent more inaccuracy (and more variability) than that observed in the all-positive condition. A one-way ANOVA revealed statistically significant effects of item wording on accuracy. Based on the results, the authors concluded that “…although the inclusion of negatively stated items may theoretically control or offset agreement response tendencies, their actual effect is to reduce response validity” (p. 1113).

Holden, Fekken, and Jackson (1985) questioned the claim that the use of balanced scales necessarily compromises response validity: “Although the balancing of scales may serve to reduce acquiescent response biases, nowhere has it been put forth that this must be accomplished through the use of negative wording. It appears that Schriesheim and Hill [1981] have not drawn a proper distinction between negative wording and negative keying” (Holden et al., 1985, p. 387). Holden et al. (1985) suggested that the two dimensions are mutually exclusive and could be varied to create four kinds of items (examples reproduced from p. 387): “He mixes with others” (positive wording, positive keying); “He doesn’t mix with others” (negative wording, negative keying); “He keeps to himself” (positive wording, negative keying); and “He doesn’t keep to himself” (negative keying).
wording, positive keying). In an effort to explore those item subtypes, the authors conducted a correlational study on 80 items from a Likert-based personality measure (the Personality Research Form or PRF). Studied features of the items included length (three proxies), negative keying (yes/no), judged face validity, judged subtlety, and three types of negative wording (use of “not”; use of negative qualifiers such as “rarely”; and use of implicit negatives such as the prefix in “unpleasant”). Another variable, “item criterion validity,” was based on “…point biserial correlations of individual items with multiple criterion scores [that] represented unweighted composites of self-evaluations on a rating scale, an adjective endorsement list, and an experimental preference rating” (p. 388). These values were calculated based on data from two prior studies involving the PRF.

An initial and predictable finding in Holden et al. (1985) was that criterion validity decreased for lengthier items (correlations between -.14 and -.23). After item length was partialled out (because negatively-worded items tend to be longer than positively-worded ones), use of negative wording (all types combined) remained significantly associated with reduced criterion validity (-.22). By contrast, the correlation between negative keying and criterion validity was not statistically significant (.01; presumably this was calculated as a point-biserial correlation). None of the three types of negative wording was significantly correlated with criterion validity on its own (“not”: -.16; negative qualifiers: -.07; implicit negatives: -.08). Due to the correlational approach of the study, the import and generalizability of its findings are uncertain. However, it raised important questions about item keying and wording that influenced subsequent research.
In Schriesheim et al. (1991), for example, the authors refined their previous research design (Schriesheim & Hill, 1981) to include four wording conditions for the response instrument (which was also shortened to 16 items): all items positively worded/keyed (“regular”); half items regular, half positively worded/negatively keyed (“polar opposite”); half items regular, half negatively worded/positively keyed (“negated polar opposite”); and half items regular, half negatively worded/negatively keyed (“negated regular”). Participants, 280 undergraduates, were randomly assigned to one of the eight (2x4) conditions. As was the case in the 1981 study, internal consistency estimates for the IS subscale (8 items) were higher for the all-positive condition (.94) than for the mixed conditions (.77-.89). A one-way ANOVA indicated that item wording had a significant effect on accuracy. Post-hoc comparisons revealed that accuracy scores were significantly higher ($p < .05$) for regular and negated regular items than for polar opposite and negated polar opposite items.

A very similar data collection design was adopted in Schriesheim and Eisenbach (1995), though the response instrument was returned to its original length (20 items) and four versions of the supervisor description were used. Based on data from 496 undergraduates, EFA and CFA analyses were conducted to investigate possible method effects. The best-fitting CFA model included a single (IS) trait factor and four method factors, one for each wording condition. Correlations between the method factors were generally nonsignificant, with the exception of that involving the two types of reverse-scored items (.42). The results indicated that method effects can result not only from keying differences, but also from different wording strategies, as had been suggested by Holden et al. (1985).
Barnette (2000) examined the effects of both item wording (2 conditions) and response scale presentation (3 conditions) on means, variances, and reliability estimates. Participants (a mix of high school students, undergraduates, graduate students, and in-service teachers; \( N = 915 \)) were administered one of six versions of a 20-item questionnaire designed by the author to assess attitudes about year-round schooling. Items were either (a) all “direct-worded” (i.e., positively keyed and worded) or (b) half direct-worded and half reverse-worded (reversals were accomplished by the insertion of an underlined “not”). The 5-point response scales were presented as (a) Strongly Disagree to Strongly Agree, (b) Strongly Agree to Strongly Disagree, or (c) a randomly-determined half-and-half mix of the two (varying by item). After reverse-scoring, items presented in the “mixed wording” format had higher means and lower variances than items presented in the “all-direct” format. Reliability estimates were higher for the all-direct wording condition (.81-.85) than the mixed wording condition (.65-.73), and the highest internal consistency was observed when items were all positively worded and the response scale varied from item to item. Barnette concluded that “…using a bidirectional response set of alternatives [i.e., varying the direction of the response scale from item to item, as opposed to keeping the response scale constant and including negatively worded items] does not result in a loss of internal consistency but would permit the possible detection of acquiescence or response set bias.” (p. 369). The author did not explain precisely how said detection should be carried out.

Several other wording-manipulation studies have reported differences in the psychometric properties of scale versions with different proportions of negative and positive items. For example, Chang (1995a) administered four versions of the LOT to
university students. CFA results indicated a two-factor solution for balanced versions and a one-factor solution for versions with all-positive or all-negative keying. Miller and Cleary (1993), analyzing loneliness scale data from undergraduate and graduate students, found that balanced versions yielded a factor defined by negatively-keyed items. Similar results were reported by Höfling, Moosbrugger, Schermelleh-Engel, and Heidenreich (2011), who examined the factor structure of a balanced version of the Mindfulness Attention and Awareness Scale (MAAS; Brown & Ryan, 2003), and by Greenberger et al. (2003), who created three versions of the 10-item RSE (all positive, all negative, balanced) to be administered to university students.

Occasionally, published manipulation studies have found the psychometric functioning of negative and positive items to be comparable. For example, Jackson and Lay (1968) crossed wording and keying conditions for selected PRF items that were then administered (in one of two questionnaires) to 158 female university students on two occasions (one week apart). Participants also completed separate measures of acquiescence and social desirability. Correlational results suggested that participants “...generally had little difficulty in responding appropriately to positively and negatively worded variations of the same item” (p. 326). Similarly, EFA results yielded substantive factors and “negligible” relationships between PRF items and acquiescence/desirability scores.

In two parallel studies with college student samples (total N ~ 1,000), Finney (2001) investigated measurement consequences of using negative items on a Likert-based test anxiety scale (the TAI). In both studies, approximately half of the sample completed the standard version of the 8-item scale (which contained only positively-worded items)
while the other half completed an adapted “mixed” version in which the word “not” was added to four items, making them negatively worded and negatively keyed. Additional measures were subsequently completed by all participants. The main difference between the two studies involved data collection procedures: In Study 1, the procedure was highly structured (e.g., participants completed one measure at a time and were not permitted to move on until everyone was ready); in Study 2, participants were allowed to work at their own pace and depart once they had finished.

In describing her analyses (primarily $t$-tests and CFAs), Finney (2001) reported that while the two studies yielded similar results, the data collection procedures in Study 2 resulted in “...a general deterioration of the [questionnaire’s] psychometric properties” (p. 142). Regarding the primary research hypotheses, some were supported. First, negative items were less reliable than positive items. Also, the presence of negative items decreased the reliability of positive items when participants were allowed to proceed at their own pace. Some findings were contrary to both expectations and results from other studies. Most notably, the negative items did not exhibit lesser validity than positive items, did not have a detrimental effect on mixed-form validity coefficients for positive items, and did not adversely impact the factor structure of the data. It was unclear whether the unexpectedly adequate fit of a one-factor (trait) model to balanced-scale data was due to the cognitive ability of the sample (i.e., they were not confused by negative wording) or some interaction among respondent characteristics, item characteristics, and data collection procedures. Finney also raised the possibility that the directions of her hypotheses may have been biased by the “file drawer problem” (i.e., previous studies that failed to find significant wording/keying effects may not have been published).
**Additional Studies.** Most published studies of wording-related method effects have used either a validation or a manipulation approach (or both). Exceptions include Melnick and Gable (1990), in which an attitude questionnaire was completed by parents of 3,328 elementary schoolers in an urban school district. The instrument used a five-point Likert scale (Strongly Agree to Strongly Disagree). Analyses were based on pairs of parallel items—that is, pairs of items deemed to be equivalent in meaning but opposite in keying direction. For each item pair, respondents were classified into groups depending on whether their two responses were “consistent” (e.g., Agree/Strongly Agree for the positive item and Disagree/Strongly Disagree for the negative item) or “inconsistent” (e.g., Agree/Strongly Agree for both items). T-tests revealed that the consistent responders had significantly higher mean scores than the inconsistent responders on all questionnaire subscales (Home/School Relations; Clear School Mission; High Expectations; Safe and Orderly Environment; Instructional Leadership; Frequent Monitoring of Student Leadership). In addition, chi-square tests indicated that for each pair of items studied, the consistent responders had a higher education level than did the inconsistent responders. The authors concluded that balanced scales might be particularly confusing for adults with lower levels of education.

Chang (1995b) conducted a generalizability study to examine the comparability of positively- and negatively-keyed (connotatively consistent and inconsistent) items. A Likert-based attitude scale created by the author (related to math/statistics) was administered on two occasions (one week apart) to 102 graduate students enrolled in a research methods course. The study was based on eight items from the scale (four positive, four negative), each of which was rewritten to have opposite keying at the
second occasion. Thus the initial design was partially nested with three facets: wording, scale version (i.e., occasion), and item. The main effect for wording was nearly zero (0.5% of total variance), but the variance components were more substantial for the two-way interaction between person and wording (5.5%) and the three-way interaction between person, wording, and scale version (9.1%). Because the largest variance component was associated with the interaction between person and scale (26.1%), indicating that the relative standing of individuals varied markedly across the two scale versions, the two versions were subsequently analyzed separately. Large variance components for the person-wording interaction (14 and 16%) indicated that wording impacted the relative standing of individuals. Finally, follow-up decision studies revealed that positively worded items had higher G coefficients (reliability) than their reversed counterparts. Thus Chang’s (1995b) conclusions were consistent with those of most other wording-related studies: Positive and negative items do not elicit equivalent responses.

Cognitive/Psycholinguistic Processing of Negation

Before various measurement-related explanations for the non-equivalence of positive and negative items are discussed, it may be informative to review the findings of experimental studies of cognitive/psycholinguistic processing of negated statements. As noted by Block (1971), “The use of ‘negation reversals’ avoids the trap of ‘polar reversals’ which possibly are not received by respondents as psychological reversals” (p. 206). For example, the word healthy has a number of antonyms that could be used as reversals (e.g., ill; sick; unhealthy; unwell). Are any of those antonyms likely to be perceived as true “polar” opposites, identical in absolute value? Given the nuances of semantics (e.g., denotative and connotative aspects of meaning), the answer is probably
no. And even if one person felt strongly that healthy and ill were precise opposites, another person might perceive a lack of symmetry (e.g., on a state-versus-trait connotative dimension). Words are not numbers, and individual representations and perceptions of words vary (e.g., Pinker, 1994). Thus sentence-level negation (e.g., reversing a measurement item by adding “not”) has been an appealing strategy for researchers constructing balanced attitude/affective scales. However, the literature strongly suggests that negated items present challenges of their own.

Wason (1959, 1961) conducted several experimental studies in which undergraduate and graduate students responded to four types of (printed) statements: true affirmatives (e.g., “Ice is cold”); false affirmatives (e.g., “Ice is hot”); true negatives (e.g., “Ice is not hot”) and false negatives (e.g., “Ice is not cold”). Performance was measured in terms of both accuracy and speed. Results consistently showed that affirmative statements were processed more quickly, and with fewer errors, than negative statements. These trends were congruent with observations volunteered by participants (e.g., during self-assessments of performance across conditions). Wason (1959) concluded that there was “…considerable evidence to suggest that responding to negative information in the logically sufficient way is detrimental to the assessment of performance” (p. 101).

The same four wording conditions were used by Peterson and Peterson (1976), who asked adults to answer (from memory) true-false statements about reading passages. Analyses of variance for accuracy data confirmed that negative statements yielded more errors than did affirmative ones. Response times were not measured in the study.

Sherman (1973, 1976) conducted several studies investigating the effects of different kinds of negation on sentence-level comprehension. Participants were asked to
read statements and indicate for each whether it made sense (half of the statements were reasonable, while half were not). Performance was measured in terms of both accuracy and speed. Consistent with expectations, “unmarked” (i.e., affirmative) sentences were processed more quickly and accurately than negated sentences. Among subtypes of negated sentences, those including “not” were the most problematic for respondents. Those with implicit (prefix-based) negation (e.g., “I am unhappy”) and adjectival negation (e.g., “I am sad”) had “…little effect on comprehension in an otherwise affirmative context… [but] a consistent and substantial effect when added to [an otherwise] negative sentence [e.g., “I am not unhappy”] (1976, p. 143). Finally, sentence comprehension became increasingly more difficult with increasing numbers of negative markers (regardless of subtype).

In summary, it is well-established that negated statements are processed more slowly and less accurately than corresponding affirmative statements. The effect appears to be strongest when negation is accomplished via overt syntactic markers (e.g., “not”). Linguistic factors impacting working memory—such as sentence length, sentence structure, and number of negative markers—can also affect comprehension (e.g., Angleitner, John, & Löhr, 1986; Carpenter & Just, 1975; Foss & Hakes, 1978).

**Explanations for the Differential Functioning of Negative and Positive Items**

The measurement literature on balanced scales suggests that negative and positive items tend to function differentially, often leading to undesirable consequences for scale dimensionality, reliability, and validity. The “blame” for those consequences has typically been laid at the doorstep of the “insidious” negative items, which appear to be more difficult to process than affirmatively-worded items, particularly for respondents
with lower levels of cognitive ability, reading skill, and/or education. As yet, however, there is no consensus regarding the exact nature of the difficulty negative items seem to present for both respondents and researchers. Why is it that confirmatory factor analysis of data from scales designed to be unidimensional so often supports a model with two factors defined by item wording/keying? Previously posited explanations for that phenomenon are reviewed below.

**The Substantive Explanation.** According to this line of reasoning, a two-factor model fits or emerges from the data because both factors reflect independent constructs or dimensions of a construct. The systematic variance modeled by the “negative” factor is, like that of the “positive” factor, substantive (rather than artifactual) in nature. As summarized by Finney (2001), “…some researchers have hypothesized that the negative item wording may tap into different or additional affective or attitudinal constructs than the positive item wording” (p. 37).

As described earlier, Bernstein and Eveland (1982) examined the dimensionality of the STAI, a balanced scale, using a multiple-groups approach with data from two samples (high school students and Air Force trainees). Results supported a solution with four factors defined by positively-keyed State items, negatively-keyed State items, positively-keyed Trait items, and negatively-keyed Trait items. The authors offered a substantive interpretation of the structure, suggesting that STAI respondents “…tend to perceive items describing the symptoms of anxiety [i.e., negatively-keyed items] and the symptoms of positive moods [i.e., positively-keyed items] as being at least as different as items describing the immediate present (state) and the long term (trait)” (p. 371).
The possibility of a substantive explanation for negative/positive differences was also raised by Mook, Kleijn, and van der Ploeg (1991), who investigated the factor structure of balanced scales measuring anxiety (a Dutch trait-only version of the STAI) and depression symptoms. Each measure consisted of 20 items, half of which were negatively keyed (it was unclear how many were negatively worded). A principal components analysis (PCA) was conducted using pooled data on both measures collected from four groups of adults \( N = 1,409 \). Results supported a two-component solution defined entirely by keying direction—that is, all negatively-keyed anxiety and depression items loaded on one component, while all positively-keyed anxiety and depression items loaded on the other. These components were tentatively referred to as “absence of positive affect” and “presence of negative affect.” The authors suggested that their results might be due to stylistic responding (e.g., social desirability), but favored an alternative explanation: “…our consistent positive-negative differences reflect the workings of two independent dimensions of positive and negative affect” (p. 558).

Mook and colleagues (1992) conducted a similar study of a Dutch version of the LOT dispositional optimism scale (8 items, half negatively keyed). A PCA of data from two adult samples \( N = 404 \) yielded two components defined by keying direction; the correlation between the two components was .31. As in their previous (1991) study, the authors favored a substantive interpretation of the apparent multidimensionality of the LOT. It was suggested that the two components reflected optimism (i.e., presence of positive affect) and pessimism (i.e., absence of negative affect).

More recently, Alessandri, Vecchione, Tisak, and Barbaranelli (2011) investigated the dimensionality of a revised (and translated) version of the LOT (LOT-r).
The measure (6 items: half positively keyed, half negatively keyed) was administered to a sample of 372 Italian adults, with 372 matched acquaintances serving as informants. Participants gave self-ratings, while each informant independently rated the participant with whom he or she was acquainted. In addition to the LOT-r, participants and informants gave ratings on measures of Big Five personality traits (40 adjectives) and egoistic bias (7 items). Results of five competing CFAs for each group yielded three plausible models, of which Model 4 (one trait factor plus a “specific factor” associated with positively-worded items) was favored for theoretical reasons. The Model 4 variance was then decomposed into three components (self-report: optimism = 29%, specific = 23%, error = 48%; other-report: 31%, 24%, 46%). Scores from the six personality indicators were included, along with the optimism factor and the specific factor, in a CTCU model. The set of personality measures explained similar amounts of variance for each factor (.41 and .50), supporting the researchers’ hypothesis that “…the tendency to endorse positively worded items represents a personality characteristic linked to individual adjustment (i.e., emotional stability) and to a specific facet of social desirability” (p. 638). In other words, a substantive interpretation of the second (“specific”) factor was favored.

**The Method Variance Explanation.** Proponents of this explanation posit that for balanced scales, multiple factors may emerge due to wording-based method variance—that is, because negative and positive items elicit different response distributions. The method variance, while systematic, is not of substantive interest; it is merely noise that should be partitioned from the measurement signal (e.g., via CFA/SEM techniques). This explanation is at odds with the substantive interpretation of wording-based variance.
Russell and Carroll (1999), for example, argued that research studies had provided little support for the idea that the relationship between positive affect and negative affect might be independent rather than bipolar (i.e., opposite ends of a unidimensional spectrum). According to Carmines and Zeller (1979), evidence of spurious (i.e., artifactual) factors based on keying/wording would include (1) high correlations between the “positive” and “negative” factors, and (2) similar correlational patterns of these with external (criterion) variables.

This approach is illustrated in Roberts, Lewinsohn, and Seeley (1993), who investigated the dimensionality of the UCLA Loneliness scale (Russell, Peplau, & Cutrona, 1980) using data collected from 1,710 high school students. The measure consisted of eight items, half negatively keyed (one negatively worded) and half positively keyed (again, one negatively worded); there were four response options ranging from Never to Often. The sample was randomly split into halves so that an initial PCA could be followed up with a CFA. As hypothesized, results of the PCA yielded two components defined by item keying direction; in the follow-up two-factor CFA, the correlation between the factors was high (.72). Roberts and colleagues then used theoretically relevant external variables (e.g., depression; social skills; social competence) to determine whether the observed factor structure might be artifactual (as recommended by Carmines and Zeller). For almost all variables, there was little variation among correlations with Loneliness scores based on all items, positive items, and negative items. Thus the authors concluded that the two-factor solution was “…largely an artifact of the attempt to counter response set by using items with both negative and positive valence” (p. 1388).
Several researchers have interpreted wording/keying-defined factors as artifactual even in the absence of information about patterns of associations with external variables (e.g., Motl et al., 2000; Schriesheim, Eisenbach, & Hill, 1991). In a study conducted by Tomás and Oliver (1999), participants (640 high school students) completed Spanish translations of the original 10-item RSE (balanced; 4-point Likert scale). Nine competing CFA models were fit to the data, the best-fitting of which were Model 6 (CTCU) and Model 9 (CTCM with two method factors; i.e., full bifactor). The authors suggested that the results likely reflected the presence of method effects, but added a caveat: “To further analyze this question, it would be useful to relate self-esteem as defined in each of the models here to other trait measures with positively and negatively worded items.” (p. 95).

