The Impact of Language and Response Format on Student Endorsement of Psychological

Misconceptions

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Abstract

The present study examined the possibility that the language and response format used in self-report questionnaires influences how readily people endorse misconceptions. Four versions of a forty-item misconception test were administered to European (n = 281) and North American (n = 123) psychology and non-psychology undergraduates. Response format and ambiguity of phrasing were manipulated. Results indicate that misconception endorsement was strongly influenced by both question phrasing and response format, with students showing more agreement and less disagreement when misconceptions were ambiguously phrased or a 7-point rating scale used. These procedure-related effects were observed for European and North American psychology and non-psychology students alike irrespective of the amount of time they had spent studying the subject. Implications for designing pedagogical procedures to assess student's disciplinary knowledge and beliefs are discussed.

Keywords: student misconceptions, psychology, questionnaire

The Impact of Language and Format on Student Endorsement of Psychological Misconceptions

Students do not arrive to the study of psychology as blank slates but are often equipped with varying levels of inaccurate or incomplete knowledge and beliefs about the core concepts (e.g., "Psychology is common sense") and empirical findings of the discipline (e.g., "The polygraph test accurately detects lies"; Kowalski & Taylor, 2009; Lilienfeld, 2011). These erroneous beliefs, often labeled misconceptions, are not unique to psychology and have been documented in a wide range of academic domains including biology (Klymkowsky & Garvin-Doxas, 2008), physics (Hein, 1999) and chemistry (Stefani & Tsaparlis, 2009). With respect to psychology, misconceptions have been found to be both widespread and resistant to change where standard instructional strategies are employed (e.g., Gardner & Dalsing, 1986; Lamal, 1995; Landau & Bavaria, 2003). Although misconceptions decrease as the number of psychology courses taken increases, upper level undergraduates still uncritically accept as true a variety of erroneous claims despite their training in the core concepts of the discipline (Glass, Bartels, Ryan & Stark-Wroblewski, 2008; Standing & Huber, 2003). Consequently, many students may depart introductory psychology courses with a variety of misconceptions intact and maintain them throughout their undergraduate and graduate studies (Arntzen, Lokke, Lokke, & Eilertsen, 2010; Gardner & Hund, 1983).

For several decades now, researchers have almost exclusively relied on self-report questionnaires to index misconceptions about psychology in the general public (Furnham, Callahan & Rawles, 2003), educators (Gardner & Hund, 1983), undergraduate and graduate students (Arntzen et al., 2010; Kowalski & Taylor, 2009). More often than not, this work has focused on undergraduate (introductory) students, whose endorsement of claims such as "It is better to express anger than to hold it in", "Psychiatric hospital admissions increase during a full

moon" and "People's response to inkblot tests tell us a lot about their personalities" varies from 28% to 71% agreement across studies (see Lilienfeld, Lynn, Ruscio & Beyerstein, 2009). On the one hand, variation across studies in the number of misconceptions that students affirm may, in part, reflect differences in the number of psychology courses taken (Standing & Huber, 2003), academic performance (Kuhle, Barber & Bristol, 2009) as well as critical thinking skills (McCutcheon, 1991; Taylor & Kowalski, 2004). On the other hand, the degree to which students purportedly agree with misconceptions may also be driven by particular features of the self-report procedures themselves, such as question ambiguity and the response format used. Where this is the case, misconception endorsement could reflect response biases or misunderstandings rather than faulty beliefs and knowledge.

For illustration purposes, consider the following claim: "*Most people use only 10% of their potential brain power*". When phrased in this manner as many as 77% of students agree with this statement (Landua & Bavaria, 2003). Yet when asked "what percentage of their potential brain power do you think most people use" and given 21 different choices ranging from 0% to 100%, students responses varied significantly, from "5% of the brain" to "90% of the brain" (Higbee & Clay, 1998). Indeed, the difficulty with devising a list of clear and unambiguous test items has been noted repeatedly in the literature. Griggs and Ransdell (1987) found that out of the 60 items consistently employed across studies, only 15 could be reliably classified as misconceptions according to their criteria (see also Brown, 1984; Ruble, 1986). At the same time, questionnaires that rely on a True-False response format may also artificially inflate misconception endorsement for two reasons. First, given the complexity of psychological phenomenon and the fact that empirical findings are often subject to further qualification, many misconception items may be partially incorrect but not entirely false. They may contain a 'kernel

of truth' or be true some of the time, but not generally. Consider the notion that "Opposites attract". Although we typically select mates that are similar to ourselves in personality, attitudes and (perceived) attractiveness, small differences between romantic partners may contribute to a more interesting and varied relationship (e.g., Buston & Emlen, 2003; Hitsch, Hortaçsu & Ariely, 2009). Gardner and Hund (1983) found that when they asked (non)social science faculty to register their (dis)agreement with a series of statements using a five point scale, the majority of misconceptions were rated as "mostly false" rather than "completely false", and several misconceptions as "partly false" or "partly true". Second, it may also be the case that the True-False format fails to distinguish between strongly held misconceptions and responses due to uncertainty or guessing. For instance, including an 'I don't know/no opinion' option in a 60 item True-False misconception questionnaire resulted in students reporting uncertainty for 12% of responses (Gardner & Dalsing, 1986).

