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Misconceptions and Conceptual Change in Undergraduate Psychology Students:

The Case of Human Uniqueness¹

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Abstract

Ten upper-division majors and 10 lower-division prospective majors in Psychology, Arts and Humanities, and Science ($n=60$) were interviewed regarding their ratings and justifications of the similarity between human beings and animals (particularly great apes) overall and with regard to specific characteristics (e.g., rationality, consciousness, and emotions). Ratings were made on a 7-point scale and their justifications were coded as more perceptually-based (i.e., literal similarity), conceptually-based (i.e., relational analogy), or as a mixture. Compared to others, only psychology students' justifications showed an increase from lower- to upper-division in their use of relational analogies. The increase occurred for all features. The discussion addressed the significance of psychology students learning to make relational analogies about psychological phenomena for their understanding of the discipline.

Misconceptions and Conceptual Change in Undergraduate Psychology Students:
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It is well documented that students hold misconceptions about the discipline of psychology (Friedrich, 1996; Gardner & Dalsing, 1986; Kowalski & Taylor, 2006; McCutcheon, 1991; Taylor & Kowalski, 2004; Thompson & Zamboanga, 2004). Many suppose that the misconceptions stem from the way psychology is depicted in the popular culture (Gardner & Dalsing, 1986; Shaffer, 1997; Stanovich, 2007; Thompson & Zamboanga, 2004; Taylor & Kowalski, 2004; Wood, Jones, & Benjamin, 1986). It is difficult to see how anyone can hold a view of psychology as anything but a frivolous pseudoscience if exposed only to media psychologists (such as Dr. Laura and Dr. Phil), ineffective self-help books, and parapsychology web sites.²

Misconceptions about the discipline may arise not only from media and popular culture, but also from students' everyday or naïve theory about the mind, called *folk psychology* (D'Andrade, 1987; Premack & Woodruff, 1978; Wimmer & Perner, 1983). Such a theory allows for the prediction, explanation, and understanding of behavior, typically by attributing mental states (e.g., thoughts, beliefs, desires, and intentions) to oneself and others (Premack & Woodruff, 1978). Folk psychology involves explaining behavior by assuming a rational agent acting consistently with respect to its mental states, i.e., an agent *doing* what it *thinks* will bring about what it *wants* (Bennett, 1991; Dennett, 1971). Although there are cultural variations in these theories (Lillard, 1998), folk accounts of mind are thought to be an evolutionarily-shaped, largely species-specific, and innate ability to appreciate the mind as an intentional system (Baron-Cohen, 1999; Bloom, 2004; Dennett, 1971).

Like folk theories of other disciplines (i.e., folk biology and folk physics), folk psychology is assumed to be composed of a core set of explanatory concepts and causal beliefs (Carey, 2000; Gopnik & Wellman, 1992; Nersessian, 1989; Perner, 1996; Welman & Gelman 1993). Also, like folk theories of other disciplines, the tenets of folk psychology are seen by philosophers and psychologists as scientifically flawed. Notably, empirical evidence can be used to challenge the presumption that human beings are rational (Gilovich, 1991; Kahneman, 2003; Nisbett & Ross, 1980; Ross, 1977), can know reliably the contents of their own mind (Andersen, Moskowitz, Blair, & Nosek, 2007; Ericsson & Simon, 1980, 1993; Nisbett & Wilson, 1977), and can be unbiased when inferring the contents of others' minds (Pronin, Gilovich, & Ross, 2004; Ross, 1977). Folk psychology has been criticized not simply as being false, but also for being unscientific (Churchland, 1981; Dennett, 1971, 1991; Stich, 1983). The scientific status of mental states can be questioned for being conceptually or ontologically incompatible with cognitive or neuroscientific explanations in the discipline (see Greenwood 1991 and Stich & Ravenscroft, 1994 for a review).