The Item Extremity Explanation. Spector and colleagues (1997) showed that artifactual multidimensionality can result through a certain kind of interaction between item and respondent characteristics. Naturally, respondents vary in the amount of a target construct (e.g., job satisfaction) they possess. Similarly, measurement items vary in strength of wording/content; “extreme” items are those that are so strongly worded that they may be difficult for respondents to endorse (regardless of keying). The concept can be illustrated with two extreme items used in the Spector et al. study: “I loathe my job” and “I am in love with my job.” In the study, real and simulated data were used to demonstrate that if items on a balanced scale are extreme relative to where most respondents fall on the underlying construct, people’s valid responses may appear inconsistent across negative/positive items. For example, a respondent very high on job satisfaction might give “consistent” responses by agreeing with “I am in love with my job” and disagreeing with “I loathe my job.” However, respondents with more moderate
levels of job satisfaction—who would presumably outnumber extreme responders—would likely disagree with both items. As explained by Spector et al. (1997), this combination of response patterns would likely result in higher correlations within items sets (positive and negative) than across item sets, leading to an artifactual two-factor solution:

Therefore, the appearance of two factors depends upon the joint distributions of both items and people on the underlying measurement continuum. If the items are extreme relative to where most people are..., and the people are spread throughout the continuum, there will be a mix of people who are consistent and inconsistent in agreeing with items on opposite ends of the continuum. Correlations between items at opposite ends of the continuum will be attenuated, while correlations between items at the same end will be relatively strong. As a result, artifactual factors would appear based on the response patterns to these items. Specifically, these factors merely reflect the greater magnitude of correlation within versus across item type based on the distributions of responses to items rather than multiple constructs. (p. 664)

According to Spector et al. (1997), the above scenario is quite plausible because “…the use of [some] extreme items in bipolar scales of unidimensional constructs is often necessary….when one intends to distinguish individuals who are extreme on the construct from those who are moderate” (p. 676). Thus the above-described joint distribution of people and items, which is likely to be the rule rather than the exception, can be expected to result in artifactual multidimensionality.
An interaction between item keying and item extremity was also evident in a study by McPherson and Mohr (2005). Participants ($N=277$; mostly women) were students enrolled in undergraduate psychology courses. Each participant was administered either the original LOT or a “moderate” version of it (LOT-M) created by the replacement or insertion of words (e.g., “I’m always optimistic” became “I’m usually optimistic”). A validity check of the relative extremity of the LOT and LOT-M items (embedded among other items) was performed by graduate students. Both scales were balanced (eight items total) and used a 5-point response scale. Based on an initial ANOVA, “The hypothesis that negatively keyed item means tend to become larger relative to positively keyed item means as item extremity increases [was] thus supported. The tendency for this effect to be reversed as items become less extreme [was] also evident” (p. 124). Next, monopolar “disagreeing” and “agreeing” respondents were identified as those whose raw positive and negative subscale scores fell to the same side of the subscales’ midpoint. In other words, individuals who tended to agree with all items (or disagree with all items) regardless of wording direction were flagged as exhibiting a monopolar (i.e., acquiescent) response style. Results (more disagreeing respondents on the LOT; more agreeing respondents on the LOT-M) “supported the suggestion that the less extreme items in the LOT–M could also result in a greater tendency for respondents to agree with items keyed in both directions” (p. 125).

McPherson and Mohr (2005) then tested one- and two-factor CFA models with both data sets. The unidimensional model fit the LOT-M data better than the LOT data, though fit statistics were not acceptable with either data set (the fit of the model to the LOT data did improve after removal of data from “disagreeing” respondents). The two-
factor model (factors defined by keying) represented a better fit to both data sets; based on the chi-square statistic, the fit to the LOT-M data was adequate while the fit to the LOT data was not. The interfactor correlation was also higher for the LOT-M (.70) than for the LOT (.59), lending support to the claims of Spector et al. (1997). In other words, data from both balanced scales yielded two wording-based artifactors; but for the version of the LOT with the more extreme items, the two factors were more distinct.

**The Careless Responding Explanation.** Based on the results of an acquiescence study, Couch and Keniston (1960) suggested that yea-saying response patterns might be related to impulsivity. A similar idea was explored by Schmitt and Stults (1985), who hypothesized that factors associated with negative keying could emerge due to careless responding (i.e., strong satisficing). They defined a careless respondent as one who “…is simply reading a few of the items in a measuring instrument, inferring what it is the items are asking of the respondent, and then responding in like manner to the remainder of the items in the instrument” (p. 367). Simulated data sets of 400 were generated based on five careless responding conditions (0%, 5%, 10%, 15%, and 20%). Results indicated that a negative keying factor would emerge if at least 10% of respondents used a consistently careless response style. Schmitt and Stults (1985) acknowledged that their simulated careless responding patterns might not be entirely realistic, but they encouraged researchers to take steps to minimize, screen for, and control for careless responding.

The findings of the above study were confirmed by Woods (2006), who conducted a CFA-based simulation study in which sample size (250; 500; 1,000) and proportion of careless respondents (0%; 5%; 10% 20%; 30%) were systematically varied. Data were generated for 23 items (10 negatively keyed) on a unidimensional measure
with two response options (e.g., True/False); item parameters were based on a 2PL IRT model and drawn from a normal distribution. Careless responders were simulated by switching 0 to 1 and 1 to 0 for the reverse-keyed items. One- and two-factor models were fit to all data sets, and fit indices for each of the 15 conditions were averaged over 1,000 replications. In summarizing her results, Woods (2006) concluded that “…if at least about 10% respond to [negatively-keyed] items carelessly, researchers are likely to reject a one-factor model for [data based on] a unidimensional scale” (p. 189). Thus the possibility of careless responding should be of concern to researchers, particularly when administration conditions are relatively unstructured and participant motivation may be suboptimal—circumstances that are likely to lead to satisficing (Krosnick, 1991).

**The Response Style/Personality Explanation.** It has long been suggested that individual response styles might be related to personality and, therefore, stable across time/measures (e.g., Bentler et al., 1971; Cronbach, 1946). According to the response style/personality explanation for CFA solutions with wording-based factors, systematic variance above and beyond that associated with the target construct results not from balanced scales or item wording per se but from individual response styles (e.g., acquiescence). This variance is not presumed to reflect a substantive aspect of the target construct (as in the distinction between “optimism” and “pessimism” factors on the LOT), but neither is it considered mere measurement noise (as assumed under the method variance explanation). Rather, it is of substantive interest because it reflects “…characteristics of the individual stable from time to time, [as opposed to] …transient sets which can only be regarded as errors in testing rather than personality characteristics” (Cronbach, 1946, p. 10). Recently, some researchers have suggested that
variation in response styles may occur not only across individuals, but across cultures (e.g., Lindwall et al., 2012; Yang et al., 2010).

Several studies have found support for the idea that response styles are stable over time, evident across measures, and/or related to personality traits. As described earlier, Horan et al. (2003) used national longitudinal data to investigate the factor structure of three brief attitude/affective instruments (including a 7-item version of the RSE) with varying proportions of negatively-keyed items. Results favored a model with three substantive factors (intercorrelations ranged from .38 to .76) and three correlated method factors defined by negative keying (intercorrelations ranged from .31 to .43). In their interpretation of a separate structural model based on RSE data from three time points (two-year intervals), the authors argued that wording/keying effects (which could not be disentangled) were also stable over time, as stability coefficients ranged from .435 (time 1-2) to .438 (time 2-3). Horan et al. (2003) concluded that the findings were “...consistent with the response-style hypothesis that...response effects represent a personality trait of the respondent rather than a methodological artifact” (p. 449). The possibility that methodological artifacts could also be stable over time was not addressed.

Similar results were reported by DiStefano and Motl (2006), who investigated (simultaneously) the dimensionality of the RSE and the SPAS based on data from students at two southeastern universities ($N = 757$). A CTCM model with two substantive factors and two negative-wording method factors (intercorrelation = .37) fit the data better than models with one or no method factors. In addition, scores from several personality measures (based on summed responses to positively-worded items only) were used to predict method effects in a series of structural path models. Most predictors (e.g.,
social desirability) had nonsignificant relationships with the negative method factor; however, significant (negative) relationships were found for both fear of negative evaluation and self-consciousness (path coefficients ranging from -0.14 to -0.20). Thus there was evidence that response styles were both stable across content areas and related to personality traits. Other studies using a similar analytic approach have also found significant (if relatively weak) relationships between wording-based method effects and personality traits such as emotional stability and conscientiousness (Quilty, Oakman, & Risko, 2006) and fun seeking (DiStefano & Motl, 2009).

An alternative methodological approach was used by DiStefano, Morgan, and Motl (2012), who analyzed responses to the RSE and seven personality scales from 752 students at two southeastern universities (it was not clear whether these were the same data analyzed in DiStefano & Motl [2006]). A Rasch partial credit model, which assumes unidimensionality, was employed to detect possible method effects. In addition, in a variation on a long-established technique (e.g., Couch & Keniston, 1960), an RSE acquiescence score was calculated for each participant (computed as the sum of all responses, before reverse-coding, linearly transformed to a 1-100 scale). Positive RSE items generally had higher means, more negative skewness, and more positive kurtosis, providing “…initial evidence of agreement bias” (p. 48). The correlation between acquiescence and global RSE scores was -0.28, indicating that people with higher reported self-esteem had lower acquiescence (i.e., yea-saying) scores. Correlations between personality measures and RSE acquiescence scores were generally weak, though several reached statistical significance at the .01 level (e.g., public self-consciousness: .17; fun seeking: .12). Some correlational patterns differed by gender; for example, the correlation
between fun seeking and acquiescence was significant among males (.23) but not females (.04). One shortcoming of the personality-based explanations reviewed here is the lack of theoretical underpinnings—for example, why would fun seeking be associated with acquiescence? In the next section, explanations based on cognitive theory are explored.

**The Individual Differences in Cognition/Reading Explanation.** As detailed earlier, cognitive/psycholinguistic studies have consistently found that responding to negated statements is more difficult than responding to affirmative statements. Measurement researchers have provided evidence that, in addition, respondents with lower levels of cognitive ability, reading skill, and/or education may be less able to cope with the processing demands of negated or reversed scale items. These individual differences may, like careless responding, affect item response distributions and lead to wording/keying-based method factors. Aberrant responding to negative items is thought to occur in (at least) two different ways. One is based on the satisficing theory of Krosnick (e.g., 1991), who has consistently found that those with less education, need for cognition, and perceived value of the measurement instrument/process are more likely to satisfice. The second is that those with less cognitive skill are simply less able to comprehend/respond to more complex syntactic structures.

In two studies of elementary schoolers’ responses to the Self Description Questionnaire (SDQ; Shavelson & Marsh, 1986), Marsh (1986) investigated the extent to which negative items (about one-sixth of the SDQ items) were associated with method effects. Most of these items were negatively keyed but not negatively worded (e.g., “I hate reading”). Marsh argued that in order to respond appropriately to negative items, “…respondents may have to invoke a double negative logic that requires a higher level of
verbal reasoning than that required by positive items” (p. 37). Consistent with expectations drawn from cognitive-developmental research, grade 2 students had much more trouble with negative wording (near-zero correlations between positive and negative items) than did older students (e.g., $r = .60$ for grade 5). At all grade levels, at least some students appeared to respond aberrantly to negative items.

In a second study, Marsh (1986) conducted a series of CFAs based on SDQ responses from a separate sample of fifth-graders ($N = 559$). Results supported a model in which negative items were allowed to load on a method factor as well as their respective substantive factors. When a reading ability factor (based on additional measures) was added to the model, it correlated substantially ($r = .42$) with the method factor. Thus children with weaker reading skills were more likely to have difficulty with negatively-keyed items. Marsh advised that such items should not be counted in scoring because, at least for children, “the variance in responses to negative items that is valid cannot easily be separated from variance attributable to the bias” (p. 45). In subsequent studies, Marsh (1996) found additional evidence that children and adolescents with less well-developed reading skills tend to have difficulty responding accurately to negative items. The results of Marsh (1996) were largely replicated by Dunbar, Ford, Hunt, and Der (2000), whose research sample consisted of 812 Scottish adults.

Corwyn (2000), based on factor analysis of RSE data from five adolescent and adult samples, reached a similar conclusion while investigating the factor structure of the full, 10-item RSE based on five data sets. This version of the measure was balanced (five negatively-keyed items, two of them negatively worded) and included a four-point Likert scale (Strongly Agree to Strongly Disagree). Consistent with prior studies of the RSE, all
models incorporating method effects related to keying direction fit the data better than did models without method effects. The best-fitting model was a full bifactor model that included one substantive factor (self-esteem) and two method factors (positive and negative keying). In the standardized solution for this model, substantive factor loadings were consistently higher for the positive items whereas uniquenesses (i.e., error variances) were consistently higher for the negative items.

Corwyn (2000) tested the claim that wording-based method effects decrease with increasing verbal ability. Analyses involved a two-factor RSE model (positive versus negative items) that demonstrated acceptable fit to five data sets. Based on a measure of verbal ability that had been administered to the largest of the samples (several thousand women aged 15-23 who participated in a national longitudinal study), cases were separated into quartiles and the two-factor model was estimated for each subgroup. Marsh’s finding was replicated: “As predicted, the correlation between the positive self-esteem and negative self-esteem factors was higher with each consecutive increase in verbal ability (.71, .76, .85, and .87 respectively)” (p. 367). Thus there is evidence that among both adolescents and adults, individuals with stronger reading/verbal ability tend to respond more consistently across positive and negative items.

One might consider educational level to be a proxy for cognitive, verbal, or reading ability. Results from studies investigating the comparability of negative-item responding across respondents of different educational levels have generally been consistent with the results described above. For example, Cordery and Sevastos (1993) investigated the dimensionality and reliability of two versions of the Job Diagnostic Survey (JDS; Idaszak & Drasgow, 1987): the original version (15 items, five negatively
worded), and an all-positive revision. A form combining the two versions (the original 15 items followed by the reworded, positive versions of the five negative items) was administered to a sample of Australian government employees ($N = 3,044$). Approximately 40% of the participants had not completed high school, while the remainder had a high school education or beyond. Data from 1,000 randomly selected members of each subsample were analyzed. One-factor CFA results for both groups favored the all-positive version of the JDS, which also yielded higher subscale-level internal consistency estimates than did the original version. Analysis of consistency scores (based on the five pairs of original-reworded items) indicated that the lower-education group gave significantly more discrepant (i.e., incongruent) responses than did the group with more education.

As described earlier, Melnick and Gable (1990) examined parents’ responses to pairs of parallel items with opposite keying. They found that for all item pairs, “consistent responders” had higher levels of education than did respondents who gave seemingly incongruent responses. Juni et al. (1996) reported that negatively-keyed items were problematic for a sample of inner-city clinical patients ($N = 70$ males; mean years of education = 11) completing the Weak Opiate Withdrawal Scale (Haertzen, Meketon, & Hooks, 1970). Item-total correlations were .10 or lower for 15 of 26 reversed items; for seven of those items, item-total correlations were strongly negative (i.e., below -.15). It was noted that “…the items with poor item-total correlations featured negative item stems, forcing respondents to conceptualize double-negatives when choosing the ‘false’ option (Juni et al., 1996).
Finally, based on meta-analyses of numerous studies conducted by Schuman and Presser (1981), Krosnick et al. (1996) found strong support for the idea that individuals with low levels of formal education are more susceptible to acquiescent response patterns (effect sizes for low, medium, and high levels of education: .33, .19, .18). In addition, acquiescence effects (i.e., incongruent responding across positive and negative items) were more prevalent among people who scored lower on a measure of nonverbal reasoning. As noted earlier, the process of giving carefully-considered, accurate responses on a measurement instrument requires cognitive effort (Tourangeau & Rasinski, 1988). Individuals with lower levels of education and/or cognitive ability may be less willing or able to expend the mental effort required; said differently, such individuals may be more likely to satisfice. Recognition of this tendency no doubt prompted Bass’s (1956) suggestion that researchers obtain higher-quality data by sampling “more intelligent and critical” participants.

**Evidence from Qualitative Studies**

Given the variety of competing explanations posited for the differential functioning of positive and negative items, surprisingly little research has been published related to the cognitive processes in which respondents engage while completing balanced attitude/affective scales. Wason (1959) reported that participants in his study said they found negated statements more difficult to process than equivalent affirmative statements, but this information was anecdotal in nature. Some construct validation studies have used a think-aloud protocol with children (e.g., Cremeens, Eiser, & Blades, 2006; Gadermann, Guhn, & Zumbo, 2011), but these studies yielded little or no information related to wording/keying effects. Certainly, scale developers use qualitative
approaches to explore response processes as they relate to the functioning of items; however, it may be the case that such data do not make their way into publications. Thus there is a need for formal qualitative research on the topic of wording/keying effects.

**Study 1 Research Questions**

The purpose of Study 1 is to investigate the psychometric consequences of using negatively-worded and/or negatively-keyed items on attitude scales. Most prior studies have neglected to distinguish between wording and keying, leaving critical measurement questions unanswered. Is the oft-reported differential functioning of positive and negative items related to wording direction, keying direction, or both? Specific research questions are as follows:

- **RQ#1:** Do balanced scales exhibit the same psychometric properties as scales where all items are keyed and worded in the same direction? Based on the existing literature, it is expected that balanced scales will exhibit weaker psychometric properties than non-balanced scales.

- **RQ#2:** Are there differences in the psychometric properties of balanced scales that reverse items through the use of negative wording and keying and balanced scales that do not? This question is important because it begins to address the issue of whether statements such as “I feel calm,” “I do not feel calm,” and “I do not feel anxious” elicit comparable responses from respondents. Based on the existing literature related to balanced scales and the cognitive/linguistic processing of grammatically negative statements, it is expected that balanced scales using negative wording and keying will exhibit weaker psychometric properties than balanced scales that use only one of those strategies.
• RQ#3: Are there differences in the psychometric properties of scales that are balanced in terms of keying and scales that are balanced in terms of wording? Again, this question addresses the issue of wording versus keying. Do statements such as “I feel calm” and “I do not feel calm” elicit comparable responses? Given the existing literature related to the cognitive/linguistic processing of grammatically negative statements, it is expected that scales balanced in terms of wording (but not keying) will exhibit weaker psychometric properties than scales balanced in terms of keying (but not wording).

• RQ#4: To what extent are method effects associated with negative keying apparent across instruments? This question can be answered for participants completing balanced versions of multiple attitude surveys. Responses to the two measures administered in this study will be modeled simultaneously (for a certain subsample) in order to estimate the correlation between negative-keying method factors across instruments. Specifically, the ODCS and SEE-R will be included in a single confirmatory factor analytic model: The ODCS responses will be represented by one substantive factor and one method factor based on negative keying; the SEE-R responses will be represented by four correlated substantive factors and one negative-keying method factor; and the two method factors will be allowed to correlate. This approach has previously been used to estimate the across-instrument effects of negative wording (e.g., DiStefano & Motl, 2006), but not of negative keying. Based on prior linguistic studies demonstrating the relative difficulty of processing grammatically negative constructions (e.g., Sherman, 1973, 1976; Wason, 1959, 1961), it seems likely that negative wording poses
more of a challenge to respondents than does negative keying. Thus it is expected that the association of keying-based method effects across instruments will be weaker than that reported by DiStefano and Motl (2006) for wording-based method effects (.37).

Questions involving psychometric properties (research questions 1-3) will be addressed for each of two attitude scales through analyses of dimensionality (i.e., how many factors are supported in CFA analyses) and reliability (i.e., internal consistency) across four wording/keying conditions. Based on the results of previous studies, it is hypothesized that the various balanced configurations (where keying and/or wording are systematically varied) will yield different CFA solutions (i.e., with method factors) and lower reliability estimates than will the non-balanced configurations.

**Study 2 Research Question**

Why do measurement items with negative wording and/or keying elicit differential response patterns than items that are positively worded/keyed? Given the number of posited explanations for the differential functioning of negative and positive items, it would be naïve to argue for a single explanatory mechanism. However, it seems likely that response processes constitute a contributing factor. Thus the response processes involved in completing balanced attitude scales will be explored using a think-aloud protocol with college students. Based on the results of previous (quantitative) cognitive/psycholinguistic studies, it is hypothesized that participants will report that the process of responding to reversed/negated items is somehow different than the process of responding to affirmative items. Regarding other posited explanations for the differential functioning between positive and negative items, it seems possible that the qualitative
study may yield evidence related to careless responding, style/personality factors, substantive differences between negative and affirmative items, and/or individual differences in cognitive/reading skills (particularly given the selection criteria described in the following section). It seems less likely that participant responses will provide insight into such proposed phenomena as method variance and item extremity. However, one of the benefits of qualitative research is that themes are permitted to emerge organically, regardless of a priori expectations (Creswell & Plano Clark, 2011, p. 207).
III. Study 1

Method

Participants. Participants were incoming freshmen at a mid-sized university who took part in mandatory, low-stakes, university-wide assessment activities in August of 2012. The measures pertinent to this study were administered to a total of 2,113 students. Test forms were spiraled throughout testing rooms to ensure randomly representative subsamples of comparable size. Demographic characteristics for each subsample (based on four test conditions that will be described in detail) are presented in Table 1 below.

Materials. Two attitude measures were selected for use in the study: the 8-item Openness to Diversity/Challenge Scale (ODCS; Pascarella, Bohr, Nora, Ranganathan, Desler, & Bulakowski, 1994; Pascarella, Edison, Nora, Hagedorn, & Terenzini, 1996) and a revised, 19-item version of Wang et al.’s (2003) Scale of Ethnocultural Empathy (SEE-R; Gerstner, 2012). The ODCS, which has previously been shown to have a one-factor structure and adequate reliability (.83) with college students, measures “…an orientation toward enjoyment from being intellectually challenged by different ideas, values, and perspectives as well as an appreciation of racial, cultural, and value diversity” (Pascarella et al., 1996, p. 179). All eight ODCS items are positively keyed/worded.