Recognizing these limitations, a number of researchers have rejected True-False designs in favor of a multiple choice format that, arguably, provides a more sensitive assessment of the direction and relative strength of beliefs, as well as responding due to uncertainty or guessing (e.g., Assanand, Pinel, Lehman, 1998; Lyddy & Hughes, 2011; Thompson & Zombonga, 2004). Others have opted for scales that assess how confident students are in their mistaken beliefs (Landau & Bavaria, 2003; Taylor and Kowalski, 2004). Despite such efforts, no study has sought to systematically investigate the impact of question ambiguity or response format in the assessment of misconceptions about psychology. Clearly, methodological issues surrounding core properties of self-report questionnaires will need to be addressed if we are to accurately identify and track the prevalence and persistence of mistaken beliefs about the discipline.

The current study

With this in mind, we set out to examine whether the language or response format used in self-report questionnaires influences student endorsement of misconceptions. We designed and administered four different versions of our procedure—each containing the same test items—to European and North American psychology and non-psychology undergraduates. Response format was varied such that participants registered their (dis)agreement using a True-False-Unsure or 7-point rating scale ranging from 1 (*Strongly Disagree*) to 7 *(Strongly Agree)* with 4 (*Unsure*) as a mid-point. Furthermore, ambiguity of phrasing was varied so that items were deemed to be either ambiguously phrased (*"Eyewitness testimony is usually reliable"*) or non-ambiguously phrased (*"Eyewitness testimony is a highly accurate and reliable method for identifying criminal suspects"*). In doing so, we sought to identify differences in misconception endorsement that arise not from the application of inaccurate knowledge and beliefs but due to the procedure itself. If question ambiguity and response format influence task performance then similar findings should be observed for both European and North American students.

Method

Participants and design. A convenience sample of four-hundred and four psychology and non-psychology undergraduates (280 women, 124 men) participated in the current study and were recruited from a European (n = 281) and North American university (n = 123). Students were all English speaking and ranged in age from 18 to 59 years ($M = 23$, $SD = 8.6$). Of the total sample, 33% of students were first year psychology undergraduates, 17% second year students and 22% third year students. The remaining 28% were non-psychology undergraduates who had never studied the subject. The experiment employed a 2 (*Language*: Ambiguous vs. Non-ambiguous) x 2 (*Response Format*: 7-point vs. True-False-Unsure) design with both factors measured between-subjects. Although European students were not compensated for their

participation North American students did receive course credit.

Psychology misconception questionnaire. To examine the prevalence of inaccurate

beliefs about psychology, we developed a 40-item questionnaire comprised of 30 misconceptions

and 10 factually correct filler items (included to minimize demand characteristics).

Misconception items were selected from previously published sources (e.g., Kowalski & Taylor,

2009; Lilienfeld et al., 2009) and worded so that a correct response required disagreement. Four

separate versions of the procedure were constructed and administered, one to each student, with

random assignment to conditions (i.e., *True-False-Unsure Ambiguous Phrasing; True-False-*

Unsure Non-Ambiguous Phrasing; 7-point Ambiguous Phrasing; 7-point Non-Ambiguous

Phrasing). To ensure that items deemed either ambiguous or non-ambiguous differed from one

another in their precision, two versions of each misconception were pre-rated by a number of

postgraduate students known to the researchers. In each case, items were to be scored as either

"ambiguously phrased" (e.g., "*People's responses to inkblot tests can tell us about their*

personality") or "not ambiguously phrased" (e.g., "*People's responses to inkblot tests provide us*

with a valid and reliable means to assess their personality"). Overall, the former were found to

be significantly more ambiguous than the latter, $t(8) = 3.7$, $p = .01$ $\eta^2 = .6$

Procedure

Approximately three months into the academic year, students from the undergraduate

psychology program were approached and asked to complete a questionnaire "pertaining to

knowledge about psychological information". Those who agreed to participate first signed a

consent form, provided relevant demographic information (e.g., gender, age, year of study) and

were randomly assigned to complete one of four versions of the questionnaire. Participants were

allowed up to 30 minutes to read the 40 test items (i.e., 30 psychological misconceptions and 10

factually correct filler items) and register their (dis)agreement with each statement. Upon

completion, students were debriefed and thanked.