According to science educators, folk theories and the misconceptions about a scientific discipline that they generate are believed to be an important impediment to successful and effective student learning of the discipline (Driver & Easley, 1978; Posner, Strike, Hewson, & Gertzog, 1982; Viennot, 1979). Although there are a number of theoretical accounts of how and why students' misconceptions impose a resistance to learning (cf. Limon & Masson, 2002), each assumes that in order for students to learn basic ideas of a discipline, they must go beyond their initial misconceptions. For example, students in college-level introductory physics classes must overcome a misconception about gravity as an internal disposition of objects to fall, in order to correctly grasp it as a relational force that is proportional to the objects' masses and inversely

proportional to distances between them (Amsel, Savoie, Deak & Clark, 1991; Gunstone & White, 1991; Reiner, Chi, & Resnick, 1988; Reiner, Slotta, Chi, & Resnick, 2000). Theoretically, at least, psychology students who hold fast to folk psychology would be similarly challenged to learn scientific psychology, which is based on the factors or forces other than mental states impacting behavior. For example, psychology students' grasp of stimulus control, cultural influences, cognitive biases, and genetic dispositions would seem to require that they overcome their misconception that behavior is explained exclusively by mental states.

The long history of research on students' misconceptions about psychology (c.f., Nixon, 1925) does not necessarily assess students' folk theories of psychology as described above. Even those who claim to be studying students' everyday or naïve theories of the discipline have employed items that do not seem to be directly related to preferring mental state explanations over other explanatory forms. As an example, consider one item used on Thompson and Zamboanga's (2004) misconception questionnaires (e.g., *Eyewitness memory for events is vivid and accurate, and resistant to misleading suggestion*). The item does not directly index whether students subscribe to folk psychology or reject scientific psychology. In addition, the process of revising such a misconception or others like it, does not seem to require a conceptual change from folk to scientific theories of mind (for a similar argument, see Friedrich, 1996). The fact that the items used to test psychology students' misconceptions do not directly assess their commitment to folk or scientific psychology may explain the finding that such questionnaires are at best equivocal in predicting student grades in psychology classes (Gardner & Dalsing, 1986; Kowalski & Taylor, 2006; McCutcheon, Apperson, Hanson, & Wynn, 1992; McKeachie, 1960; Miller, Wozniak, Rust, Miller, & Slezak, 2002; Taylor & Kowalski, 2004; Thompson & Zamboanga, 2004), despite the theoretical assumption that holding such misconceptions is an

impediment to learning (Driver & Easley, 1978; Posner, Strike, Hewson, & Gertzog, 1982; Viennot, 1979).

The present study addresses the nature and change in psychology students' misconceptions that are specifically based on their holding a folk theory of mind. It has been argued that folk psychology gives rise to a view of humans as unique among the species because of the assumed qualities of the human mind. Although acknowledged as shaped by evolutionary forces, the adoption of a folk psychology supports a view of the mind as non-material, spiritual, and eternal; that is, as possessing a soul (Atran, 2003; Bering, 2007; Boyer, 2001; Bloom, 2004). According to Bloom (2004):

At the core of our attribution of souls is a belief in the existence of entities with mental lives. Their actions are not to be explained in terms of brute physical forces, the way one would understand the movement of a rock or baseball, but are instead the results of what they know and what they desire. (p. 223)

There is indirect evidence that psychology students hold beliefs that humans are unique due to the qualities of mind assumed by folk psychology. For example, introductory psychology students in the U.S., Australia, and Germany subscribe to dualist views of mind-body relations, which are compatible with immaterial folk psychological views of mind and incompatible with much of contemporary neuroscience, psychology, and philosophy of mind (Fahrenberg & Cheetham, 2000; Stanovich, 1989; Svenson, 1992). Psychology students also hold beliefs in paranormal phenomena (Messer & Griggs, 1989), including in life after death (Vitulli & Luper, 1998) which is consistent with folk psychological spiritual and eternal views of mind (Bering, 2007; Bloom, 2004; Boyer, 1991). College students judge that one consequence of accepting the evolutionary account of human origins is that it undermines qualities that make human beings

special, including having a sense of a purpose in life, self-determination, and spirituality (Brem, Ranney, & Schindel, 2003). A view of the mind as purposeful and spiritual is also an assumption of the folk theory of mind (Bering, 2007; Bloom, 2004; Boyer, 1991). Indeed, Evans (2001) found that college-educated adults who believed in evolution regarding the origin of dinosaurs tended to hold creationist explanations regarding the origin of humans. Evans (2001) used the term “human exception” to refer to the belief that human beings are not subject to the same evolutionary process which are assumed to operate on other animals.