The SEE, developed using a PCA approach, was designed to measure “…empathy toward people of racial and ethnic backgrounds different from one’s own” (Wang et al., 2003, p. 221). The SEE-R, modified by Gerstner (2012) using a CFA approach, includes 19 of the original 31 items and has been shown to have four related substantive factors (Acceptance of Cultural Differences; Empathic Perspective Taking; Empathic Awareness; and Empathic Feeling and Expression) as well as a method factor.
### Table 1
**Descriptive Statistics by Subsample**

<table>
<thead>
<tr>
<th>Subsample / Test Condition</th>
<th>n</th>
<th>Mean Age</th>
<th>% Female</th>
<th>% by Racial Identity Category&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>White</td>
</tr>
<tr>
<td>1. SEE-R-1 / ODCS-2</td>
<td>540</td>
<td>18.4</td>
<td>60.6</td>
<td>88.7</td>
</tr>
<tr>
<td>2. SEE-R-2 / ODCS-3</td>
<td>532</td>
<td>18.4</td>
<td>63.9</td>
<td>88.4</td>
</tr>
<tr>
<td>3. SEE-R-3 / ODCS-4</td>
<td>527</td>
<td>18.5</td>
<td>64.9</td>
<td>86.3</td>
</tr>
<tr>
<td>4. SEE-R-4 / ODCS-1</td>
<td>514</td>
<td>18.4</td>
<td>59.1</td>
<td>87.7</td>
</tr>
</tbody>
</table>

*Note.* N = 2,113. In the SEE-R-1 and ODCS-1, all items were positively worded and keyed; in the SEE-R-2 and ODCS-2, half of the items were negatively worded and keyed; in the SEE-R-3 and ODCS-3, half of the items were positively worded and negatively keyed; in the SEE-R-4 and ODCS-4, all items were negatively keyed and half were negatively worded.

<sup>a</sup>Sum of percentages by subsample may exceed 100 because respondents could identify themselves as belonging to more than one category.
associated with negative keying (eight items). The ODCS and SEE-R were chosen for this study partly because they differ in length and factor structure, and it was of interest to explore keying/wording effects across such conditions.

For both the ODCS and the SEE-R, four adaptations were created based on the following wording/keying conditions:

1. all positive wording/keying (e.g., “I am happy”);
2. half positive wording/keying (e.g., “I am happy”) and half negative wording/keying (e.g., “I am not happy”);
3. half positive wording/keying (e.g., “I am happy”) and half positive wording/negative keying (e.g., “I am sad”);
4. half positive wording/negative keying (e.g., “I am sad”) and half negative wording/keying (e.g., “I am not happy”). This condition was balanced in terms of wording rather than keying.

The “balanced” versions of the ODCS (conditions 2, 3, and 4 above) were created by modifying four of the eight items (1, 4, 6, and 8) and, in condition 4, the other four items as well; the placement of two items (5 and 6) was reversed to establish a near-alternating (positive/negative) order so that potential confounds between item keying and item order would be reduced.

Because the SEE-R contains an odd number of items (19), balanced versions were created using a 10-9 split (in favor of positive items). The original sequence of the items was retained, yielding a near-alternating order for the balanced conditions; the wording of the same nine items (1, 4, 6, 8, 11, 14, 17, 18, and 19) was altered across all conditions, and for condition 4 the wording of the remaining items was altered as well. The four
administered versions of the ODCS and the SEE-R can be found in Appendix A and Appendix B, respectively. All measures were modified to include the same 7-point response scale (Strongly Disagree; Disagree; Slightly Disagree; Neither Agree nor Disagree; Agree; Slightly Agree; Strongly Agree). The justification for this approach was twofold. First, it was desirable to put all measures on the same response scale. Second, it has been suggested that while categorical data cannot be normally distributed, ordinal scales with at least 6-7 response points may elicit data that function as coarsely continuous (Bollen, 1989; Finney & DiStefano, 2006; Rhemtulla, Brosseau-Liard, & Savalei, 2012).

Procedure. Students were randomly assigned to assessment rooms based on the last two digits of their student ID numbers. The number of seats in the rooms ranged from approximately 50 to 300. In each room, students were asked to complete two to three hours’ worth of cognitive and attitude measures, which were partitioned into four or five separate “tests.” Upon arrival, proctors oriented students to the assessment activities and obtained informed consent. The tests were then administered in a predetermined sequence by experienced proctors who read standardized instructions, maintained a quiet testing environment, and observed specified time limits. Participants completed only one version of the ODCS and one version of the SEE-R.

The ODCS and SEE-R were administered in several of the larger assessment rooms as part of a longer test (SDA7) that included a total of five measures. The first measure was a 29-item multiple-choice test of student knowledge about social science research methods, and the remaining four were Likert-based attitude scales containing fewer than 20 items each. The total time allotted for completion of the SDA7 was 40
minutes; general SDA7 instructions were read aloud, but the brief instructions introducing each measure within the SDA7 were not. In order to ensure a balanced design, the versions of the SEE-R and the ODCS were combined such that no participant received the same version (e.g., all-positive) of both scales. The specific combinations were as follows: SEE-R-1 with ODCS-2; SEE-R-2 with ODCS-3; SEE-R-3 with ODCS-4; and SEE-R-4 with ODCS-1. In addition, to control for possible fatigue effects, placement of the measures within the SDA7 was varied so that the SEE-R and ODCS appeared sometimes in the second and third positions and sometimes in the fourth and fifth positions. The SEE-R, the longer of the two measures, always preceded the ODCS. An order-balanced presentation of the two scales within each condition might have been preferable from a design standpoint but would have necessitated doubling the number of different forms to 16, which would have exceeded constraints imposed by the larger (assessment-driven) data collection plan. The adopted configurations yielded eight versions of the SDA7 (labeled A through H) that were spiraled throughout all testing rooms in order to ensure randomly representative subsamples and mitigate possible room-specific administration effects. Each test condition (e.g., Condition 1: SEE-R-1 with ODCS-2) was implemented in two SDA7 versions (e.g., A and E); once comparability of subsamples on demographic variables was established, data were aggregated by test condition. On all versions of the SDA7, the first question asked students to indicate which form they had received. Item responses were recorded on scantron forms that were collected at the end of the testing session. Additional variables (e.g., gender and ethnicity) were obtained from the university database.
**Analyses.** Data were screened using SAS 9.2 (SAS Institute, Cary, NC); CFA models were estimated using Mplus 7 (Muthén & Muthén, 2012). For each of the four versions of both the ODCS and the SEE-R, a parallel series of models was estimated in order to address research questions 1-3. The ODCS models were as follows:

- **ODCS Model 1:** a one-factor model in which all eight items load on a single, substantive factor (Openness to Diversity/Challenge). This model assessed the unidimensionality of each scale version.

- **ODCS Model 2:** a two-factor model with the (correlated) factors defined by item keying/wording (the four positive/affirmative items loading on one factor, and the four negative/reversed items loading on the other). This model assessed the extent to which balanced versions of the scale yielded two substantively distinct factors.

- **ODCS Model 3:** a model with one trait factor (Openness to Diversity/Challenge) and one method factor defined by positive keying/wording. This model assessed the extent to which positively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

- **ODCS Model 4:** a correlated uniquenesses (CU) model positing a single substantive factor and allowing correlated error terms for items with positive keying/wording. This model assessed the extent to which positively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

- **ODCS Model 5:** a model with one trait factor (Openness to Diversity/Challenge) and one method factor defined by negative keying/wording. This model assessed
the extent to which negatively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

- ODCS Model 6: a correlated uniquenesses (CU) model positing a single substantive factor (Openness to Diversity/Challenge) and allowing correlated error terms for items with negative keying/wording. This model assessed the extent to which negatively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

These six models are depicted graphically in Figure 1 (below).

As noted earlier, a parallel set of models was estimated for the SEE-R versions. However, the SEE-R models differed from the ODCS models due to the more complex structure of the SEE-R (four subscales):

- SEE-R Model 1: a four-factor model in which each of the 19 items loads on one of four substantive (subscale) factors (Acceptance of Cultural Differences; Empathic Perspective Taking; Empathic Awareness; Empathic Feeling and Expression). This model assessed the extent to which data fit the “intended” (i.e., subscale-unidimensional) SEE-R structure. No cross-loadings were permitted.

- SEE-R Model 2: a two-factor model with the (correlated) factors defined by item keying/wording (the ten positive/affirmative items loading on one factor, and the nine negative/reversed items loading on the other). This model, which ignored subscale designations, assessed the extent to which balanced versions of the scale yielded two distinct factors defined solely by keying/wording direction. It was not possible to assess this at the subscale level (i.e., by modeling a positive and a
negative factor within each subscale) because one SEE-R subscale consists of only positive items and another consists of only negative items.

- SEE-R Model 3: a correlated traits, correlated methods (CTCM) model with four correlated trait factors (one for each subscale) and one method factor defined by positive keying/wording. This model assessed the extent to which positively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

- SEE-R Model 4: a correlated traits, correlated uniquenesses (CTCU) model positing four substantive factors (one for each subscale) and allowing correlated error terms for items with positive keying/wording. This model assessed the extent to which positively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

- SEE-R Model 5: a correlated traits, correlated methods (CTCM) model with four correlated trait factors (one for each subscale) and one method factor defined by negative keying/wording. This model assessed the extent to which negatively-keyed/worded items shared systematic, non-subscale-driven variance.

- SEE-R Model 6: a correlated traits, correlated uniquenesses (CTCU) model positing four correlated substantive factors (one for each subscale) and allowing correlated error terms for items with negative keying/wording. This model assessed the extent to which negatively-keyed/worded items shared systematic variance above and beyond estimated construct-relevant variance.

SEE-R Models 1 and 5 are depicted graphically in Figures 2 and 3 (below). To save space, the remaining SEE-R models are not depicted.
Figure 1. ODCS Models: Model 1 = one factor; Model 2 = two factors (Positive and Negative); Model 3 = one trait factor (ODC) and one method factor (Positive); Model 4 = one trait factor (ODC) and correlated uniquenesses (CU) among positive items; Model 5 = one trait factor (ODC) and one method factor (Negative); Model 6 = one trait factor (ODC) and correlated uniquenesses (CU) among negative items. For simplicity of presentation, error variances are not depicted. For all models, factor scaling was accomplished by setting the variance of the factors to a value of 1.0.
Figure 2. SEE-R Model 1 = four (correlated) substantive factors (ACD, EPT, EA, and EFE). For simplicity of presentation, error variances are not depicted. Factor scaling was accomplished by setting the variance of the factors to a value of 1.0.
Figure 3. SEE-R Model 5 = four (correlated) substantive factors and one method factor (Negative). For simplicity of presentation, error variances are not depicted. Factor scaling was accomplished by setting the variance of the factors to a value of 1.0.
Figure 4. Combined ODCS/SEE-R Model 7B = five substantive factors plus two correlated method factors (Negative Keying). For simplicity of presentation, error variances are not depicted. Factor scaling was accomplished by setting the variance of the factors to a value of 1.0.
Model fit was assessed through examination of several global fit indices including the chi-square statistic ($\chi^2$), the robust root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), and the robust comparative fit index (CFI). Because the assumption of multivariate normality was violated for all subsamples (details can be found in the Results section), a robust scaling method—maximum likelihood with robust standard errors (MLR; Muthén & Muthén, 2012) was used. The following researcher-recommended values were used as indicators of adequate model fit for the robust fit indices: RMSEA values of .08 or less (Browne & Cudeck, 1993), SRMR values of .08 or less (Hu & Bentler, 1999), and CFI values of .95 or greater (Bentler, 1990; Hu & Bentler, 1999).

Regarding reliability, a version of coefficient omega was calculated for every ODCS model (most of which included a single substantive factor) and every SEE-R model (most of which included four substantive factors). Based on approaches recommended or used in Green and Yang (2009), Johnston and Finney (2010), Raykov and Shrout (2002), and Yang and Green (2011), one of three equations was used in each calculation. For models in which no method factor was hypothesized (i.e., Models 1, 2, 4, and 6), the following equation was used to calculate coefficient omega for each subscale:

$$
\frac{(\sum b_i)^2}{(\sum b_i)^2 + \sum e_i}
$$

(1)

where $b_i$ represents the unstandardized pattern coefficient and $e_i$ represents the unstandardized error variance of the items loading on the substantive factor (McDonald, 1999).
For Models 3 and 5, in which a method factor was hypothesized, the following equation was used to calculate coefficient omega for each subscale:

\[
\frac{\left( \sum b_i \right)^2}{\left( \sum h_i \right)^2 + \sum e_i + \left( \sum b_j \right)^2}
\]  

(2)

where \( b_i \) represents the unstandardized pattern coefficient, \( e_i \) represents the unstandardized error variance of the items loading on the substantive factor, and \( b_j \) represents the unstandardized pattern coefficient reflecting the relationship between the “reversed” item on the subscale and the negative wording/keying method factor (Bentler, 2009). The advantage of this approach is that it takes into account (in the denominator) the systematic variance associated with the method effect.

A similar equation was used to calculate reliability for Models 4 and 6, in which correlated error terms were allowed:

\[
\frac{\left( \sum b_i \right)^2}{\left( \sum h_i \right)^2 + \sum e_i + \left( 2 \sum Cov(e_ie_k) \right)}
\]  

(3)

where \( b_i \) represents the unstandardized pattern coefficient, \( e_i \) represents the unstandardized error variance of the items loading on the substantive factor, and \( Cov(e_ie_k) \) represents the unstandardized covariance associated with correlated error terms (Raykov & Shrout, 2002; Yang & Green, 2011). Once again, the advantage of this approach is that it takes into account (in the denominator) the systematic variance associated with shared variance presumed to be related to wording/keying.

Regarding research question 4, some participants were administered balanced versions of both the ODCS and the SEE-R. Using data from a subset of these participants, both measures were modeled simultaneously in a CTCM configuration to
estimate the correlation between keying-based method factors across the two instruments.
The baseline structure of those “combined” models is depicted in Figure 4 (above). Two
versions of the combined model were estimated: one in which substantive factors were
permitted to covary across instruments (Model 7A), and one in which they were not
(Model 7B, shown in Figure 4). Given the similarity of the SEE-R and ODCS target
constructs (ethnocultural empathy and openness to diversity/challenge), it was anticipated
that the former model would fit the data significantly better.

The specific instrument combination involved in the combined models was the
SEE-R-2 and the ODCS-3. The SEE-R-2 method factor was associated with negatively-
keyed and -worded items, while the ODCS-3 method factor was associated with items
that were negatively keyed but positively worded. Thus the method factor correlation in
both models (7A and 7B) represented the association of negative keying effects across the
two instruments. Because linguistic studies have repeatedly demonstrated the relative
difficulty of processing/comprehending negatively-worded statements (e.g., Sherman,
1973, 1976; Wason, 1959, 1961), it seemed likely that negative wording would be a more
salient factor than negative keying in method effects. It was therefore expected that the
association of negative keying effects across the SEE-R and ODCS would be relatively
weak (i.e., less than the .37 reported by DiStefano and Motl [2006] for the association of
negative wording effects across personality measures).
Results

Item-Level Descriptive Statistics. Descriptive statistics for items from all versions of the ODCS and SEE-R (based on all available data) are presented below in Tables 2 and 3; correlation matrices can be found in Appendix F. Regarding normality, skewness and kurtosis values were within normal limits (absolute values less than 2 and 7, respectively). However, as noted earlier, data were multivariate nonnormal for all subsamples. Mardia’s standardized coefficient for multivariate kurtosis was well above the recommended cutoff of 3 in each condition: ODCS-1, 39.91; ODCS-2, 22.51; ODCS-3, 29.45; ODCS-4, 29.60; SEE-R-1, 51.57; SEE-R-2, 43.14; SEE-R-3, 44.06; SEE-R-4, 38.69. Thus the Mplus MLR estimator, which is appropriate for datasets that are nonnormal and/or incomplete (missingness was estimated at 2% or less for all conditions), was used for all CFA models.

Among positively-keyed ODCS and SEE-R items, means were somewhat above the midpoint of the 7-point response scale (indicating a tendency toward agreement with those items). Among reversed items (i.e., those with negative keying), a parallel tendency toward disagreement was evident. For example, the mean for SEE-R item 1 was 5.38 when it was positively keyed (condition 1). In the remaining conditions, when it was negatively keyed, (raw) item 1 mean values were 2.82, 3.11, and 3.12.

Confirmatory Factor Analyses. Six models were estimated for each ODCS and SEE-R scale version, even in cases where fit might be expected to be poor. For example, it seemed unlikely that any model specifying a method factor (i.e., Model 3 or 5) would outperform a substantive-only model for a scale where all items were positively keyed and worded. The fit of such a model (with method factor loadings to items that were
Table 2
Descriptive Statistics for ODCS Items

| Item | ODCS-1 | | | ODCS-2 | | | | ODCS-3 | | | | ODCS-4 | | |
|------|--------|---|---|--------|---|---|--------|---|---|--------|---|---|--------|---|---|
| 1    | 5.56 | 1.18 | -0.92 | 1.24 | 2.74 | 1.46 | 0.79 | 0.01 | 2.57 | 1.40 | 0.81 | 0.07 | 2.49 | 1.33 | 0.95 | 0.53 |
| 2    | 5.33 | 1.28 | -0.85 | 0.66 | 5.05 | 1.37 | -0.57 | -0.01 | 5.26 | 1.33 | -0.78 | 0.67 | 3.05 | 1.41 | 0.39 | -0.15 |
| 3    | 5.50 | 1.14 | -0.75 | 0.77 | 5.38 | 1.23 | -0.95 | 1.20 | 5.45 | 1.20 | -0.61 | 0.25 | 2.19 | 1.15 | 1.10 | 1.09 |
| 4    | 5.39 | 1.28 | -0.63 | 0.12 | 2.78 | 1.53 | 0.87 | 0.19 | 2.51 | 1.49 | 1.10 | 0.60 | 2.48 | 1.56 | 1.26 | 0.97 |
| 5    | 5.47 | 1.27 | -0.67 | 0.00 | 5.26 | 1.32 | -0.57 | 0.02 | 5.25 | 1.40 | -0.63 | 0.60 | 3.29 | 1.87 | 0.47 | -0.91 |
| 6    | 4.95 | 1.46 | -0.49 | -0.31 | 3.26 | 1.48 | 0.29 | -0.51 | 3.07 | 1.49 | 0.43 | -0.44 | 2.93 | 1.55 | 0.45 | -0.67 |
| 7    | 5.22 | 1.35 | -0.52 | -0.14 | 5.07 | 1.44 | -0.56 | -0.10 | 5.22 | 1.36 | -0.53 | -0.05 | 2.74 | 1.50 | 0.81 | 0.05 |
| 8    | 5.54 | 1.23 | -0.94 | 0.85 | 2.58 | 1.38 | 0.77 | -0.03 | 2.33 | 1.29 | 1.22 | 1.41 | 2.25 | 1.16 | 0.95 | 0.84 |

Note. Kurt. = kurtosis. Values calculated using pairwise deletion. Cases with missing data were utilized for CFA models, since full information maximum likelihood can utilize response patterns with missing data. In the ODCS-1 (item-level \( n \) range = 500-502), all items were positively worded and keyed; in the ODCS-2 (\( n \) range = 519-520), four items (1, 4, 6, and 8) were negatively worded and keyed; in the ODCS-3 (\( n \) range = 515-517), four items (1, 4, 6, and 8) were positively worded and negatively keyed; in the ODCS-4 (\( n \) range = 504-507), all items were negatively keyed and four (2, 3, 5, and 7) were negatively worded. Within the condition-specific sub-rows above, negative keying is indicated by italics and negative wording is indicated by boldface type.
Table 3
Descriptive Statistics for SEE-R Items

<table>
<thead>
<tr>
<th>Item</th>
<th>SEE-R-1</th>
<th>SEE-R-2</th>
<th>SEE-R-3</th>
<th>SEE-R-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.38</td>
<td>1.54</td>
<td>-0.88</td>
<td>-0.02</td>
</tr>
<tr>
<td>2</td>
<td>5.27</td>
<td>1.43</td>
<td>-0.80</td>
<td>0.08</td>
</tr>
<tr>
<td>3</td>
<td>3.19</td>
<td>2.18</td>
<td>0.58</td>
<td>-1.18</td>
</tr>
<tr>
<td>4</td>
<td>5.38</td>
<td>1.42</td>
<td>-0.89</td>
<td>0.31</td>
</tr>
<tr>
<td>5</td>
<td>5.15</td>
<td>1.49</td>
<td>-0.82</td>
<td>0.29</td>
</tr>
<tr>
<td>6</td>
<td>4.67</td>
<td>1.66</td>
<td>-0.31</td>
<td>-0.75</td>
</tr>
<tr>
<td>7</td>
<td>5.52</td>
<td>1.27</td>
<td>-0.75</td>
<td>0.30</td>
</tr>
<tr>
<td>8</td>
<td>5.34</td>
<td>1.32</td>
<td>-0.78</td>
<td>0.47</td>
</tr>
<tr>
<td>9</td>
<td>5.80</td>
<td>1.32</td>
<td>-1.53</td>
<td>2.59</td>
</tr>
<tr>
<td>10</td>
<td>4.74</td>
<td>1.61</td>
<td>-0.44</td>
<td>-0.46</td>
</tr>
<tr>
<td>11</td>
<td>3.86</td>
<td>1.64</td>
<td>-0.61</td>
<td>-0.71</td>
</tr>
<tr>
<td>12</td>
<td>4.71</td>
<td>1.45</td>
<td>-0.56</td>
<td>0.16</td>
</tr>
<tr>
<td>13</td>
<td>5.40</td>
<td>1.53</td>
<td>-0.94</td>
<td>0.41</td>
</tr>
<tr>
<td>14</td>
<td>5.73</td>
<td>1.15</td>
<td>-1.20</td>
<td>2.13</td>
</tr>
<tr>
<td>15</td>
<td>5.53</td>
<td>1.14</td>
<td>-0.90</td>
<td>1.31</td>
</tr>
<tr>
<td>16</td>
<td>4.60</td>
<td>1.50</td>
<td>-0.43</td>
<td>-0.38</td>
</tr>
<tr>
<td>17</td>
<td>5.20</td>
<td>1.42</td>
<td>-0.66</td>
<td>-0.06</td>
</tr>
<tr>
<td>18</td>
<td>3.55</td>
<td>1.71</td>
<td>0.24</td>
<td>-0.75</td>
</tr>
</tbody>
</table>

Note. Kurt. = kurtosis. Values calculated using pairwise deletion. Cases with missing data were utilized for CFA models, since full information maximum likelihood can utilize response patterns with missing data. In the SEE-R-1 (item-level n range = 537-540), all items were positively worded and keyed; in the SEE-R-2 (n range = 525-532), nine items (1, 4, 6, 8, 11, 14, 17, 18, and 19) were negatively worded and keyed; in the SEE-R-3 (n range = 520-524), nine items (1, 4, 6, 8, 11, 14, 17, 18, and 19) were positively worded and negatively keyed; in the SEE-R-4 (n range = 504-512), all items were negatively keyed and ten (2, 3, 5, 7, 9, 10, 12, 13, 15 and 16) were negatively worded. Within the condition-specific sub-rows above, negative keying is indicated by italics and negative wording is indicated by boldface type.
reversed in other adaptations of the scale) would, however, inform the interpretation of results for the same model estimated on data from balanced versions of the scale. Imagine, for instance, that a model positing a method effect were to adequately fit data from both an all-positive wording/keying condition and a balanced version of the same scale. That pattern of results would suggest that the “method” variance might actually be substantive, or at least attributable to something other than wording/keying. In short, all models were estimated in order to safeguard against overinterpretation of method factors.