Results

Data Preparation. Although our questionnaire was comprised of 30 misconceptions and

10 filler items, only misconceptions were analyzed. Participant feedback indicated that one

misconception item was identified as ambiguous in the non-ambiguous questionnaire and thus

was removed from both versions of the procedure. Irrespective of the question phrasing or rating

format scale used, we defined a correct response as disagreement with each of the

misconceptions tested. For the 7 point questionnaire we recorded the number of items rated at 5

or above as indicating 'agreement', 3 or below as indicating "disagreement" and 4 as "unsure".

Thus for each student we calculated three scores; the average number of misconceptions they

agreed with, disagreed with and reported uncertainty about. Doing so enabled us to assess

whether question phrasing or response format differentially impacted on the degree to which

students agree, disagree or report uncertainty for misconceptions as well as directly compare

scores obtained from the 7-point and True-False-Unsure procedures.

The overall means, standard deviations and percentage agreement, disagreement and

uncertainty for European and North American students are presented in Table 1. Of the four

versions of the questionnaire, European and North American students who received the 7-Point

ambiguous version of the task affirmed the most (47-59%) and rejected the least misconceptions

(29-34%). Conversely, students who received the True-False-Unsure non-ambiguous

questionnaire affirmed the least (31-43%) and rejected the most test items (45-50%). Finally,

students reported uncertainty for 25% of items when a True-False-Unsure ambiguous procedure

was used compared to 11% on the 7-point non-ambiguous version.

To test the influence of question ambiguity, response format, university or time spent studying psychology on task performance, a series of 2 (*Ambiguous vs. Non-ambiguous*) x 2 (*True-False-Unsure vs. 7-point*) x 2(*European vs. North American*) x 4(*years studying psychology*) between-groups ANOVAs were conducted for each of the three misconception scores (*agree, disagree, unsure*). This analysis revealed a significant main effect for question phrasing, with students more likely to agree, $F(1, 403) = 5.2$, $p = .02$, $\eta_p^2 = .02$, and less likely to disagree, $F(1, 403) = 15.4$, $p = .01$, $\eta_p^2 = .04$, when misconceptions were ambiguously rather than non-ambiguously phrased (no effect emerged for uncertainty; $p =.2$). Similarly, a main effect for response format revealed that students agreed more, $F(1, 403) = 19.2$, $p = .01$, $\eta_p^2 = .05$, disagreed less, $F(1, 403) = 6.7$, $p = .01$, $\eta_p^2 = .02$, and report less uncertainty when a 7-point rating scale was employed ($p = .04$). However, analyses did not reveal any interaction between response format and question phrasing (all $ps > .2$).

In addition to these two procedural properties, task performance also differed according to the student's location of study, with North American students agreeing more, $F(1,403) = 22.2$, $p =.01$, $\eta_p^2 = .06$, and reporting less uncertainty compared to their European counterparts, $F(1,403) = 13.2$, $p = .01$, $\eta_p^2 = .04$. That said, European and North American students did not differ with respect to their disagreement with test items ($p = .08$). Finally, the number of misconceptions students agreed, $F(3, 401) = 8.4$, $p = .01$, $\eta_p^2 = .07$, as well as disagreed with, $F(3,401) = 13.3$, $p = .01$, $\eta_p^2 = .1$ differed according to the number of years they had spent studying psychology (no between groups differences emerged for uncertainty scores; $p = .8$). Post hoc tests revealed that first year psychology and non-psychology undergraduates were equally likely to agree ($p = .9$), and disagree with test items ($p = .7$). In contrast, second year psychology students affirmed less and rejected significantly more test items than either group (all

*p*s < .01) while third year psychology students rejected more misconceptions than their first year, second year or non-psychology counterparts (all *p*s < .01). Perhaps most importantly in the context of the current paper, years spent studying psychology or university location did not interact with response format or question ambiguity for any of the misconception scores (all *p*s > .1).