Estimation problems were expected—and encountered—for certain model-data combinations (see above paragraph). In these situations, models were re-estimated with maximized iterations and (when provided) Mplus-suggested start values. These strategies, which never resulted in convergence, were followed by a review of item content and statistical results (e.g., correlations and standardized residuals); in cases where a minor modification (e.g., the elimination of one correlated residual) was deemed justifiable, it was made in an effort to obtain convergence. Occasionally, minor modifications were successful. When they were not, statistical results for the models in question were not reported. This conservative approach was adopted because the focus of the study was not on validation or revision of the administered scales. Rather, the goal was to examine the psychometric consequences of certain keying/wording conditions on the models that might typically be used to assess their validity/reliability. Thus it was important to retain comparability of models across scales and scale versions as much as possible.

In the following paragraphs, CFA results will be delineated by instrument and scale version. For each data condition (e.g., ODCS-2), the relative fit of the competing
model(s) will be discussed along with reliability estimates. Tables 4 and 5 (below) include fit statistics and reliability estimates for all ODCS and SEE-R models, respectively. Table 6 includes fit statistics for the combined SEE-R/ODCS models. Parameter estimates for selected models can be found in Appendix G.

**ODCS-1 Models.** The ODCS-1 was identical to the published version of the ODCS except that the order of items 5 and 6 had been switched. Because all items were positively worded and keyed, it was expected that Model 1 (SUB; positing a single substantive factor and no correlated errors or method factor) would fit the observed data. However, it did not—although all factor loadings were statistically significant and in the expected direction. In fact, Table 4 shows that none of the ODCS-1 models exhibited acceptable fit (e.g., RMSEA > .10). Model 5 (METH-) yielded similarly poor fit statistics to those for Model 1, whereas the CU models (4 and 6) did slightly better in terms of most indices. Models 2 (POS/NEG) and 3 (METH+) did not converge. Reliability estimates for all converging models ranged from .86 to .88 and were slightly higher than the coefficient alpha values (.83-.84) reported by Pascarella et al. (1996) for their one-factor model.

A review of standardized residuals for ODCS-1 Model 1 indicated that several pairs of items shared significant variance beyond that accounted for by the substantive factor. Most of these item pairs were similar in terms of semantic and/or lexical content (e.g., #6. I enjoy taking courses that challenge my beliefs and values.; and #8. I enjoy courses that are intellectually challenging.). In short, the ODCS-1 results—particularly
Table 4  
Fit Indices and Reliability Estimates for ODCS Models

<table>
<thead>
<tr>
<th>Model</th>
<th>MLR $\chi^2$</th>
<th>df</th>
<th>SRMR</th>
<th>RMSEA</th>
<th>CFI</th>
<th>Coefficient Omega$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ODCS-1, N = 502 (all positive wording/keying)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>151.71*</td>
<td>20</td>
<td>.055</td>
<td>.115</td>
<td>.879</td>
<td>.88</td>
</tr>
<tr>
<td>2: POS/NEG$^b$</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3: METH+$^b$</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4: CU+</td>
<td>113.88*</td>
<td>14</td>
<td>.047</td>
<td>.119</td>
<td>.908</td>
<td>.86</td>
</tr>
<tr>
<td>5: METH-</td>
<td>149.62*</td>
<td>16</td>
<td>.051</td>
<td>.129</td>
<td>.877</td>
<td>.86</td>
</tr>
<tr>
<td>6: CU-</td>
<td>123.95*</td>
<td>14</td>
<td>.049</td>
<td>.125</td>
<td>.899</td>
<td>.86</td>
</tr>
<tr>
<td><strong>ODCS-2, N = 523 (half positive wording/keying, half negative wording/keying)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>86.38*</td>
<td>20</td>
<td>.050</td>
<td>.080</td>
<td>.898</td>
<td>.79</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>58.48*</td>
<td>19</td>
<td>.040</td>
<td>.063</td>
<td>.939</td>
<td>.75 / .65</td>
</tr>
<tr>
<td>3: METH+</td>
<td>44.57*</td>
<td>16</td>
<td>.036</td>
<td>.058</td>
<td>.956</td>
<td>.72</td>
</tr>
<tr>
<td>4: CU+</td>
<td>41.54*</td>
<td>14</td>
<td>.035</td>
<td>.061</td>
<td>.958</td>
<td>.72</td>
</tr>
<tr>
<td>5: METH-</td>
<td>44.30*</td>
<td>16</td>
<td>.034</td>
<td>.058</td>
<td>.956</td>
<td>.73</td>
</tr>
<tr>
<td><strong>ODCS-3, N = 519 (half positive wording/keying, half positive wording/negative keying)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>108.48*</td>
<td>20</td>
<td>.056</td>
<td>.092</td>
<td>.858</td>
<td>.78</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>95.01*</td>
<td>19</td>
<td>.052</td>
<td>.088</td>
<td>.878</td>
<td>.76 / .61</td>
</tr>
<tr>
<td>3: METH+</td>
<td>143.46*</td>
<td>16</td>
<td>.051</td>
<td>.124</td>
<td>.795</td>
<td>.72</td>
</tr>
<tr>
<td>4: CU+</td>
<td>83.26*</td>
<td>14</td>
<td>.049</td>
<td>.098</td>
<td>.889</td>
<td>.70</td>
</tr>
<tr>
<td>5: METH-</td>
<td>72.04*</td>
<td>16</td>
<td>.040</td>
<td>.082</td>
<td>.910</td>
<td>.74</td>
</tr>
<tr>
<td>6: CU-</td>
<td>56.33*</td>
<td>14</td>
<td>.037</td>
<td>.076</td>
<td>.932</td>
<td>.73</td>
</tr>
<tr>
<td><strong>ODCS-4, N = 508 (half positive wording/negative keying, half negative wording/keying)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>30.92</td>
<td>20</td>
<td>.029</td>
<td>.033</td>
<td>.978</td>
<td>.77</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>30.88*</td>
<td>19</td>
<td>.029</td>
<td>.035</td>
<td>.977</td>
<td>.63 / .64</td>
</tr>
<tr>
<td>3: METH+</td>
<td>21.50</td>
<td>17</td>
<td>.025</td>
<td>.023</td>
<td>.991</td>
<td>.76</td>
</tr>
<tr>
<td>4: CU+</td>
<td>22.72</td>
<td>14</td>
<td>.024</td>
<td>.035</td>
<td>.983</td>
<td>.75</td>
</tr>
<tr>
<td>5: METH-</td>
<td>28.07*</td>
<td>17</td>
<td>.028</td>
<td>.036</td>
<td>.978</td>
<td>.76</td>
</tr>
<tr>
<td>6: CU-</td>
<td>26.21*</td>
<td>14</td>
<td>.027</td>
<td>.041</td>
<td>.976</td>
<td>.75</td>
</tr>
</tbody>
</table>

*Note.* MLR $\chi^2$ = scaled maximum-likelihood chi-square; SRMR = standardized root mean square residual; RMSEA = scaled root mean square error of approximation; CFI = scaled confirmatory fit index. For all scale versions, Model 1 included a single substantive factor; Model 2 included “positive” and “negative” substantive factors (thus the two reliability estimates); Model 3 included a substantive factor and a “positive” method factor; Model 4 was the CU equivalent of Model 3; Model 5 included a substantive factor and a “negative” method factor; Model 6 was the CU equivalent of Model 5. $^a$For models with a method factor, estimates of omega were based on inclusion of the variance explained by the hypothesized method factor in the total variance. For CU models, omega estimates were based on inclusion of the covariance of correlated error terms in the total variance. $^b$Model did not converge. $^c$In Mplus, the MLR scaling correction factor makes it possible for a complex model to yield a higher $\chi^2$ than a simpler (nested) model. $^d$After initial convergence problems, the path from the method factor to item 4 was removed. $^e$After initial convergence problems, the path from the method factor to item 3 was removed. * $p<.05.$
those for Model 1—suggest that the instrument lacks unidimensionality. This finding may not come as a complete surprise, given that 8-item ODCS was designed to measure openness to both diversity (e.g., people from different cultures) and challenge (e.g., courses that provide intellectual challenges).

**ODCS-2 Models.** Half of the ODCS-2 items were positively worded and keyed (2, 3, 5, and 7), while the remaining half were negatively worded and keyed (1, 4, 6, and 8). Thus it was expected that the fit statistics for Model 1 (SUB) would be worse than those for the other models. Such was the case, as all models exhibited adequate fit other than Model 1 (see Table 4). The best fit statistics were obtained with Models 3 through 6 (positing method effects among positive or negative items), which yielded good fit but weaker reliability estimates (.72-.73) than did the parallel ODCS-1 (all-positive wording/keying) models (.86). For Models 2 through 6, all factor loadings were statistically significant and in the expected direction. For Model 6 (CU-), two of the six error covariances did not reach statistical significance. Both involved item 4 (*Learning about people from different cultures is not an important part of my education.*). Based on all diagnostic information, the best-fitting models appeared to be those with method factors (3 and 5), which were close variants of one another. As noted above, the unique variance shared by certain item pairs (e.g., 6 and 8) likely reflected more than “method effects” associated with negative wording/keying.

**ODCS-3 Models.** Four of the ODCS-3 items were positively worded and keyed (2, 3, 5, and 7), while the remaining four were positively worded and negatively keyed (e.g., #8. *I try to avoid courses that are intellectually challenging.*). Said differently, the wording was consistent throughout the instrument but the keying was balanced. Thus it
was expected that the fit statistics for Model 1, which posited no keying effects, would be worse than those for the other models. In fact, the worst fit was obtained with Model 3 (METH+); Models 1 (SUB), 2 (POS/NEG), and 4 (CU+) did slightly better by most statistical criteria but did not fit the data adequately; and Models 5 and 6 (positing method effects among negatively-keyed items) did best, exhibiting marginally acceptable fit. The factor loadings for Model 5 (METH-) were all statistically significant and in the expected direction. For Model 6 (CU-), as was the case with the parallel model in the ODCS-2 condition, two of the error covariances involving item 4 did not reach statistical significance. Thus Model 5 seemed to provide the best fit to the observed data. Reliability estimates for all models were similar to those observed for the ODCS-2 dataset.

RMSEA estimates were systematically higher across all ODCS-3 models (.076-.124) than the corresponding values for models in the other balanced conditions (ODCS-2 and ODCS-4). It is worth noting that the RMSEA is believed to reflect only model misspecification and not error due to sampling or other causes (Browne & Cudeck, 1992). The nature of the misspecification observed for the ODCS-3 models was likely related to the manner in which item reversals were accomplished. Rather than the simple/direct use of sentence-level negation (e.g., *I do not enjoy courses that are intellectually challenging*), this condition called for more elaborate alterations (e.g., *I try to avoid courses that are intellectually challenging*) that varied from item to item and may have made the reversed items less cohesive as a group and less distinct from the positively-keyed items.

**ODCS-4 Models.** In this condition, all items were negatively keyed; half were positively worded (1, 4, 6, and 8), while the remainder were negatively worded (e.g.,
#2. *The real value of a college education does not lie in being introduced to different values.* Given that balance, it was again expected that the fit indices for Model 1 (SUB) would be worse than those for the other models. However, as can be seen in Table 4, all six models exhibited good overall fit (e.g., SRMR < .03; RMSEA ≤ .04; CFI > .97). The best fit statistics were obtained with Models 3 and 4 (positing method effects associated with negative wording), and reliability estimates for all METH and CU models were slightly higher (.75-.76) than parallel estimates based on the other balanced scale versions (but still lower than the .86 estimated for those models based on the all-positive wording/keying condition). It should be noted that there were initial estimation problems with the method-factor models, each of which converged to an admissible solution after removal of one nonsignificant path from the method factor (to item 4 in Model 3, and to item 3 in Model 5).

In addition to exhibiting good global fit, all six ODCS-4 models yielded substantive factor loadings that were statistically significant and in the expected direction. However, examination of Models 3-6 revealed several nonsignificant method factor loadings (for the METH models) and error covariances (for the CU models). Given that the Model 2 correlation between hypothesized POS and NEG factors was extremely high (.96), it would be difficult to endorse any model as being superior to Model 1, which was characterized by good global fit and the most parsimonious configuration. As anticipated based on the literature, coefficient omega for this model was lower (.77) than for the parallel model in the all-positive condition (.88), even though ODCS-1 Model 1 exhibited poor fit.
**SEE-R-1 Models.** In this adapted version of the instrument, all 19 items were positively worded and keyed. Thus it was expected that Model 1 (SUB; positing four substantive factors and no correlated errors or method factor) would fit the observed data. As can be seen in Table 5 (below), Model 1 exhibited marginally adequate global fit. In addition, all factor loadings were significant and in the expected direction. Model 2 (POS/NEG) exhibited poor fit, while the CTCU models (4 and 6)—each of which included dozens of correlated error terms—did not converge (in fact, this occurred for both CTCU models under all SEE-R conditions). The fit statistics for the CTCM models (3 and 5) were similar to those for Model 1. However, very few of the method factor loadings were statistically significant, and a few were slightly negative. Thus Model 1 appeared to provide the best fit to the data from the all-positive SEE-R condition.

Coefficient omega values for that model, by subscale, were as follows: ACD = .77; EPT = .78; EA = .75; EFE = .84. The correlation between the ACD and EFE factors was more substantial (.83) than those among other factors (.39-.65).

**SEE-R-2 Models.** Ten of the SEE-R-2 items were positively worded and keyed (2, 3, 5, 7, 9, 10, 12, 13, 15, and 16), while the remaining nine items were negatively worded and keyed (e.g., #17. I am not able to put myself in the shoes of someone who is racially and/or ethnically different from me.). Thus it was expected that the fit statistics for Model 1 (which accounted for no wording/keying effects) and Model 2 (which ignored subscale designations and was based solely on wording/keying direction) would be worse than those for other models. Excluding the CTCU models, which again did not converge, such was the case. As Table 5 shows, Model 2 exhibited poor fit; Model 1 yielded marginally acceptable fit; and the best fit statistics were obtained with the CTCM models.
Table 5

**Fit Indices and Reliability Estimates for SEE-R Models**

<table>
<thead>
<tr>
<th>Model</th>
<th>MLR $\chi^2$</th>
<th>df</th>
<th>SRMR</th>
<th>RMSEA</th>
<th>CFI</th>
<th>Coefficient Omega$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEE-R-1, N = 540 (all positive wording/keying)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>361.16*</td>
<td>146</td>
<td>.049</td>
<td>.052</td>
<td>.923</td>
<td>.77 / .78 / .75 / .84</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>889.00*</td>
<td>151</td>
<td>.082</td>
<td>.095</td>
<td>.737</td>
<td>.79 / .83</td>
</tr>
<tr>
<td>3: CTCM+</td>
<td>346.39*</td>
<td>136</td>
<td>.045</td>
<td>.054</td>
<td>.925</td>
<td>.77 / .77 / .69 / .83</td>
</tr>
<tr>
<td>4: CTCU+</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5: CTCM-</td>
<td>328.62*</td>
<td>137</td>
<td>.046</td>
<td>.051</td>
<td>.932</td>
<td>.75 / .78 / .69 / .83</td>
</tr>
<tr>
<td>6: CTCU-</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>SEE-R-2, N = 532 (half positive wording/keying, half negative wording/keying)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>289.36*</td>
<td>146</td>
<td>.051</td>
<td>.043</td>
<td>.920</td>
<td>.70 / .73 / .72 / .72</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>717.08*</td>
<td>151</td>
<td>.083</td>
<td>.084</td>
<td>.686</td>
<td>.73 / .75</td>
</tr>
<tr>
<td>3: CTCM+</td>
<td>243.90*</td>
<td>136</td>
<td>.047</td>
<td>.039</td>
<td>.940</td>
<td>.69 / .72 / .55 / .63</td>
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<tr>
<td>4: CTCU+</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5: CTCM-</td>
<td>249.35*</td>
<td>137</td>
<td>.041</td>
<td>.039</td>
<td>.938</td>
<td>.39 / .72 / .72 / .69</td>
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<tr>
<td>6: CTCU-</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>SEE-R-3, N = 524 (half positive wording/keying, half positive wording/negative keying)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>326.62*</td>
<td>146</td>
<td>.055</td>
<td>.049</td>
<td>.896</td>
<td>.77 / .74 / .75 / .69</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>790.39*</td>
<td>151</td>
<td>.092</td>
<td>.090</td>
<td>.631</td>
<td>.70 / .77</td>
</tr>
<tr>
<td>3: CTCM+</td>
<td>264.79*</td>
<td>136</td>
<td>.049</td>
<td>.043</td>
<td>.926</td>
<td>.77 / .71 / .47 / .66</td>
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<td>4: CTCU+</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5: CTCM-</td>
<td>230.86*</td>
<td>137</td>
<td>.044</td>
<td>.036</td>
<td>.946</td>
<td>.58 / .71 / .69 / .68</td>
</tr>
<tr>
<td>6: CTCU-</td>
<td>--</td>
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<td>--</td>
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<tr>
<td>SEE-R-4, N = 512 (half positive wording/negative keying, half negative wording/keying)</td>
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<td></td>
</tr>
<tr>
<td>1: SUB</td>
<td>380.77*</td>
<td>146</td>
<td>.052</td>
<td>.056</td>
<td>.911</td>
<td>.77 / .79 / .71 / .81</td>
</tr>
<tr>
<td>2: POS/NEG</td>
<td>949.07*</td>
<td>151</td>
<td>.083</td>
<td>.102</td>
<td>.696</td>
<td>.83 / .76</td>
</tr>
<tr>
<td>3: CTCM+</td>
<td>318.28*</td>
<td>138</td>
<td>.045</td>
<td>.051</td>
<td>.931</td>
<td>.64 / .79 / .71 / .81</td>
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<tr>
<td>4: CTCU+</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5: CTCM-</td>
<td>376.98*</td>
<td>136</td>
<td>.049</td>
<td>.059</td>
<td>.908</td>
<td>.77 / .79 / .55 / .81</td>
</tr>
<tr>
<td>6: CTCU-</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Note. MLR $\chi^2$ = scaled maximum-likelihood chi-square; SRMR = standardized root mean square residual; RMSEA = scaled root mean square error of approximation; CFI = scaled confirmatory fit index. For all scale versions, Model 1 included four substantive factors (thus the four reliability estimates); Model 2 included only “positive” and “negative” factors (thus the two reliability estimates); Model 3 included four substantive factors and a “positive” method factor; Model 4 was the CTCU equivalent of Model 3; Model 5 included four substantive factors and a “negative” method factor; Model 6 was the CTCU equivalent of Model 5. $^a$For models with a method factor, estimates of omega were based on inclusion of the variance explained by the hypothesized method factor in the total variance. $^b$Model did not converge. $^c$After initial convergence problems, the path from the method factor to item 18 was removed.

* $p<.05$. 


All factor loadings were statistically significant and in the expected direction for Models 1, 3, and 5. In each model, the strongest inter-factor correlation was between ACD and EFE (.69, .80, and .75, respectively). Reliability estimates for the converging SEE-R-2 models were systematically lower than estimates for the comparable models in the all-positive wording/keying condition (e.g., Model 3: ACD = .77 [SEE-R-1]/.69 [SEE-R-2]; EPT = .77/.72; EA = .69/.55; EFE = .83/.63). The reader will observe that for the SEE-R-2 CTCM model with a “negative” method factor (Model 5), coefficient omega was quite low for the ACD subscale (.39). This result was a function of the fact that all four ACD items (1, 4, 6, and 18) had (unstandardized) method factor loadings nearly as large as or slightly larger than their (unstandardized) substantive factor loadings. Such a pattern suggests that including unbalanced subscales within a larger, balanced scale may be a suboptimal strategy from a measurement standpoint.

**SEE-R-3 Models.** In this condition, ten items were positively worded and keyed (2, 3, 5, 7, 9, 10, 12, 13, 15, and 16), while the remainder were positively worded and negatively keyed (e.g., #17. *It is difficult for me to put myself in the shoes of someone who is racially and/or ethnically different from me.*). Put another way, item wording was consistently positive and item keying was balanced (10/9). Of the four adaptations of the SEE-R administered in this study, the SEE-R-3 was closest to the version advocated in Gerstner (2012). Alterations were limited to the wording of three items (8; 11; 14), which were modified slightly to meet the condition 3 balancing and wording configuration.

Given the above, it was anticipated that Model 5 (CTCM-), the model most similar to that endorsed in Gerstner (2012), would best fit the observed data. The fit statistics in Table 5 show that this was the case, as the CTCM- model yielded marginally
acceptable fit (e.g., SRMR = .044; RMSEA = .036; CFI = .946) and better fit statistics than those obtained for Model 3 (e.g., CFI = .926), Model 1 (e.g., CFI = .896), and Model 2 (which, predictably, fit poorly). Once again, the CTCU models failed to converge. All factor loadings for Model 5 and Model 1 were statistically significant and in the expected direction; this was also true for Model 3, with one exception (the method factor loading for item 10 approached, but did not reach, statistical significance). Coefficient omega values for the best-fitting SEE-R-3 model, the CTCM- configuration, remained lower (ACD = .58; EPT = .71; EA = .69; EFE = .68) than those for the parallel SEE-R-1 model, and inter-factor correlations were also somewhat lower (range: .25-.45) than in conditions 1 and 2. Finally, the fit statistics and reliability estimates for Model 5 (see Table 5) were similar to (if slightly worse than) those reported by Gerstner (2012) for her scalar invariance model, which was based on data collected at two time points: SRMR = .047; RMSEA = .027; CFI = .953; coefficient omega values (accounting for method variance) for time point 1: ACD = .65; EPT = .74; EA = .71; EFE = .79.

**SEE-R-4 Models.** In this condition, all items were negatively keyed; nine were positively worded (1, 4, 6, 8, 11, 14, 17, 18, 19), while the remainder were negatively worded (e.g., #16. *I do not believe that society differentially treats racial or ethnic groups other than my own.*). Given that balance, it was again expected that models accounting for both substantive and method variance would yield the best fit. The pattern of model-by-model global results was similar to that observed for the other balanced conditions in Table 5 (although most of the SEE-R-4 models exhibited somewhat worse statistics). Specifically, Models 4 and 6 did not converge; Model 2 exhibited poor fit; and the SUB, CTCM+, and CTCM- models yielded acceptable fit to the observed data in terms of
SRMR and RMSEA but not in terms of CFI (after removal of the nonsignificant path from the CTCM+ method factor to item 18). For Model 1, all substantive factor loadings were statistically significant and in the expected direction. This was true for the CTCM models as well; a majority of their method factor loadings, however, did not reach statistical significance (though all method factor loadings were in the expected direction). As was the case with the ODCS-4 models, it would be difficult to endorse any SEE-R-4 configuration as being superior to Model 1. In contrast to the results for all other balanced scales, reliability coefficients for SEE-R-4 Model 1 (ACD = .77; EPT = .79; EA = .71; EFE = .81) were quite comparable to those obtained for the corresponding (all-positive) SEE-R-1 model (ACD = .77; EPT = .78; EA = .75; EFE = .84). Thus it appears that the consistent (negative) keying in condition 4 may have served to dampen any method effects associated with balanced wording among the items.

**Combined SEE-R/ODCS Models.** The combined models were based on data from students who had been administered the SEE-R-2 (half positive wording/keying, half negative wording/keying) and the ODCS-3 (half positive wording/keying, half positive wording/negative keying). Models 7A and 7B were CTCM variants in which a method factor for negative keying was specified for each instrument, and the two method factors were allowed to covary. In Model 7A, correlations were permitted between the substantive ODCS-3 factor and the four substantive SEE-R-2 substantive factors. In Model 7B, these correlations were not permitted.

Statistical results for the combined models are presented in Table 6 (below). Model 7B failed to converge even after adjustments were made. This was not unexpected, given that the model did not specify correlations between conceptually
Table 6
Fit Indices for Combined SEE-R/ODCS Models

<table>
<thead>
<tr>
<th>Model</th>
<th>MLR $\chi^2$</th>
<th>df</th>
<th>SRMR</th>
<th>RMSEA</th>
<th>CFI</th>
<th>Method Factor Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEE-R-2/ODCS-3, N = 532</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 7A</td>
<td>498.85*</td>
<td>304</td>
<td>.044</td>
<td>.035</td>
<td>.932</td>
<td>.40</td>
</tr>
<tr>
<td>Model 7B</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Note. MLR $\chi^2$ = scaled maximum-likelihood chi-square; SRMR = standardized root mean square residual; RMSEA = scaled root mean square error of approximation; CFI = scaled confirmatory fit index; Method Factor Correlation = the estimated correlation between the ODCS and SEE-R method factors. In Model 7A, the single substantive ODCS factor was allowed to covary with the four substantive SEE-R factors; in Model 7B, it was not. *After initial convergence problems, two of the SEE-R subscales (ACD and EFE) were collapsed into one factor due to a very high correlation between them. bModel did not converge.
* $p<.05$.

similar substantive factors. Initial estimation problems were also encountered with Model 7A, but it converged to an admissible solution after two SEE-R subscales (ACD and EFE) were collapsed into a single factor. In both the current study (adequately-fitting models for the four adaptations of the SEE-R) and Gerstner’s (2012) longitudinal study, high correlations (.65-.83) were consistently observed between the ACD and EFE factors. As can be seen in Table 6, the modified version of Model 7A yielded a CFI value slightly below .95 but otherwise acceptable fit statistics. With one exception (a nonsignificant and negative loading from the ODCS method factor to ODCS item 4), all factor loadings were statistically significant and in the expected direction. Correlations among the SEE-R subscale factors ranged from .27 to .57; correlations between those factors and the ODCS substantive factor ranged from .30 to .72. Finally, the correlation between the two method factors (.40) indicated an association of medium strength between negative keying effects.
Discussion of Study 1

The goal of Study 1 was to investigate the psychometric consequences of balancing attitude scales by including negatively-worded and/or negatively-keyed measurement items. Prior studies have generally reported differential functioning (in terms of validity, dimensionality, and reliability) for positive and negative items on balanced scales. However, previous research designs have not typically made any distinctions between negative wording and negative keying, leaving important measurement questions unanswered. In the current study, several adaptations of two attitude scales (the ODCS and the SEE-R) were used to investigate the effects of balancing via wording direction, keying direction, or both. Below, the four research questions posed at the outset of the study will be addressed in turn. The reader is encouraged to review Tables 4, 5, and 6 as needed.

Research Question #1. The first research question concerned balanced scales (conditions 2, 3, and 4) and whether they would exhibit psychometric properties comparable to those of scales where all items were keyed and worded in the same direction (condition 1). The properties examined were dimensionality (assessed via confirmatory factor analysis) and reliability (estimated using model-appropriate equations for coefficient omega). Based on prevailing trends in the measurement literature, it was hypothesized that all-positive (i.e., unbalanced) versions of the ODCS and SEE-R would yield better psychometric properties than balanced adaptations.

In terms of reliability, the hypothesis was generally confirmed. Regarding the ODCS, coefficient omega was systematically higher for the all-positive version of the scale (.86-.88 across converging models) than for any of the balanced adaptations (.70-
.79 across models positing a single substantive factor with or without method effects). Regarding the SEE-R, which includes four subscales, the trend was similar. Subscale reliability estimates were usually highest in the all-positive condition (e.g., SEE-R-1 Model 1: .77 / .78 / .75 / .84), although similar estimates were obtained in the condition where keying was consistently negative and wording was balanced (SEE-R-4 Model 1: .77 / .79 / .71 / .81). It should be noted that the apparent internal consistency advantage for all-positive wording/keying may be somewhat illusory. Given the low-stakes data collection context, for example, each dataset no doubt included careless responders (i.e., satisficing students who, in an effort to finish as quickly as possible, consistently agreed [or disagreed] with items without actually reading them). In the all-positive condition—and condition 4, where keying did not change—such response patterns likely contributed to internal consistency; in the balanced keying conditions, they likely detracted from it.

The pattern of dimensionality results provided mixed support for the RQ#1 hypothesis. Of the four ODCS adaptations, the all-positive version (ODCS-1) yielded the worst fit statistics in all model configurations. In fact, no model—including the simple one-factor model championed by Pascarella et al. (1994)—provided acceptable fit to the ODCS-1 data. By contrast, and contrary to expectations, Model 1 fit the ODCS-4 data (all negative keying, half negative wording) very well. Standardized residuals for the ODCS-1 Model 1 suggested that several pairs of items shared significant variance beyond that accounted for by the substantive factor. The ODCS-1 CU models fit the data marginally better than did the SUB model, perhaps because the correlated error terms “capitalized” on the variance shared by certain item pairs (e.g., items 6 and 8) that happened to be chosen for reversal in conditions 2-4. Regardless, the poor ODCS-1 fit
statistics (and the pattern of results among the balanced conditions) indicated that the
original instrument, which is nearly identical to the ODCS-1, may not function well as a
unidimensional measure without revision. This finding may stem from the nature of the
scale, which was designed to assess both openness to diversity and openness to challenge;
it seems probable that given individuals may possess more of one of those traits than the
other. In short, the all-positive version of the ODCS did not show an advantage over
balanced versions in terms of dimensionality.

The dimensionality story was generally similar for the SEE-R adaptations. One
notable difference was that in the all-positive condition, Model 1 (positing four
substantive factors and no method effects) did fit the data reasonably well—and better
than the competing models in that condition. However, the fit statistics for that model
were only slightly better than those of the comparable (and best-fitting) model in the
SEE-R-4 condition (where keying was consistently negative and wording was balanced).
Across all conditions, the best-performing models appeared to be the SEE-R-3 Model 5
(whose CTCM- configuration that was very close to that endorsed in Gerstner [2012])
and the SEE-R-2 CTCM models. As is evident from a review of the best-fitting model(s)
by dataset in Table 5, conditions 2 and 3 resulted in a better fit for models specifying
method variance than did conditions 1 and 4. Thus the dimensionality results for the
SEE-R models showed an advantage (in terms of model fit) for the all-positive
wording/keying condition over the balanced conditions, though the advantage over
condition 4 (balanced via wording only) was minimal.

In summary, results were mixed with regard to the RQ#1 hypothesis. Estimates of
reliability (coefficient omega) were generally higher for the all-positive versions of the
ODCS and SEE-R than for the balanced versions, in keeping with expectations. Regarding dimensionality, the SEE-R results indicated that balanced conditions 2 and 3 were more conducive to method effects than were conditions 1 and 4 (whose results favored substantive-only models). For the ODCS, no advantage was evident for condition 1 because no model adequately fit the data from the ODCS-1. This finding indicates that the canonical version of ODCS may lack unidimensionality.

**Research Questions #2 and #3.** The next research questions will be addressed together because both concerned the utility of competing approaches to balancing measurement scales. Specifically, were there differences in the psychometric properties (i.e., dimensionality and reliability) of balanced scales that reversed items through the use of negative wording and keying (condition 2), those that created reversals only via negative wording (condition 4), and those that created reversals only via negative keying (condition 3)? Based on trends in the measurement literature, two hypotheses were generated:

- **RQ#2:** Balanced scales with items characterized by negative wording and keying would exhibit weaker psychometric properties than balanced scales using only one reversal strategy.
- **RQ#3:** Among balanced scales using only one reversal strategy, those with balanced wording would exhibit weaker psychometric properties than those with balanced keying.

Regarding reliability, trends were fairly consistent across the ODCS and SEE-R. Coefficient omega values tended to be highest in condition 4 (which had consistent keying) and somewhat lower in the other balanced conditions (which did not). Among
ODCS models positing method effects, for example, reliability estimates were slightly higher in condition 4 (range: .75-.76) than in condition 2 (range: .72-.73) or condition 3 (range: .70-.74). A similar (if slightly muddier) pattern was observed for the SEE-R, as conditions 3 (half negative keying) and 4 (half negative wording) tended to yield higher reliability estimates than did condition 2 (half negative wording/keying). This trend was evident for both substantive-only and CTCM models, as exemplified by the Model 1 reliability coefficients (SEE-R-4: .77 / .79 / .71 / .81; SEE-R-3: .77 / .74 / .75 / .69; SEE-R-2: .70 / .73 / .72 / .72). In short, across balanced ODCS and SEE-R conditions, coefficient omega tended to be highest in condition 4 (all negative keying, half negative wording) and lowest in condition 2 (half positive wording/keying, half negative wording/keying).

Regarding dimensionality, results varied somewhat by instrument. The strongest fit statistics for the ODCS were clearly obtained under condition 4, where the best-fitting model had a simple, one-factor structure (Model 1: SRMR = .029; RMSEA = .033; CFI = .978). Under conditions 2 and 3, the best-fitting ODCS models posited method effects; fit statistics were consistently better for the ODCS-2 (Model 5: SRMR = .034; RMSEA = .058; CFI = .956) than for the ODCS-3 (Model 5: SRMR = .040; RMSEA = .082; CFI = .910). Thus method effects were more apparent in conditions 2 and 3 (where keying varied) than in condition 4 (where it did not).

Among balanced SEE-R datasets, the best-fitting models for condition 2 (SEE-R-2 Model 5: SRMR = .041; RMSEA = .039; CFI = .938) and condition 3 (SEE-R-3 Model 5: SRMR = .044; RMSEA = .036; CFI = .946) yielded better statistics than the best-fitting model for condition 4 (SEE-R-4 Model 1: SRMR = .052; RMSEA =
Method effects were less apparent when only wording was balanced (SEE-R-4) than when only keying was balanced (SEE-R-3) or when both wording and keying were balanced (SEE-R-2).

In summary, results were informative with regard to the second and third research questions. ODCS and SEE-R estimates of reliability (coefficient omega) were generally lowest in condition 2 (where wording and keying were balanced) and highest in condition 4 (where only wording was balanced). Regarding dimensionality, across both instruments the condition 4 data supported a substantive-only model (one factor for the ODCS; four factors for the SEE-R), while the data for conditions 2 and 3 supported models with method factors. The above findings supported the RQ#2 hypothesis (that condition 2 would yield the worst psychometric properties among the balanced scales), but not the RQ#3 hypothesis (that condition 4 would yield weaker psychometric properties than condition 3). Thus it appears that among balancing strategies, the use of balanced wording (with consistently negative keying) may be preferable to the use of balanced keying (with consistently positive wording), which may be preferable to the use of both strategies (half positive wording/keying, half negative wording/keying).

Research Question #4. The final research question addressed the extent to which method effects associated with negative keying might be evident across instruments. This question could be answered for participants completing the SEE-R-2 and the ODCS-3 (both balanced adaptations). Responses to the two measures were modeled simultaneously (using two CTCM- configurations) in order that the correlation between negative-keying method factors across the instruments could be estimated. It was
hypothesized that the association of keying-based method effects across the SEE-R-2 and the ODCS-3 would be weaker than that reported by DiStefano and Motl (2006) for wording-based method effects (.37).

As noted in the results section, Model 7B (which did not permit the substantive ODCS-3 factor to covary with the substantive SEE-R-2 factors) did not converge to an admissible solution. Initial estimation problems were also encountered with Model 7A (which did allow those substantive covariances); convergence was reached after the two of the SEE-R-2 factors—ACD and EFE, which exhibited high correlations in simpler SEE-R models—were combined. The final model fit the observed data fairly well (SRMR = .047; RMSEA = .032; CFI = .938). Correlations between the (three) SEE-R substantive factors and the ODCS substantive factor ranged from .30 to .72.

The parameter of interest to the research question, the correlation between the two method factors in the combined model, was estimated at .40. Thus the RQ#4 hypothesis was not supported; the moderate association of negative keying method effects observed across the ODCS and SEE-R was comparable in strength to the association reported (for a different pair of self-report instruments) by DiStefano and Motl (2006) for negative wording method effects (.37). This finding suggests that scales balanced via keying and scales balanced via wording may be similar in their susceptibility to method variance.

**Study 1 Limitations.** There are several aspects of Study 1 that may limit the generalizability of its results. First, the participants were quite homogeneous in terms of age and educational level/status. Thus the psychometric trends reported here might differ for data from other populations. Second, as even a cursory review of Appendix A and Appendix B will demonstrate, the adapted instruments administered in this study
included many lengthy, grammatically complex items. Among the ODCS items, for example, only one (item 8) was less than ten words long; and a majority of SEE-R items included at least 15 words (and often 20 or more). To the extent that such item characteristics are not typical of attitude measures, the study results may not generalize to other instruments. Furthermore, the participants were all first-year college students—a population whose ability to comprehend complex language structures is likely stronger than that of the general population.

The two measures adapted for the study differed in length and (presumed) factor structure. However, as the instrument names imply and the results for Model 7A suggest, there appears to be substantial overlap among their ODCS and SEE-R target constructs (range of cross-instrument substantive factor correlations: .30-.72). Given the nebulous nature of method factors (i.e., it is difficult to know what they really represent), a research design using more conceptually distinct measures might provide “cleaner” answers to some research questions (e.g., RQ#4). Additionally, results from the ODCS-1 (all-positive wording/keying) condition raise questions about the unidimensionality and robustness of the canonical ODCS, given that a simple, one-factor model did not fit the observed data for the all-positive wording/keying condition (in contrast to the findings of Pascarella et al., 1994). By contrast, CFA results for the SEE-R-3 adaptation (which was very close to the original SEE-R) supported the CTCM- factor structure endorsed by Gerstner (2012). Finally, it seems possible that for multi-factor scales like SEE-R, multidimensionality could interact with (potential) method effects.
IV. Study 2

Method

Participants. As in Study 1, participants were incoming freshmen who took part in mandatory, low-stakes, university-wide assessment activities in August of 2012. A qualitative think-aloud protocol was employed individually with a total of 8 randomly-selected students who were given the option to fulfill their assessment requirement by participating in this study rather than taking part in the activities conducted in their (randomly-assigned) assessment rooms. All participants were traditional (i.e., 18-year-old) freshmen; half were female, and all were white. Regarding reading skills, three participants had “high” documented SAT Critical Reading scores (650 or above) and five had “average” documented scores on the same measure (between 440 and 550).

Materials. The ODCS was adapted to create a 12-item version incorporating a combination of the four wording/keying conditions employed in Study 1 (positive keying/wording; positive keying/negative wording; negative keying/positive wording; negative keying/negative wording). The same three items were presented four times each, once in each keying/wording condition. This design was used to facilitate the elicitation of participant verbalizations pertinent to the research question (i.e., the nature of differential functioning of positive and negative items within balanced scales). The Study 2 version of the ODCS, which included the same printed instructions and response scale used in Study 1, can be found in Appendix C.

Procedure. Students assigned to certain (larger) assessment rooms were randomly selected in advance as potential participants. Once these individuals had reported to their assigned rooms, been oriented to the nature of general assessment
activities at the university, and given informed consent, they were asked to come to the front of the room. The lead proctor then provided them with brief written offers (“golden tickets”) giving them the option to take part in a research study (see Appendix E). Of the 8 students who received the offer, all accepted and were directed to another room where they were oriented to the nature of the study. It was explained that the research would be conducted with one participant at a time in a nearby room; participants were provided with a series of university-based assessment instruments unrelated to this study (pilot measures of critical thinking) and instructed to work on these before and after their turn. This approach was adopted to ensure that study participants spent an equivalent amount of time (two to three hours) engaged in assessment activities as their peers who did not receive a golden ticket. After the completion of study-specific consent forms (on which permission to record verbal responses was requested), data collection commenced.