Discussion

Student misconceptions represent an important issue for educators and researchers only insofar as they reflect a genuine, general and replicable phenomenon. Meeting these three criteria requires that the procedures employed in this area provide an accurate and sensitive index of student's knowledge and beliefs. Overall, our results show that, under certain conditions, both the language and response format used in misconception questionnaires can independently inflate students' self- reported acceptance of erroneous claims about psychology. For instance, although undergraduates subscribed to a number of psychological misconceptions, they agreed more and disagreed less when test items were ambiguously rather than non-ambiguously phrased. Likewise, when a 7-point scale rather than a True-False-Unsure format was employed students affirmed more and rejected less of the misconceptions. Finally, students reported greater uncertainty about test items when a True-False format was used relative to a 7 point scale. These procedure-related effects were observed for European and North American psychology and non-psychology students alike irrespective of the amount of time they had spent studying the subject. Although the effect sizes associated with response format and question ambiguity in the current study are modest, they do reveal that procedural properties of the assessment procedure play a role in student endorsement of erroneous psychological claims.

These findings have several important implications for the assessment of student

knowledge and beliefs about psychology. First, many (if not most) of the misconception

questionnaires used to date have been constructed using items from Vaughan's (1977) Test of

Common Beliefs (TCB), instructional texts, course content or instructors' manuals (e.g., Brown,

1983; Lamal, 1979; Landau Bavaria, 2003) and used a True-False response format (e.g.,

Arntzen et al., 2010; Gutman, 1979; Kowalski & Taylor, 2009; Taylor & Kowalski, 2004). In

each case, the rationale for question phrasing, response format as well as inclusion or exclusion

of specific test items is typically based on the subjective judgment of the researcher rather than

any clearly specified criteria. In light of the current findings, it is entirely possible that the

manner in which questionnaires have so far been constructed has in part contributed to

unsystematic variations in misconceptions observed from study to study (i.e., a lack of

measurement reliability across procedures). Therefore we recommend that researchers and

educators interested in assessing student knowledge and beliefs about psychology specify the

source and phrasing of their test items, rationale for their inclusion and response format used.

Doing so will enable others to identify questionnaires that provide an accurate and reliable

account of misconceptions as well as a means for choosing between different tools. To aid in this

process we have included the non-ambiguous misconceptions as well the two response formats

employed in the current study (see Appendix). These may prove useful for instructors to deploy

as in-class assignments or as a brief assessment of students beliefs about the discipline.

      Second, there is a clear need to ascertain the utility of alternative procedures above and

beyond self-report questionnaires. Although numerous techniques have been devised to index

misconceptions in other scientific domains, including computer assessment (Gregg et al., 2001),

interviews (Hamza & Wickman, 2008), open-ended questions (Klymkowsky & Garvin-Doxas,

2008) and concept-mapping (Liu, Lin, & Tsia, 2009), these procedures have yet to be used

consistently in the study of psychological misconceptions. Future work could also include one or more of these procedures when indexing student misconceptions and compare task performance for the same student population using existing questionnaires. Adopting such a strategy would help educators to better identify legitimate methods of assessing their student's knowledge and beliefs.

It should be noted that while procedural differences may contribute to variations in misconception endorsement, agreement with erroneous claims about the discipline also differs due to genuine features of the students sampled. In the current study, for instance, the ability to identify and reject erroneous claims was significantly related to the number of years students had spent studying psychology. Second year psychology students rejected more items than their first year counterparts or non-psychology students while third year psychology students performed better than those in second year or below. These findings are consistent with past work indicating that while misconceptions decrease as the number of psychology courses taken increases, upper level undergraduates still uncritically accept as true a variety of erroneous claims (Glass, Bartels, Ryan & Stark-Wroblewski, 2008; Standing & Huber, 2003). Although the observed reduction in misconception endorsement could be the product of increased training in the core concepts and values of psychological science, such effects could equally have emerged due to differences in critical thinking ability (Kowalski & Taylor, 2004; McCutcheon, Apperson, Hanson & Wynn, 1992) or the development of a general bias towards disagreeing with overarching claims about psychological phenomena. Replicating the current work, while controlling for the aforementioned variables, would serve to provide a more fine grained analysis of not only the methodological but student specific factors responsible for changes in misconceptions.

At the same time there were also notable differences in task performance between the two

educational institutions sampled, with North American students demonstrating greater acceptance of misconceptions and less uncertainty relative to their European counterparts. On the one hand, it is quite possible that certain misconceptions are more/less prevalent in other countries and cultures, and that some of those that are prevalent in North America are not elsewhere. Future work could more closely examine the impact of cultural and geographical contexts on student beliefs, particularly given that the majority of published work has focused on North American students to date. On the other hand, methodological differences between our two samples could also account for the obtained findings. Specifically, all European students completed a pencil-and-paper version of the questionnaire while all North American students were administered an electronic version of the task. A replication of the current study that counterbalanced questionnaire format across different countries/cultures would more accurately map out the relative contribution of cultural versus methodological factors in misconception endorsement.