Each session began with a brief training module that included scripted instructions and a researcher-illustrated example (these materials are included in Appendix D). In order to enhance levels of comfort/confidence with the procedure (and screen for potential confusion about instructions), the researcher first administered a few (two to three, as necessary) practice items using a brief set of measurement items related to attention and organization skills. For both the practice measure and the research version of the ODCS, participants were asked to “think aloud” (i.e., verbalize their thoughts) as they processed and responded to individual items. As advised by Sudman, Bradburn, and Schwarz (1996), spoken cues were used as needed to encourage complete verbalizations (e.g., “Remember to tell me everything you’re thinking”).
Following completion of the ODCS think-aloud, a brief structured interview was conducted (again, individually) to ascertain retrospective participant opinions about the relative difficulty of certain oppositely-keyed item pairs. This was planned in case the procedure did not elicit (unprompted) information specifically related to the processing of different types of item wording/keying. As noted by Van Someren et al. (1994), think-aloud protocols can yield invalid or incomplete data for a variety of reasons including disturbance of the cognitive process (i.e., the added requirement to think aloud causes participants to complete the task differently than they would otherwise), synchronization problems (i.e., verbalization is slower than the cognitive processes being described), and working memory errors. All participant verbalizations (prompted and unprompted) were audio-recorded; sessions lasted approximately 20 minutes each.

**Analyses.** Participant audio files were transferred to a computer and transcribed. The think-aloud and interview portions of the transcriptions were subsequently analyzed using a thematic networks approach (Attride-Stirling, 2001). This approach typically entails six steps: (1) development of codes and dissection of data into discrete text segments; (2) identification of themes; (3) construction of thematic networks, which are “…web-like illustrations…that summarize the main themes constituting a piece of text” (Attride-Stirling, 2001, p. 386); (4) description of thematic networks; (5) summarizing of thematic networks; and (6) interpretation of patterns. The thematic networks approach was chosen because of its rigor as well as its suitability for analysis of think-aloud data.

Regarding the first step of the analysis (dissection/coding of text), Attride-Stirling (2001) notes that a coding framework is typically developed “…on the basis of the theoretical interests guiding the research questions, on the basis of salient issues that arise
in the text itself, or on the basis of both” (p. 390). In this case, codes were developed in both ways. First, six codes were established to reflect literature-based explanations (described in Chapter 2) for the differential functioning of negative and positive scale items: (1) careless responding; (2) individual differences in response style/personality; (3) individual differences in cognitive/reading skills; (4) substantive differences between positive and negative items; (5) method variance due to use of negative items; and (6) item extremity. Then, based on an initial review of participant responses, ten additional codes were established: (7) item does not apply to respondent; (8) misread of item; (9) partial read of item; (10) item causes reread/confusion; (11) comment about repetition of items; (12) respondent referring back to a prior item; (13) mapping/refining of response; (14) apparent disparity between observed and reported behavior (i.e., the participant reports doing/saying one thing but the researcher observes something different); (15) comment reflecting participant’s attitude toward scale/task; and (16) comment related to maintaining response consistency across items (e.g., wanting to give congruent responses for similarly-worded items). All text segments (i.e., participant statements) deemed to be related to any of the 16 codes and/or the larger Study 2 research question (Why do measurement items with negative wording and/or keying elicit differential response patterns than items that are positively worded/keyed?) were selected for further analysis, regardless of the terminology used by participants. The text segments were then assigned codes based on the above framework.

Once the coding process (step 1) had been completed, salient/common themes were extracted from the text segments (step 2). Continuing with the analysis as delineated by Attride-Stirling (2001), identified themes were then organized into a visual network.
that was subsequently reviewed and refined (step 3). In step 4, the components of the thematic network were described verbally and exemplified with supporting text segments. Finally, the thematic network was summarized (step 5) and its patterns interpreted (step 6). Responses to the brief structured interview were analyzed along with the think-aloud data, since there was a great deal of thematic overlap among them.

**Results**

As summarized above, a thematic network typically consists of basic themes, organizing themes, and one or more global themes. Although the network results from a bottom-up construction (i.e., coding and categorization of discrete text segments), the reader may benefit from a top-down orientation to its hierarchical structure. In the present study, analysis of the think-aloud/interview data suggested the inclusion of what could be termed a “universal” theme at the level above that of the global themes. The universal or overarching theme that emerged from the data was *Individual Differences*. In short, participants varied in their processing of, style of responding to, and comments about the 12-item, think-aloud adaptation of the ODCS (Appendix C). The nature of the individual differences suggested the presence of variability that seemed independent of participants’ professed levels of the target construct (openness to diversity).

The main sources of individual differences, classified as global themes, were based on groupings of the organizing themes at the next level down. There were a total of three (arbitrarily-numbered) global themes: (1) *Reading Skill*; (2) *Personality*; and (3) *Style of Responding*. Each global theme was based on two organizing themes (identified below), each of which encapsulated a number of the basic themes that had emerged from the text segments. The resulting thematic network is described in the following sections.
(which delineate and exemplify the organizing and basic themes associated with each global theme) and presented in Figure 5 (below). It should be noted that basic themes have been omitted from the figure.

**Global Theme 1: Reading Skill**

The first global theme involved individual differences in participant reading skill/behavior. Within the think-aloud procedure, all participants save one elected to read the adapted ODCS items aloud before giving their responses. Thus it was possible to directly observe instances when participants made reading errors and/or experienced confusion regarding individual items. During the follow-up structured interview, participants were asked to identify any items that had been confusing or difficult to process. In addition, they were asked to gauge the comparability of a specific pair of items (numbers 1 and 4) in terms of meaning and extremity. Taken together, these data highlighted individual differences in reading skill/comprehension (particularly with regard to negatively-worded statements) as well as differences in how items were interpreted (i.e., meaning/semantics).

**Organizing Theme: Negative Wording**

This organizing theme pertained to participant processing of negatively-worded items on the adapted ODCS. Encapsulated basic themes included misreads, rereads, self-corrections, comprehension difficulties, and resulting response errors. These behaviors were observed (and reported) primarily on items that featured negative wording. Consistent with prior studies (e.g., Sherman, 1976; Wason, 1961), the statements that participants found most challenging to process were those that had high complexity.
Figure 5. Thematic network resulting from the qualitative study. The highest level includes the universal theme (Individual Differences), the next level includes the global themes (Reading Skill; Personality; Style of Responding), and the lowest level includes the organizing themes (Negative Wording; Semantic Interpretations; Attitude/Effort; Frustration Tolerance; Desire for Consistency; Use of Midpoint). For simplicity of presentation, the basic themes encapsulated by the organizing themes are not depicted here.
and/or included multiple negative particles (e.g., #11. Learning about people from different cultures is not an unimportant part of my education.). Some misreads were minor (e.g., omitting an article; saying “culture” rather than “cultures”), but others had the potential to alter meaning in a substantial way. In the following example, which involves item 11, the participant caught and corrected one reading mistake but not another (P2 refers to participant 2; quotation marks indicate an item being read aloud; capital letters denote participant emphasis; editorial notes are in brackets):

   P2: “Learning about people from different cultures is [not omitted] an important—UNimportant part of my education.”

In other cases, participants avoided significant reading mistakes but experienced comprehension difficulties. The example below (involving item 9) illustrates the confusion sometimes caused by complex sentences with negative wording:

   P5: “The courses I enjoy the least are NOT those that make me think about things from a different perp—perspective.” Alright, it’s getting more complicatedly worded, I can see that! [pause] “…I enjoy the least are not…” [laugh] Oh my gosh, I have to think—OK, ah…oh my god, I’m actually really confused. That’s annoying [laugh].

Occasionally, participants used what might be called a verbal reduction strategy to process negatively-worded items they found confusing:

   P4: “Learning about people from different cultures is NOT an unimportant part of my education.” Is…not an unimportant part, so that would be—IS an important part. Got it, alright. Number 11, I would agree with that, definitely.
Complex items like those referenced above (e.g., 9 and 11) seemed to consistently tax participants’ working memory skills. In several cases, the processing demands of such items resulted in apparent response errors:

\[ P6: \quad \text{“The cois—courses I enjoy the least are not those that make me think about things from a different perspective.”} \quad \text{OK, kinda confusing. “The courses I enjoy the least are not those...” [pause] “The courses I enjoy the least are NOT those...” Um, I’ll have to, disagree with that, I think? [laugh] That’s a confusing question! Yeah, I’d be a 3 with that one. It’s a tough question to understand.} \]

In the above excerpt, the participant became confused by item 9 and responded “3” (Slightly Disagree) when her likely intent, based on previous responses and comments, was to indicate agreement with the underlying sentiment of the statement (i.e., that such courses are enjoyable). Consistent with expectations based on prior studies (e.g., Marsh, 1996), participants with lower SAT Critical Reading scores seemed somewhat more susceptible to confusion (e.g., misreads, rereads, response latencies, response errors) than did their peers with higher SAT Critical Reading scores. This was true in terms of both frequency (i.e., the number of items on which processing difficulties were observed) and severity (i.e., degree of confusion; amount of time needed to process items).

In both the think-aloud and interview portions of the study, participants identified confusing items and provided insight into the nature of the processing difficulties they experienced. As noted earlier, “problem” items tended to be complex and contain grammatical negation. The two items most often described as confusing were items 9 and 11, both of which were negatively worded but positively keyed. Several students offered
the (unprompted) suggestion that one or both of these items should be reworded. Items 6, 10, and 12 were also cited by at least one student each as being difficult to process. Participants often used terms like “double negatives” or “contradictory” when explaining why such items confused them (R denotes the researcher):

\[ P5: \] Almost the last half [were confusing or difficult to process]. Number 9, number 12, and number 11. And number 10. So I guess, 9 through 12.

\[ R: \] Why?

\[ P5: \] Um, I guess there’s some contradictory wording, with “enjoy” and “the least” in number 9. 10, “I do not mind” was just kind of like a wishy-washy statement. And then, 11 had “not” AND “unimportant.” So that kind of like, switched things around in my mind. And the same thing with 12, “enjoy the least.”

Finally, aspects of sentence structure were occasionally mentioned as factors in comprehensibility. For example, one participant noted that the (syntactic) location of negative wording tended to make a difference:

\[ P4: \] If the NOT, like the negative—I guess it would be a negative—is in the beginning part, it kind of sets the precedent for the rest of the statement, that it’s going to be an opposite, as opposed to the previous statement [#6].

This observation was insightful, as participants did not generally exhibit or report difficulty comprehending negatively-worded statements in which the structure was relatively straightforward and the polarity was established early on (e.g., #7. I do not enjoy having discussions with people whose ideas and values are different from my
own). By contrast, the more complex items with negative wording, and particularly those with multiple negative particles, were conducive to confusion and response errors:

P8: Once I started getting into some of these I feel like I was crossing myself, I guess I was getting confused, and I didn’t really understand some of the questions—I was probably going back and, one of them I would say Strongly Agree and the other [comparable item with the same keying] would be like, Disagree or something.

In short, some adapted ODCS items with negative wording were consistently difficult for participants to process. Misreads, self-corrections, rereads, and response errors were observed on these items. Such behaviors were more frequent, and severe, among participants with lower SAT Critical Reading scores.

Organizing Theme: Semantic Interpretations

This organizing theme related to participants’ perceptions of the meaning of items on the adapted ODCS. It emerged primarily from data obtained during the structured interview, which included a series of questions about two similar items: #1. I enjoy having discussions with people whose ideas and values are different from my own.; and #4. I try to avoid having discussions with people whose ideas and values are different from my own. The second of those items was designed to be parallel to the first but keyed in the opposite direction. Participants were asked whether items 1 and 4 (which were not “problem” items in terms of comprehension) were equivalent in meaning or extremity (i.e., strength). Some favored the former interpretation, some favored the latter interpretation, and some reported finding the items to be equivalent in meaning and
extremity. It should be noted that a few participants asked for clarification of the questions, while others struggled to articulate their thoughts on semantic issues.

Participants who reported finding a substantive difference in meaning between items 1 and 4 generally described that difference as subtle:

*R:* Do you feel like [items 1 and 4] mean the same thing?

*P5:* Um, kind of but not exactly because, if they did mean the same thing—like you know, for me strongly agreeing or disagreeing, I’d rather have, instead of “try to avoid,” I would say, like, “I DISlike having discussions.” Cause “try to avoid” doesn’t necessarily mean that you dislike it, it’s just that it [pause] makes you feel more uncomfortable. Well it’s slightly different, not a whole lot different.

Given that the items in question included different verbs, it was not surprising that some participants perceived a distinction in meaning. Other participants couched perceived distinctions between the two items in terms of extremity:

*P6:* I think number 4 is more extreme, because most people, they see the question “I enjoy having discussions with people,” [and] they’re pretty much just gonna agree. But you’re gonna have to—“I try to avoid having discussions”—people who…try to avoid having discussions, someone really has to [pause] not like having discussions to agree with that.

It may not be of critical importance whether participants described perceived differences between items 1 and 4 in terms of meaning or extremity (as noted earlier, the students had some trouble articulating the nature of distinctions they perceived). The main point is that for some participants, the two items were not equivalent.
The following excerpt would appear to reflect the alternative point of view: that items 1 and 4 constitute polar reversals, like the numbers positive 3 and negative 3—that is, opposite but equal in meaning/extremity:

R: Do you feel like [items 1 and 4] mean the same thing?

P1: Well, I think one of them’s the opposite. So, not really.

R: So they’re reversed?

P1: They relate but they’re not the same thing.

R: Does one seem more extreme than the other?

P1: No, cause they’re the same.

Other participants also expressed the opinion that the two items were comparable opposites. Thus there were two “camps” on the equivalence issue; and each camp was mixed in terms of reading skill (based on SAT Critical Reading scores).

One possible explanation for the interpretive differences described above is that some participants conducted a more nuanced reading of items 1 and 4 than did others. For instance, one of the participants who reported a difference in their meanings had provided the following comments about item 10 during the think-aloud session:

P5: “I do not mind having discussions with people whose ideas and values are different from my own.” That’s a little more confusing just cause it said “I do not MIND.” Um, cause I—it’s hard to agree with it—I guess I’d strongly agree with it, even though—it’s not that I don’t mind, it’s that I actually LIKE having them.

Item 10 was a variation on items 1 and 4, written to be negatively worded but positively keyed. The nuanced reading of Participant 5 highlights another pertinent semantic
question: Is “I do not mind” comparable in meaning and extremity to “I enjoy” (or “I like”)?

In fact, the answers to such questions are likely to be subjective. Even if all respondents to an attitude measure give optimal attention to item wording (i.e., nuanced readings), they will vary in their judgments about item meaning and extremity. The individual differences observed in this study suggest that perceptions of words are, like perceptions of the world, idiosyncratic. It follows that two respondents with the same underlying level of a target construct (e.g., openness to diversity) could differ in their item-level interpretations and responses. Thus the measurement medium itself (language/reading) introduces a certain amount of construct-irrelevant variance.

**Global Theme 2: Personality**

The second global theme encapsulated individual differences in how participants engaged in the research tasks. It should be noted that no personality measures were administered, nor was there an intent to identify “personality features” per se. Rather, the label *Personality* was chosen because the measurement literature suggests that personality-based factors are relevant to response behaviors (e.g., Cronbach, 1946, 1950; DiStefano & Motl, 2009). For instance, some individuals may be more conscientious than others; some may be more willing to assist in research endeavors than others; and some may be more likely to satisfice (e.g., Krosnick, 1991) than others when completing an attitude measure. In the present study, there were numerous instances when participants exhibited and/or reported issues related to effort, annoyance, and frustration. Taken together, the data highlighted individual differences in engagement and response
behavior that may have been related to personality factors (in the context of the research session).

*Organizing Theme: Attitude/Effort*

All participants in the qualitative study presented as cooperative, alert, and euthymic. One student preferred not to read the adapted ODCS items aloud, but otherwise the participants complied with all task demands in a polite manner. Despite this agreeable state of affairs, the data suggested the presence of variation in terms of participant attitude (e.g., about the importance of the study) and effort (e.g., time spent on items; thoroughness in thinking aloud) regarding the research tasks.

The think-aloud protocol was not conducive to extreme satisficing (e.g., responding without having read items), but most participants exhibited at least a modicum of satisficing on some items. Recall that satisficing is defined by Krosnick (1991) as suboptimal effort in (1) reading/interpreting an item, (2) retrieving pertinent feelings/memories, (3) making a judgment, or (4) mapping that judgment onto the response scale. Participant responses often gave insight into at least some stages of the response process. The following excerpt, which involves item 2 from the adapted ODCS, reflects an apparently impulsive response style:

*P3:* Um, “Learning about people from different cultures is not an”—no no no, no no no. I want to study abroad so much and learn about different cultures, so that is a Strongly Disagree [laugh].

The participant seemingly did not read the entire item, arrived at an emphatic judgment before retrieving (or at least before describing) her feelings, and executed an immediate and decisive mapping. Her speediness was unusual, particularly compared with other
students’ speed in responding to the first three items on the measure (i.e., before the item stems began to be repeated).

By contrast, the excerpt below suggests a much more thorough and deliberate treatment of the same item:

\[ P7: \] “Learning about people from different cultures is not an important part of my education.” Um, I definitely think it is a part of my education, because learning about other people—I might…encounter them in my career? So, I have to either say like, between a 1 and a 3, so I’m like in the Disagree side. And I’m thinking that—“…important to my education”—I would say, like, it is not that strong. I mean, I have other classes to worry about too for my education? But it’s—so I’m pretty sure it’s between a 3—but [pause] well, um, I’m just between a 2 and a 3.

This participant was on the other end of the spectrum in terms of the amount of thought and time she devoted to making judgments and mapping her responses. In fact, as exemplified above, she sometimes had difficulty arriving at a final decision and would have liked to place her response between two scale points.

Participants were told in advance that some of the adapted ODCS statements would appear several times with slightly different wording. Once the item stems did start to recur (beginning with item 4), some participants adopted (at least intermittently) a “shortcut” way of responding that included references to one or more previous items. The excerpt below involves item 5, which was a slight variation on item 2:
P5: OK, “Learning about people from different cultures is an important part of my education.” So I guess I’d strongly agree with that, just because that’s the opposite of number 2.

Rather than processing item 5 as a stand-alone unit, the participant recognized it as “the opposite” of item 2 and simply reversed the answer she had given previously. Even though this strategy (which will be discussed further under the Desire for Consistency organizing theme) yielded an apparently congruent response, it still constituted a substantial form of satisficing.

In fact, almost all participants gradually began to give quicker responses (relative to their “baseline” speeds) as they progressed through 12 think-aloud items. This may have been partly attributable to the high degree of repetition inherent in the measurement instrument, but it likely also reflected a more general behavioral trend in attitude measurement situations: Respondents may give good attention/effort on initial items, orienting themselves to the target construct(s), their own pertinent feelings/memories, and the response scale; after that, they proceed more efficiently—through increased satisficing. As one participant (P3) remarked, “I remember certain words from questions and [when] I see [them] again I’m like, ‘Oh, I could use that question to maybe help me with the next one’.”

While discussing “confusing” items in his interview session, another participant described the motivation to work as quickly as possible. He observed that for students completing research measures or academic tests, confusing items are undesirable specifically because they interfere with the prime directive, efficiency:
$P4$: …I mean, you’re also going faster [than usual], just trying to finish the questionnaire. And then you have this [confusing item], it throws you for a loop, and then you feel kind of rushed, and like, “Oh no, I’m losing time” cause of the whole test-taking syndrome: “I need to finish.”

In summary, participants varied in their use of satisficing behaviors during the think-aloud task. Some approached the items in a reflective, conscientious way, while others gave quick and seemingly impulsive responses. Finally, there was a general tendency for participants to gradually give faster/less thorough think-aloud responses as they moved through the research instrument. One participant attributed this trend to the “test-taking syndrome,” while another (P3) suggested that some people “just go through the motions” when completing attitude measures.

*Organizing Theme: Frustration Tolerance*

This organizing theme centered on reactions to aspects of the think-aloud task that were identified as annoying or frustrating. Participant comments (and researcher observations) suggested that individuals varied in their ability to tolerate frustration, regulate their emotions, and remain patient/focused. Again, the data were context-specific but may have reflected more general personality factors that can impact response behavior.

One potential source of frustration was the degree of repetition in the ODCS adaptation. Simply put, questionnaire respondents tend to become impatient or exasperated when they feel they are being asked to answer “the same question” again and again. During the present study, participants were alerted in advance to the fact that statements would be repeated with slightly different wording. This warning was
incorporated into the research design with the hope that participants would not become hyperfocused on the repetition of content, and it seemed to be successful. However, basic themes related to repetition emerged nonetheless (i.e., recognition of, annoyance with, and questions about repeated content). The following excerpt came from the end of an interview, when the participant was given the chance to ask questions about the study:

P2: Why are [the items] so similar? [laugh] I’m sure you probably know—like, you did it on purpose, but…

R: Is it annoying that they’re so similar?

P2: Yeah. [pause] It was kind of annoying, but it’s probably a good tool for you to analyze, like, what does one word do?

Most participants commented on item similarity during the think-aloud task, the interview, or both. Their remarks often suggested a combination of mild annoyance and amusement, the relative proportions of which seemed (based on the researcher’s impressions) to depend on factors such as investment level and frustration tolerance.

Another potential source of frustration was the difficulty of processing certain items. As detailed earlier, complex items with negative wording (e.g., items 9 and 11) often confused participants. Frustration over confusing items, which may have been exacerbated by feelings of embarrassment (since participants were reading and thinking aloud in the presence of the researcher), tended to be stronger than reported frustration associated with content repetition. The following excerpt involved item 9:

P1: “The courses I enjoy the least are not those that make me think about things from a different perspective.” Ah, these are making my head hurt! How is that different than the other one?
There also appeared to be an interaction between (1) the tendency of participants to increase their work speed and (2) the location of the items that were reported to be confusing. Nearly all items identified as difficult to process were located in the latter half of the measure, when participants had “established set” (i.e., oriented themselves to the measure) and appeared to want to proceed more efficiently. The following interview excerpt suggests that for at least some respondents in measurement situations, frustration can lead to satisficing:

\[
P5: \text{Um, I guess just that [laugh] the complicated wording really messed with me. And it would probably frustrate me more in a test, and it wouldn’t really make me want to [laugh] answer them as much, if I had to go back and keep on thinking about ONE item, in a test when I want to keep on taking the test.}
\]

\[
R: \text{You would lose patience?}
\]

\[
P5: \text{Yeah. So that might affect my answers for the other ones.}
\]

Not all participants became this frustrated. Some were remarkably patient—particularly one of the weaker readers (according to SAT Critical Reading scores), who reviewed certain items multiple times in an effort to comprehend them. It was clear that individual differences in frustration tolerance represented a potential source of measurement error. Finally, it seems likely that extent of respondent frustration would be greater, and tolerance/patience less, in more typical (i.e., non-think-aloud) measurement contexts where respondents have little or no direct interaction with the researcher(s).
Global Theme 3: Style of Responding

The third global theme involved individual differences in how the response scale was used. Specifically, there were certain situations in which some participants adopted unorthodox strategies for arriving at judgments and mapping those judgments onto the response scale. First, some students made an effort to ensure consistency (i.e., congruent responses) across similarly worded items. Second, there were instances of participants choosing the midpoint response (Neither Agree nor Disagree) because they found an item lacking in applicability or clarity. Both issues were observed during the think-aloud task and explored further in the interview portion of the study. Taken together, the data highlighted additional sources of potential measurement error.

Organizing Theme: Desire for Consistency

The think-aloud instructions, which were read aloud by the researcher, alerted participants to the fact that some statements on the adapted ODCS would be repeated in a slightly varied form. The instructions also advised, “Don’t worry about trying to be consistent.” Once the item stems did start to recur, however, it was clear that some participants wanted to provide consistent (i.e., congruent) responses to parallel items. For example, items 3 and 6 were syntactically identical but for one word (“not”) that made the latter item a reversal of the former. Participants exhibiting a desire for consistency, upon recognizing an oppositely-keyed item like number 6, would process the item but then make sure they gave the opposite response they had given for item 3.

This behavior was similar to the “shortcut” approach described earlier in the context of efficiency. However, the desire for consistency seemed fundamentally different—motivated not by efficiency (i.e., trying to complete the measure quickly as
possible), but by conscientiousness or compulsiveness. The interview responses of participants suggested a certain response style dimension or spectrum bounded by two extreme approaches, holistic and analytic. The “holistic” approach, as illustrated in the following interview excerpt related to items 3 and 6 (final prompt), could be characterized by a desire for consistency within all similarly worded items on a measure:

   P5: Yeah, if I agreed with that one, I would disagree with this one. Or if I strongly agreed with that one, I would strongly disagree with that [other] one. I would definitely do that.

By contrast, proponents of the “analytic” approach (which the instructions advocated) attempted to treat each item as its own entity, independent of any preceding items:

   P1: …I wouldn’t do that [try to establish consistency], but I think most people would… I personally would just be difficult and say whatever I thought for [each] one.

Another participant (P8) argued that there is “no point [taking a] survey” if the items are not treated independently.

   In fact, the responses of most participants suggested that their approaches were somewhere between the holistic and analytic extremes. One student (P4) opined that consistency efforts might depend on how far down the measure a “repeated” item appeared (“If you had it further down in the questionnaire, I feel like it would be more of a different, whole new statement”). In summary, individual differences were apparent in the desire to provide consistent (i.e., congruent) responses across similar items; such variation would likely be unrelated to the target construct on an attitude measure.
Organizing Theme: Use of Midpoint

This relatively narrow organizing theme encapsulated measurement issues related to use of the midpoint response (Neither Agree nor Disagree). In certain instances, participants opted for the midpoint (“4” on the 7-point scale) because they found an item lacking in either applicability or clarity. Regarding the former situation, one participant enlisted this strategy for item 3 and all its variants:

P3: “The courses I enjoy the most are those that make me think about things from a different perspective.” Well, hmmm [pause]. I don’t really think I’ve had much experience with courses that have made me think about things from a different perspective, so I’m probably gonna have to go with Neither Agree nor Disagree.

The above strategy, while understandable given the available response choices, is problematic from a measurement perspective because a “4” response is intended to designate a relative value on a spectrum of opinion rather than the absence of an opinion. During the follow-up interview, Participant 3 reported that she “would definitely have chosen” a Does Not Apply (N/A) option had it been available as an option. Another participant (P1) suggested that “bailout” use of the midpoint by respondents is not uncommon (“Oh, yeah, if they’re—if they don’t really know at all, they’d just pick 4”).

There were also rare instances in which a participant used response option 4 to indicate that s/he did not comprehend an item and was thus unsure how to answer it. The following excerpt involved item 11:
“Learning about people from different cultures is not an unimportant part of my education.” Um, it IS important, so “is not an unimportant part of my education.” Um I would say Agree? What—wait. “Learning about people from different cultures is an important—is not an unimportant part of my education.” I don’t know how to answer that one, so I’ll put 4 [laugh].

This response behavior, while again understandable given the available response choices, is undesirable from a measurement perspective for obvious reasons. The participant reported in her interview that she would have opted for N/A or Not Sure had either been available. She went on to describe another Likert-based measurement instrument (administered electronically by the university to all incoming freshmen) which had labels only for the anchor points on the response scale:

They didn’t really give you one [option] where you neither agree nor disagree. It was just like, Strongly Disagree [on one end] or Strongly Agree [on the other], so whenever you weren’t sure about it, I would just click the middle one, cause I didn’t know what else to do…

When you weren’t sure, was that because the statement itself was confusing?

Yeah. Yep, or it didn’t apply to me too, so I would click the middle one.

So it would have been good if they had a box like Doesn’t Apply to Me?

Yeah. In order just to answer the question, cause I felt like I HAD to answer it. So, that’s what I would do.
In sum, the present study yielded evidence that Likert-based midpoints, in the absence of an option such as N/A, may be used at times to communicate information that is not scale-meaningful. Specifically, participants reported opting for the midpoint response (“4”) in situations where an item was either very confusing or not applicable to them. Such responses are problematic because they appear to represent a point on the attitude spectrum when in fact they were intended as non-responses.

**Discussion of Study 2**

The Study 2 research question concerned measurement items with negative wording and/or keying. In short, why do such items tend to elicit differential response patterns than items that are positively worded/keyed? The qualitative data yielded several pertinent themes under the “universal” umbrella of individual differences. Text excerpts were classified into three global themes—Reading Skill, Personality, and Style of Responding—and, at the next level down, six organizing themes: Negative Wording; Semantic Interpretations; Attitude/Effort; Frustration Tolerance; Desire for Consistency; and Use of Midpoint (see Figure 5 for a schematic presentation of the network). The organizing themes reflected variation in respondent characteristics, usually as they interacted with scale/item characteristics and the situational context (i.e., a think-aloud research study). In the following paragraphs, each organizing theme will be discussed in turn with regard to posited explanations for the differential functioning of positive and negative measurement items (these explanations were summarized in Chapter 2).

The Negative Wording organizing theme involved participant processing of negatively-worded items on the adapted ODCS. The data certainly provided supporting evidence for the well-established theory that cognitive/linguistic demands are higher for
grammatically negative statements than for equivalent positive statements (e.g., Sherman, 1976; Wason, 1961). Negative items (particularly complex items such as 9 and 11) were often associated with participant misreads, rereads, response delays, and confusion. To the extent that relative difficulty processing negatively-worded statements is experienced by the general population, that phenomenon may manifest as method variance (i.e., variation that cannot be explained in terms of respondent characteristics). However, in addition, and consistent with the findings of Marsh (1986; 1996), Study 2 participants with (documented) weaker reading skills experienced more frequent and severe comprehension difficulties on negatively-worded items than did individuals with stronger reading skills.

The Semantic Interpretations organizing theme centered on perceived meanings of certain adapted ODCS items. Many of the relevant text excerpts came from the structured interviews, during which participants were asked whether items 1 and 4 (which were parallel and differentiated only by the word “not”) seemed equivalent in terms of meaning and/or strength. These interview questions were designed to glean information related to two posited explanations for the differential functioning of positive and negative measurement items: (1) the substantive explanation, or the idea that positive and negative items may tap separable constructs such as “presence of anxiety” and “absence of anxiety” (e.g., Mook, Kleijn, & van der Ploeg, 1991); and (2) the item extremity explanation (Spector, Van Katwyk, Brannick, & Chen, 1997), or the idea that systematic differences in the extremity (strength) of oppositely-keyed items can lead to keying-based artifacors. The qualitative data yielded partial support for each explanation. Whereas some participants perceived distinctions in meaning between items 1 and 4, others
perceived differences in extremity; and some participants felt the items were equivalent in both meaning and extremity (i.e., polar opposites). This diversity of opinions suggests that semantic interpretations are subtly idiosyncratic, and that the use of language as a measurement medium may introduce construct-irrelevant variance.

The Attitude/Effort organizing theme involved variation in participant engagement in the research tasks—for example, some students were thorough and conscientious while others seemed more susceptible to satisficing behaviors. The data strongly supported the long-established theory that personality-based factors are relevant to response behaviors (e.g., Cronbach, 1946, 1950). In addition, although the research design was not conducive to extreme satisficing, there were instances where individuals processed negatively-worded items so quickly/impulsively that apparent response errors resulted. Thus there was evidence of some degree of careless responding, a phenomenon that has been identified as a potential explanation for keying-based artifacts (e.g., Woods, 2006).

The Frustration Tolerance organizing theme, which emerged based on participant comments as well as researcher observations, involved variation in the degree to which participants became annoyed or frustrated with aspects of the think-aloud task (e.g., repetition of content; items that were difficult to comprehend). The data suggested that for some individuals, frustration was detrimental to investment/conscientiousness and conducive to increased satisficing. This theme provided further evidence that personality characteristics are relevant to response behaviors, and that careless responding (in varying degrees) may contribute to differential response distributions for negative and positive items.
The Desire for Consistency organizing theme reflected variation in the degree to which participants treated similar items on the adapted ODCS as independent entities. Some respondents exhibited and reported a holistic strategy whose goal was apparently to establish congruent responses across parallel items or item sets (e.g., strongly agreeing with items 3 and 9, and strongly disagreeing with items 6 and 12). This behavior seemed to constitute evidence of a particular response style possibly related to personality factors such as conscientiousness or compulsiveness.

Finally, the Use of Midpoint organizing theme centered on instances when participants opted for the Likert midpoint response (Neither Agree nor Disagree) because they found an item to be either very confusing or not applicable to them. The data suggested that in the absence of a response choice such as “Does Not Apply,” respondents may feel more comfortable (mis)using the midpoint option than skipping the item. Such response behavior, which has previously been identified as an important measurement issue (e.g., Harter, 1997; Marsh, 2013; Presser & Schuman, 1980), is not specific to balanced scales. However, it may be more likely to occur with negatively-worded items, which tend to be more difficult for respondents to comprehend.

In summary, Study 2 yielded some degree of validating evidence for most, if not all, of the literature-based explanations for the differential functioning of positive and negative measurement items. The evidence seemed more compelling for some explanations (method variance; careless responding; response styles; individual differences in cognitive/reading skills) than for others (substantive differences; item extremity), though this pattern may have been a function of the research design. As noted earlier, most of the posited explanations are not mutually exclusive. For example, in a
given measurement study it would seem possible to have a substantial percentage (e.g., 10%) of careless responders, a substantial percentage of individuals with weak reading skills, and a systematic difference in extremity between negative and positive items.

**Study 2 Limitations.** There are several limitations of Study 2 that may affect the generalizability of its results. First, the group of participants lacked diversity in terms of age, race, and educational level. Second, the adapted version of the ODCS included (by design) a high degree of repetition and a preponderance of lengthy, complex statements. Because such features would typically be undesirable in (and, hopefully, absent from) a measurement scale, some respondent behaviors observed in the study (e.g., comprehension difficulties; efforts to ensure congruent responses) might be less frequent/prominent with more typical measures. Third, the think-aloud methodology no doubt impacted respondent behavior. For example, would participants have given the same level of attention to items had they remained in a large testing room and completed measures independently? Might their reading/comprehension of items have been more accurate had they not been reading aloud for the researcher? In light of such questions, the results reported here should be interpreted with caution until they can be replicated.
V. General Discussion

Overall, findings from Studies 1 and 2 implicated a number of phenomena that may contribute to the oft-reported differential functioning of positive and negative measurement items on balanced scales. These phenomena can be conceptualized as characteristics of respondents, measurement items, or the data collection context—or interactions among those characteristics. Some can also be conceptualized in terms of previously posited explanations for differential positive/negative item functioning. With regard to those explanations, the contrasting designs of Study 1 and Study 2 yielded some convergent evidence and some divergent evidence. The overall findings and their implications are summarized below.

Study 2, which was qualitative and exploratory in nature, elicited several themes related to the types of characteristics noted above: that negatively-worded items are more difficult to process than positively-worded equivalents (item characteristic); that the difficulty of processing negatively-worded items is greater for individuals with weaker reading skills (respondent characteristic); that perceptions of item meaning/strength vary by individual (item-respondent interaction); that individuals vary in terms of personality characteristics that may be predictive of satisficing behaviors (respondent characteristic); that response styles, such as the desire for consistent responding across similar items, impact response patterns (respondent characteristic); and that in some situations, respondents may “misuse” Likert scale midpoints in order to indicate that an item lacks applicability or comprehensibility (item-respondent interaction).

In Study 1, which concerned the psychometric properties of scales with different wording/keying configurations, results were not entirely consistent across measures and
conditions. However, several trends were apparent. First, reliability estimates were
generally highest for scales where all items were positively worded and keyed, slightly
lower for scales with consistent (negative) keying and balanced wording, and lowest for
scales with balanced keying (with or without balanced wording). Similarly, CFA results
indicated that method variance was more substantial/evident when keying was balanced
(conditions 2 and 3, where the best-fitting models posited method effects) than when it
was not (conditions 1 and 4, where the best-fitting models accounted for only substantive
variance). Analysis of a combined SEE-R/ODCS model suggested that the association of
keying-based method effects across instruments (.40) may be similar in strength to that
previously reported for wording-based method effects.

Condition 4 in Study 1 was of particular interest, as it had not been utilized in any
previous (published) studies. The configuration—in which all items were negatively
keyed and half were negatively worded—yielded higher reliability estimates than did the
other balanced conditions. In addition, as noted above, the best-fitting models in
conditions 2 and 3 posited method effects while the best-fitting models in condition 4 did
not (although the advantage of those substantive models was slim). Thus it appeared that
balanced keying was more conducive to method effects than was balanced wording, at
least in an unstructured data collection situation (i.e., where participants could proceed
through multiple measures at their own pace). It should be noted, however, that the nature
of the employed item adaptation approaches may have affected the Study 1 results. For
example, the strategy of creating negatively-worded items in a highly consistent manner
(via the addition of “not” or “do not”) could have inflated (at least some) correlations
among them, whereas negatively-keyed adaptations may have been more semantically
distinct from one another (and thus less highly correlated) because they were necessarily
crafted on an item-by-item basis. Further research is needed to determine whether
consistent keying can in fact reduce method effects associated with balanced wording,
and/or whether its apparent benefits come at the expense of validity because it essentially
masks careless responding.

Questions about the effects of negative wording and keying were also informed
by Study 2, which featured more structure and encouraged participants to read and think
aloud. The nature of the research design was not conducive to “pure” careless responding
and other strong forms of satisficing, but participants did have consistent difficulty
processing certain negatively-worded items (some of which were also negatively keyed).
The extent of the comprehension difficulties, which sometimes led to response errors,
tended to be greater for individuals identified as having average (rather than above-
average) reading skills. These patterns seemed consistent with the Study 1 finding that
the combination of negative wording and negative keying (condition 2) may be more
conducive to method effects than either in isolation.

Among literature-based theories for the psychometric consequences of balancing
scales, current results yielded no support for the “substantive differences” hypothesis
(e.g., Mook et al., 1991; 1992). That hypothesis states that balanced keying/wording can
result in the emergence of related but distinct substantive factors (e.g., presence of
ethnocultural empathy; absence of ethnocultural empathy). In Study 1, models positing
only wording/keying-based factors (POS/NEG) generally exhibited poor fit and were
always outperformed by competing models. Study 2 provided at least initial evidence that
respondents vary in their perceptions of the relative meaning/extremity of parallel but
oppositely-keyed items, rendering unlikely the possibility that positive and negative items are perceived as substantively distinct across respondents.

Similarly, current findings did not support the “item extremity” hypothesis—that artifactors can result when at least some pairs of oppositely-keyed items are semantically extreme relative to the standing of most respondents on the target construct (Spector et al., 1997). Implicit in this explanation is the idea that perceptions of extremity are uniform across respondents. However, as described above, Study 2 participants did not agree on the relative meaning or extremity of pairs of items written to be semantically equivalent but oppositely keyed. It should be noted that the items in Study 2 may not have been sufficiently extreme to elicit evidence for the item extremity hypothesis. In addition, the Study 1 design was probably not conducive to triggering this complex phenomenon; observed item means did not suggest that the ODCS or SEE-R items were “extreme” relative to the response scale spectrum.

By contrast, there was compelling evidence from both studies in support of the method variance hypothesis (e.g., Russell & Carroll, 1999). That hypothesis argues that the balancing of measurement scales introduces systematic but construct-irrelevant variance because negative and positive items elicit different response distributions. Study 2 participants reported and exhibited difficulty processing a number of negatively-worded items, some of which were also negatively keyed. In Study 1, models positing method effects related to wording/keying generally fit “balanced” data better than did simpler models (condition 4 was an exception to this trend). Thus it appears that balancing scales via negative wording and/or keying (item characteristics) is in fact conducive to method effects, as most prior studies of balanced scales suggests.
Study 2 findings provided at least some support for several respondent-based hypotheses about the nature of differences in the psychometric properties of balanced and unbalanced scales. First, although the Study 2 research design was not conducive to strong satisficing, some apparent response errors were observed. This pattern provided support for the “careless responding” explanation (e.g., Woods, 2006), which suggests that aberrant responding to negative items by a portion of respondents can result in artifacts (or method factors). Study 2 findings also supported the idea that item response distributions can be impacted by individual differences in cognitive/reading skills (e.g., Marsh, 1986; 1996) as well as by response styles that may be related to personality traits (e.g., DiStefano & Motl, 2006). It was not a goal of this project to detect/disentangle these mechanisms in the Study 1 datasets; however, it seems likely they were present given CFA results (particularly for conditions 2 and 3) and the relatively unstructured data collection conditions (i.e., participants proceeded through multiple measures at their own pace).

Interestingly, the Desire for Consistency response style (which emerged as a Study 2 theme) would theoretically counteract or override the mechanism by which wording/keying-based method variance would typically be expected to operate. By giving congruent responses to parallel items with opposite keying, respondents would minimize the extent to which their response patterns could differ across positive and negative items. Further research of this phenomenon is warranted, given the consensus among Study 2 participants that it is not uncommon.
Implications

As noted elsewhere, most of the explanations posited for the differential functioning of negative and positive items are not mutually exclusive. Contributing factors may include item characteristics, respondent characteristics, and/or contextual characteristics (e.g., the stakes and degree of structure involved in the data collection process). Regardless of the constellation of such factors that may be present in a given research situation, the strategy of balancing scales via wording/keying and scoring all items seems likely (based on a preponderance of published studies) to introduce method variance. As suggested by Marsh (1986; 1996), researchers may want to consider alternative strategies for minimizing and/or identifying potentially anomalous/invalid response patterns. For instance, certain clinical measures (e.g., the Minnesota Multiphasic Personality Inventory) include items, some negatively worded, that are intended to gauge response consistency rather than loading on a substantive subscale. For computer-administered measures, the tracking of item-level response time may allow for the identification of extreme satisficers (e.g., careless responders).