In conclusion, our findings draw attention to the dual influences of language and response format when constructing and interpreting the findings of misconception questionnaires. We suggest that features of the procedures used to capture student misconceptions may inadvertently lead researchers and educators alike to overestimate their prevalence. In the current study, for instance, we found that a 7 point response scale - as well as ambiguously phrased items - may serve to magnify the degree to which students "endorse" erroneous beliefs about the discipline relative to a True-False-Unsure scale or non-ambiguous items. Consequentially, greater empirical attention may need to be focused on core properties of self-report procedures if we are to better identify the factors responsible for shaping, maintaining and changing psychological misconceptions.

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Table 1.

Mean, standard deviations and percentage of misconceptions European and North American students agreed with, disagreed with and reported uncertainty for as a function of response format and question ambiguity.

	Misconception Agree			Misconception Disagree			Misconception Unsure		
	M	SD	%	M	SD	%	M	SD	%
European Students									
True-False Ambiguous	11.6	5.1	40%	10.5	4.8	36%	7.0	4.6	24%
True-False Non-Ambiguous	8.9	4.5	31%	14.5	5.4	50%	5.3	3.7	19%
7-Point Ambiguous	13.5	5.6	47%	9.8	5.2	34%	5.2	3.8	18%
7-Point Non-Ambiguous	11.6	5.9	40%	13	5.8	45%	4.2	3.0	15%
North American Students									
True-False Ambiguous	13.2	4.2	46%	11.5	3.8	40%	3.9	3.1	14%
True-False Non-Ambiguous	12.5	4.2	43%	13	4.1	45%	3.6	3.5	12%
7 point Ambiguous	17.1	3.6	59%	8.3	3.9	29%	3.6	2.4	12%
7 Point Non-Ambiguous	14.7	4.7	51%	11	5.2	38%	3.4	2.8	11%

Appendix

Misconception items defined as non-ambiguous in the current study

1. People predominantly use either the left-side or the right-side of their brain.

2. The more people present at an emergency the higher the probability is that someone will intervene.

3. People only use 10% of their brain's total processing capability.

4. The vast majority of autistic individuals possess savant abilities (i.e. one or more isolated pockets of remarkable intellectual ability).

5. People with amnesia always forget all the details of their early life.

6. Eyewitness testimony is a highly accurate and reliable method for identifying criminal suspects.

7. Academic performance is significantly improved when teaching styles are matched to student learning styles.

8. A person's handwriting is a valid and reliable indicator of their personality traits

9. Thinking positive thoughts reduces the development of cancer.

10. A defining characteristic of a person with schizophrenia is that they have multiple personalities

11. Dream interpretation is a valid and reliable method for revealing people's unconscious motivations and desires.

12. Within the past 20 years there has been a significant increase in the rate of children developing infantile autism.

13. Hypnosis is an altered state of consciousness that is qualitatively distinct from normal waking consciousness.

14. 80% of our brain's potential processing capability goes unused.

15. People's responses to inkblot tests provide us with a valid and reliable means to assess their personality.

16. Every dying person passes through a universal series of psychological stages (i.e. denial, anger, bargaining, depression and anger).

17. We can accurately and reliably determine if another person is lying by examining their facial expressions.

18. For a majority of people, adolescence is characterised as a period of intense emotional distress and turmoil.

19. A majority of people experience a mid-life crisis between the ages of 40 and 60.

20. People always repress painful or traumatic memories.

21. On average, people are romantically attracted to individuals who differ from them in their personality, interests, and attitudes.

22. People with a history of child sex abuse frequently develop severe personality disturbances in adulthood.

23. Hypnosis is a reliable and valid technique for retrieving forgotten memories.

24. Memory works like a tape recorder or video camera, accurately recording the events we experience.

25. Playing classical music (e.g., Mozart) to infants and children produces long-lasting increases in their intelligence.

26. The polygraph ("lie detector") test is a highly accurate and valid method for identifying dishonesty.

27. A majority of people will not follow instructions to hurt another person from an authority figure.

28. People's attitudes are always highly predictive of their behaviours.

29. Children raised in gay or lesbian families almost always grow up gay or lesbian themselves.

Example of the response scale used in the True-False-Unsure procedure.

Please circle either "T" for True or "F" for False or "U" for Unsure next to each item.

T   F   U   1. People predominantly use either the left-side or the right-side of their brain

Example of the response scale used in the 7-point procedure.

1. People predominantly use either the left-side or the right-side of their brain.

1	2	3	4	5	6	7
Strongly Disagree	*Moderately Disagree*	*Slightly Disagree*	*Unsure*	*Slightly Agree*	*Moderately Agree*	*Strongly Agree*