Additional strategies for collecting “better data” may include careful attention to scale instructions, item comprehensibility, respondent motivation, and data collection procedures (e.g., Crocker & Algina, 1986; Cronbach, 1950; Finney, 2001). For example, shorter and clearer items (whether positively or negatively worded/keyed) should be less conducive to confusion, frustration, impatience, fatigue, and other potential threats to validity. Regarding Likert scales, the provision of a “Don’t Know” or “N/A” option may reduce inappropriate use of the midpoint response option. Scale instructions can be written to remind participants that their responses are valued and that accurate responses
to attitude items will require both thought and time. Similarly, data collection conditions that are highly structured—for example, having participants complete measures one at a time—can yield higher-quality data (Finney, 2001).

In closing, it should be reiterated that none of the ODCS and SEE-R adaptations used in this project matched the original, published versions of those instruments. Thus caution should be exercised in drawing inferences about the properties of the original measures based on current findings. However, the Study 1 results did provide support for the presumed factor structure of the SEE-R (CTCM-) and raise concerns about the unidimensionality of the ODCS.
Appendix A

Versions of the Openness to Diversity/Challenge Scale (ODCS)

Administered in Study 1
Please respond by indicating how much you agree or disagree with each statement using the response options 1 (Strongly Disagree) to 7 (Strongly Agree).

**There are no right or wrong answers; just answer thoughtfully and honestly.**

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<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
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1. I enjoy having discussions with people whose ideas and values are different from my own.
2. The real value of a college education lies in being introduced to different values.
3. I enjoy talking with people who have values different from mine because it helps me understand myself and my values better.
4. Learning about people from different cultures is a very important part of my education.
5. The courses I enjoy the most are those that make me think about things from a different perspective.
6. I enjoy taking courses that challenge my beliefs and values.
7. Contact with individuals whose background (e.g., race, national origin, sexual orientation) is different from my own is an essential part of my college education.
8. I enjoy courses that are intellectually challenging.
Please respond by indicating how much you agree or disagree with each statement using the response options 1 (Strongly Disagree) to 7 (Strongly Agree).

**ODCS-2 (half positive wording/keying, half negative wording/keying)**

**There are no right or wrong answers; just answer thoughtfully and honestly.**

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<tr>
<td>Strongly Disagree</td>
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<td>Slightly Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
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1. I do not enjoy having discussions with people whose ideas and values are different from my own.
2. The real value of a college education lies in being introduced to different values.
3. I enjoy talking with people who have values different from mine because it helps me understand myself and my values better.
4. Learning about people from different cultures is not an important part of my education.
5. The courses I enjoy the most are those that make me think about things from a different perspective.
6. I do not enjoy taking courses that challenge my beliefs and values.
7. Contact with individuals whose background (e.g., race, national origin, sexual orientation) is different from my own is an essential part of my college education.
8. I do not enjoy courses that are intellectually challenging.
**ODCS-3 (half positive wording/keying, half positive wording/negative keying)**

Please respond by indicating how much you agree or disagree with each statement using the response options 1 (Strongly Disagree) to 7 (Strongly Agree).

**There are no right or wrong answers; just answer thoughtfully and honestly.**

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<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
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1. I try to avoid having discussions with people whose ideas and values are different from my own.

2. The real value of a college education lies in being introduced to different values.

3. I enjoy talking with people who have values different from mine because it helps me understand myself and my values better.

4. Learning about people from different cultures is an unimportant part of my education.

5. The courses I enjoy the most are those that make me think about things from a different perspective.

6. I dislike taking courses that challenge my beliefs and values.

7. Contact with individuals whose background (e.g., race, national origin, sexual orientation) is different from my own is an essential part of my college education.

8. I try to avoid courses that are intellectually challenging.
**ODCS-4 (half positive wording/negative keying, half negative wording/keying)**

Please respond by indicating how much you agree or disagree with each statement using the response options 1 (Strongly Disagree) to 7 (Strongly Agree).

There are no right or wrong answers; just answer thoughtfully and honestly.

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<td>Strongly Disagree</td>
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<td>Neither Agree nor Disagree</td>
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1. I try to avoid having discussions with people whose ideas and values are different from my own.
2. The real value of a college education does not lie in being introduced to different values.
3. I do not enjoy talking with people who have values different from mine, even if it could help me understand myself and my values better.
4. Learning about people from different cultures is an unimportant part of my education.
5. The courses I enjoy the most are not those that make me think about things from a different perspective.
6. I dislike taking courses that challenge my beliefs and values.
7. Contact with individuals whose background (e.g., race, national origin, sexual orientation) is different from my own is not an essential part of my college education.
8. I try to avoid courses that are intellectually challenging.
Appendix B

Versions of the Scale of Ethnocultural Empathy – Revised (SEE-R)

Administered in Study 1
Read each of the statements below and decide whether you agree or disagree with each statement. Mark the alternative that best describes your opinion. There are no right or wrong answers so do not spend too much time deciding on an answer. The first thing that comes to mind is probably the best response. Be sure the number on the answer sheet corresponds to the number of the statement to which you are responding.

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<tr>
<th></th>
<th>Strongly Disagree</th>
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<tr>
<td>1</td>
<td>I’m okay with me when people speak something other than standard English.</td>
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<td>2</td>
<td>I am touched by movies or books about discrimination issues faced by racial or ethnic groups other than my own.</td>
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<td>3</td>
<td>I know what it feels like to be the only person of a certain race or ethnicity in a group of people.</td>
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<td>4</td>
<td>I am patient when communicating with people from other racial or ethnic backgrounds, regardless of how well they speak English.</td>
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<tr>
<td>5</td>
<td>I am aware of institutional barriers (e.g., restricted opportunities for job promotion) that discriminate against racial or ethnic groups other than my own.</td>
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<td>6</td>
<td>I feel comfortable when people of different racial or ethnic backgrounds speak their language around me.</td>
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<td>7</td>
<td>When I know my friends are treated unfairly because of their racial or ethnic backgrounds, I speak up for them.</td>
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<td>8</td>
<td>When I interact with people from other racial or ethnic backgrounds, I show my appreciation of their cultural norms.</td>
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<td>9</td>
<td>I feel supportive of people of other racial or ethnic groups, if I feel they are being taken advantage of.</td>
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10. I get disturbed when other people experience misfortunes due to their racial or ethnic backgrounds.

11. I am likely to participate in events that promote equal rights for people of all racial and ethnic backgrounds.

12. It is easy for me to understand what it would feel like to be a person of another racial or ethnic background other than my own.

13. I can see how other racial or ethnic groups are systematically oppressed in our society.

14. It bothers me when people make racist statements against other racial or ethnic groups.

15. I recognize that the media often portrays people based on racial or ethnic stereotypes.

16. I am aware of how society differentially treats racial or ethnic groups other than my own.

17. I am able to put myself in the shoes of someone who is racially and/or ethnically different from me.

18. I feel comfortable when I am around a significant number of people who are racially/ethnically different than me.

19. It is easy for me to relate to stories in which people talk about racial or ethnic discrimination they experience in their day to day lives.
**SEE-R-2 (half positive wording/keying, half negative wording/keying)**

*Read each of the statements below and decide whether you agree or disagree with each statement. Mark the alternative that best describes your opinion. There are no right or wrong answers so do not spend too much time deciding on an answer. The first thing that comes to mind is probably the best response. Be sure the number on the answer sheet corresponds to the number of the statement to which you are responding.*

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</table>

1. It’s not okay with me when people speak something other than standard English.
2. I am touched by movies or books about discrimination issues faced by racial or ethnic groups other than my own.
3. I know what it feels like to be the only person of a certain race or ethnicity in a group of people.
4. I am not patient when communicating with people from other racial or ethnic backgrounds, regardless of how well they speak English.
5. I am aware of institutional barriers (e.g., restricted opportunities for job promotion) that discriminate against racial or ethnic groups other than my own.
6. I do not feel comfortable when people of different racial or ethnic backgrounds speak their language around me.
7. When I know my friends are treated unfairly because of their racial or ethnic backgrounds, I speak up for them.
8. When I interact with people from other racial or ethnic backgrounds, I do not show appreciation of their cultural norms.
9. I feel supportive of people of other racial or ethnic groups, if I feel they are being taken advantage of.
10. I get disturbed when other people experience misfortunes due to their racial or ethnic backgrounds.

11. I am not likely to participate in events that promote equal rights for people of all racial and ethnic backgrounds.

12. It is easy for me to understand what it would feel like to be a person of another racial or ethnic background other than my own.

13. I can see how other racial or ethnic groups are systematically oppressed in our society.

14. It does not bother me if people make racist statements against other racial or ethnic groups.

15. I recognize that the media often portrays people based on racial or ethnic stereotypes.

16. I am aware of how society differentially treats racial or ethnic groups other than my own.

17. I am not able to put myself in the shoes of someone who is racially and/or ethnically different from me.

18. I do not feel comfortable when I am around a significant number of people who are racially/ethnically different than me.

19. It is not easy for me to relate to stories in which people talk about racial or ethnic discrimination they experience in their day to day lives.
**SEE-R-3 (half positive wording/keying, half positive wording/negative keying)**

*Read each of the statements below and decide whether you agree or disagree with each statement. Mark the alternative that best describes your opinion. There are no right or wrong answers so do not spend too much time deciding on an answer. The first thing that comes to mind is probably the best response. Be sure the number on the answer sheet corresponds to the number of the statement to which you are responding.*

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<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Neither</th>
<th>Slightly Agree nor Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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</thead>
<tbody>
<tr>
<td>1. I feel annoyed when people speak something other than standard English.</td>
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<td>2. I am touched by movies or books about discrimination issues faced by racial or ethnic groups other than my own.</td>
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<td>3. I know what it feels like to be the only person of a certain race or ethnicity in a group of people.</td>
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<td>4. I get impatient when communicating with people from other racial or ethnic backgrounds, regardless of how well they speak English.</td>
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<td>5. I am aware of institutional barriers (e.g., restricted opportunities for job promotion) that discriminate against racial or ethnic groups other than my own.</td>
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<td>6. I feel irritated when people of different racial or ethnic backgrounds speak their language around me.</td>
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<td>7. When I know my friends are treated unfairly because of their racial or ethnic backgrounds, I speak up for them.</td>
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<tr>
<td>8. When I interact with people from other racial or ethnic backgrounds, I avoid showing appreciation of their cultural norms.</td>
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<tr>
<td>9. I feel supportive of people of other racial or ethnic groups, if I feel they are being taken advantage of.</td>
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</tbody>
</table>
10. I get disturbed when other people experience misfortunes due to their racial or ethnic backgrounds.

11. I am unlikely to participate in events that promote equal rights for people of all racial and ethnic backgrounds.

12. It is easy for me to understand what it would feel like to be a person of another racial or ethnic background other than my own.

13. I can see how other racial or ethnic groups are systematically oppressed in our society.

14. I am okay with people making racist statements against other racial or ethnic groups.

15. I recognize that the media often portrays people based on racial or ethnic stereotypes.

16. I am aware of how society differentially treats racial or ethnic groups other than my own.

17. It is difficult for me to put myself in the shoes of someone who is racially and/or ethnically different from me.

18. I feel uncomfortable when I am around a significant number of people who are racially/ethnically different than me.

19. It is difficult for me to relate to stories in which people talk about racial or ethnic discrimination they experience in their day to day lives.

************************************************************************
**SEE-R-4 (half positive wording/negative keying, half negative wording/keying)**

Read each of the statements below and decide whether you agree or disagree with each statement. Mark the alternative that best describes your opinion. There are no right or wrong answers so do not spend too much time deciding on an answer. The first thing that comes to mind is probably the best response. Be sure the number on the answer sheet corresponds to the number of the statement to which you are responding.

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</thead>
<tbody>
<tr>
<td>1</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
<td>Neither Agree nor Disagree</td>
<td>Slightly Disagree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

1. I feel annoyed when people speak something other than standard English.
2. I am not touched by movies or books about discrimination issues faced by racial or ethnic groups other than my own.
3. I do not know how it feels to be the only person of a certain race or ethnicity in a group of people.
4. I get impatient when communicating with people from other racial or ethnic backgrounds, regardless of how well they speak English.
5. I am not aware of institutional barriers (e.g., restricted opportunities for job promotion) that discriminate against racial or ethnic groups other than my own.
6. I feel irritated when people of different racial or ethnic backgrounds speak their language around me.
7. When I know my friends are treated unfairly because of their racial or ethnic backgrounds, I do not speak up for them.
8. When I interact with people from other racial or ethnic backgrounds, I avoid showing appreciation of their cultural norms.
9. I do not feel supportive of people of other racial or ethnic groups, even if I feel they are being taken advantage of.
10. I do not get disturbed when other people experience misfortunes due to their racial or ethnic backgrounds.

11. I am unlikely to participate in events that promote equal rights for people of all racial and ethnic backgrounds.

12. It is not easy for me to understand what it would feel like to be a person of another racial or ethnic background other than my own.

13. It’s not clear to me that other racial or ethnic groups are systematically oppressed in our society.

14. I am okay with people making racist statements against other racial or ethnic groups.

15. I do not think that the media often portrays people based on racial or ethnic stereotypes.

16. I do not believe that society differentially treats racial or ethnic groups other than my own.

17. It is difficult for me to put myself in the shoes of someone who is racially and/or ethnically different from me.

18. I feel uncomfortable when I am around a significant number of people who are racially/ethnically different than me.

19. It is difficult for me to relate to stories in which people talk about racial or ethnic discrimination they experience in their day to day lives.
Appendix C

Version of the Openness to Diversity/Challenge Scale (ODCS)

Administered in Study 2
Think-Aloud Questionnaire

Please respond by indicating how much you agree or disagree with each statement using the response options 1 (Strongly Disagree) to 7 (Strongly Agree).

There are no right or wrong answers; just answer thoughtfully and honestly.

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<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
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<td>Slightly Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

1. I enjoy having discussions with people whose ideas and values are different from my own.
2. Learning about people from different cultures is not an important part of my education.
3. The courses I enjoy the most are those that make me think about things from a different perspective.
4. I try to avoid having discussions with people whose ideas and values are different from my own.
5. Learning about people from different cultures is an important part of my education.
6. The courses I enjoy the most are not those that make me think about things from a different perspective.
7. I do not enjoy having discussions with people whose ideas and values are different from my own.
8. Learning about people from different cultures is an unimportant part of my education.

9. The courses I enjoy the least are not those that make me think about things from a different perspective.

10. I do not mind having discussions with people whose ideas and values are different from my own.

11. Learning about people from different cultures is not an unimportant part of my education.

12. The courses I enjoy the least are those that make me think about things from a different perspective.
Appendix D

Instructions and Training Materials Used in Study 2
Researcher Introduction/Practice/Instructions

I’m going to ask you to complete a short questionnaire. As you are responding to each statement, I’d like you to think aloud—that is, say all the things that go through your mind as you’re choosing your answer. I’ll demonstrate that process using the first statement on this practice questionnaire.

Please respond by indicating how much you agree or disagree with each statement using the response options 1 (Strongly Disagree) to 7 (Strongly Agree).

There are no right or wrong answers; just answer thoughtfully and honestly.

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<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree nor Disagree</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

1. I’m an impulsive person.
2. I tend to remember important meetings and appointments.
3. I’m an organized person.
4. I’m usually able to pay attention during conversations.

OK, I see that the response scale goes from 1 to 7, with these choices (SD > SA). The first statement says, “I’m an impulsive person.” Well, what does that mean? That I do or say things without thinking about them first. I can definitely think of times when I’ve done that. So maybe I don’t totally agree with that statement, but it’s sometimes true. So my answer will be 5 (Slightly agree).
That example was just one way people might think through their answers. There's no "right" way to do it. I just want you to say all the things that go through your mind as you're choosing your answers. Does the thinking-aloud thing make sense? OK, you go ahead and try the next couple.

[Give feedback/clarification/encouragement as needed for items 2 and 3. If additional practice is needed, item 4 can be used.]

Now I’m going to turn on the recorder and we’ll move on to the real questionnaire. Remember to talk out loud—say everything you’re thinking as you figure out your answer choices. You don’t have to write down your answers, because they’re not the focus of the study. I’m more interested in the process by which you reach your answers. Does that make sense? OK, one thing you’ll notice about this questionnaire is that some of the statements appear several times with slightly different wording. Don’t worry about trying to be consistent. Just process each statement as if it’s the first one you’ve answered.

[During process, can prompt by saying, Remember to tell me what you’re thinking.]
Brief Structured Interview Questions

[Administer as soon as the 12 ODCS statements are finished.]

Great, thank you! We’re almost done, but before you go back to the other room I want to ask you a couple of quick questions. And I’ll keep the recorder on if that’s OK, so I don’t forget your answers.

First, were there any of these that you found confusing or difficult to process? Which one(s)? Why?

OK, now re-read #1 and #4 (pause). Do you feel like they mean the same thing? Why (not)? Does one seem more extreme than the other? If so, why? Can you imagine a situation in which somebody might disagree with both #1 and #4?

Next, look at #3 and #6 (pause). Did one of those seem easier to process than the other one? Why (not)? If you were just filling out this questionnaire on your own—not as part of a study—would you feel like you had to give consistent answers for those? That is, if you chose Agree for #3, and then you got down to #6, would you think, “Oh, #6 is basically the opposite of #3, so I should choose Disagree”?

Thank you very much. Do you have any questions about anything?

[Turn off recorder.]
Appendix E

“Golden Ticket” Used to Recruit Study 2 Participants
Dear _________________________,

Instead of participating in the regularly scheduled Assessment Day activities, you have been selected to participate in a special research study today! The research is designed to help us understand the thinking processes involved in completing assessment tests and questionnaires. In short, we’ll be asking you to help us make our assessment measures better. Please gather your belongings and report to room _______ immediately after reading this message. Participation in the research will meet all of the requirements for Assessment Day. Once you arrive at room _______, we will describe the research in more detail and you will have the opportunity to either accept or decline participation, as well as the chance to ask any questions you might have about the research. We look forward to hearing what you have to say!
Appendix F

Correlation Matrices for Datasets

Collected in Study 1
### Table F1
**Correlations for the ODCS-1 and ODCS-2 Datasets**

<table>
<thead>
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<th>Item</th>
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*Note.* Correlations for the ODCS-1 sample \(N = 502\) are presented above the diagonal. Correlations for the ODCS-2 sample \(N = 523\) are presented below the diagonal.

### Table F2
**Correlations for the ODCS-3 and ODCS-4 Datasets**

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*Note.* Correlations for the ODCS-3 sample \(N = 519\) are presented above the diagonal. Correlations for the ODCS-4 sample \(N = 508\) are presented below the diagonal.
Table F3

*Correlations for the SEE-R-1 and SEE-R-2 Datasets*

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*Note.* Correlations for the SEE-R-1 sample (N = 540) are presented above the diagonal. Correlations for the SEE-R-2 sample (N = 532) are presented below the diagonal. Scale key: ACD = Acceptance of Cultural Differences; EPT = Empathic Perspective Taking; EA = Empathic Awareness; EFE = Empathic Feeling and Expression.
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**Note.** Correlations for the SEE-R-3 sample (N = 524) are presented above the diagonal. Correlations for the SEE-R-4 sample (N = 512) are presented below the diagonal. Scale key: ACD = Acceptance of Cultural Differences; EPT = Empathic Perspective Taking; EA = Empathic Awareness; EFE = Empathic Feeling and Expression.
Appendix G

Parameter Estimates

from Selected Study 1 CFA Models
Table G1
*Completely Standardized Parameter Estimates and Error Terms from ODCS-1 Model 1*

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*Note.* For Model 1, no method factor was posited.

Table G2
*Completely Standardized Parameter Estimates and Error Terms from ODCS-2 Model 5*

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*Note.* In condition 2, items 1, 4, 6, and 8 were negatively keyed and worded.
Table G3

*Completely Standardized Parameter Estimates and Error Terms from ODCS-3 Model 5*

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*Note.* In condition 3, items 1, 4, 6, and 8 were negatively keyed. 

nsNot statistically significant ($p > .05$).

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Table G4

*Completely Standardized Parameter Estimates and Error Terms from ODCS-4 Model 1*

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*Note.* In condition 4, all items were negatively keyed and four (2, 3, 5, and 7) were negatively worded. For Model 1, no method factor was posited.
Table G5

*Completely Standardized Parameter Estimates and Error Terms from SEE-R-1 Model 1*

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*Note.* For Model 1, no method factor was posited.
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<sup>ns</sup>Not statistically significant (<i>p</i>>.05).

*Note.* In condition 2, items 1, 4, 6, 8, 11, 14, and 17-19 were negatively keyed/worded.
### Table G7
*Completely Standardized Parameter Estimates and Error Terms from SEE-R-3 Model 5*

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*Note.* In condition 2, items 1, 4, 6, 8, 11, 14, and 17-19 were negatively keyed.
Table G8
*Completely Standardized Parameter Estimates and Error Terms from SEE-R-4 Model 1*

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*Note.* In condition 4, all items were negatively keyed and ten (2, 3, 5, 7, 9, 10, 12, 13, 15, and 16) were negatively worded. For Model 1, no method factor was posited.
References


Magazine, S., Williams, L., & Williams, M. (1996). A confirmatory factor analysis examination of reverse coding effects in Meyer and Allen’s Affective and