In the present study, we further explored the extent to which, over the course of their undergraduate career, psychology students reject the assumption that human beings are unique among the species. Specifically, we examined whether students believed that properties of the human mind can be extended to animal minds. A belief in folk psychology would support the conviction regarding the uniqueness of the human mind and give rise to judgments that human and animal minds are not similar. Lower-division potential psychology majors (freshmen and sophomores) judgments and justifications of the similarity between human beings and animals (particularly great apes) were compared to those of upper-division psychology majors (juniors and seniors). Judgments and justifications were made regarding whether human and animal minds are similar in terms of rationality, emotionality, and consciousness. These properties were selected because they are closely aligned with folk psychology. However, in each case, even Introductory Psychology textbooks (e.g. Myers, 2007; Weiten, 2006) discuss evolutionary evidence suggesting that such qualities exist by virtue of having similar functions in animals as they do in human beings.

Differences in upper- and lower-division psychology students’ reasoning was compared to Arts and Humanities and Science students of similar levels. No difference in similarity

judgments or justifications was expected from lower- and upper-division Arts & Humanities and Science students as it was not assumed that they would encounter discipline-specific evidence to change their whether and how they attribute qualities of the human mind to animals. In contrast, it was predicted that there would be significant differences between lower- and upper-division psychology students in both similarity judgments and justifications. We predicted that lower-division psychology students would be reluctant to attribute folk psychological qualities of human minds to animals based on a lack of any literal similarity between them. Gentner & Wolff (2000) define literal similarity as largely perceptually-based judgments that two entities share a particular physical property in common. Such judgments reflect a concrete analysis of the relation between entities often made by novices who lack knowledge about conceptually deeper relations between the entities (Gentner, Brem, Ferguson, Markman, Levidow, Forbus, & Wolff, 1997, Gentner & Wolff, 2000).

It was also predicted that upper-division psychology students would be more likely to make judgments extending a greater degree of similarity between humans and animals. Moreover, it was expected that such judgments would be made on the basis of relational analogical rather than literal similarity arguments. According to Gentner & Wolff (2000), relational analogies recognize that although there may not be a physical similarity between the entities, there may be similar conceptual or functional relations between them. Similarity judgments based on relational analogy are more sophisticated than those based on literal similarity, because the former requires non-perceptually-based coordination of the relations in each domain in which an analogy is being forged (Gentner et al. 1997; Gentner & Wolff, 2000). Rational similarity arguments are often presented in psychology textbooks and articles regarding how best to conceptualize the relations between humans and animals. For example, rather than

presenting animals and humans as having the same emotions, it is argued that emotions are seen as having similar functions, features, or relations for animals as they do for humans (c.f., Demoulin, Leyens, Paladino, Rodriguez, Rodriguez, & Dovidio, 2004; Real, 1991).

In summary, to assess the nature and change in psychology students' misconceptions about the discipline, the present study examined differences between upper-division majors in Psychology, Arts & Humanities, and Science and lower-division prospective majors in their ratings and justifications of the similarity between human beings and animals overall and in certain mental qualities (consciousness, rationality, and emotions). To constrain their comparisons, participants were asked to compare humans to great apes (chimpanzees, bonobos, orangutans and gorillas), with whom humans share a high degree of genetic similarity, abilities to use and modify tools, and a sense of self (Gagneux, Moore, & Varki, 2005; Povinelli & Bering, 2003; Russon & Bard, 1996; Savage-Rumbaugh, Shanker, & Taylor, 1998; Suddendorf & Whiten, 2001). It was predicted that only psychology students' judgments and justifications of the relation between human beings and great apes will show increasing similarity and sophistication, reflecting a rejection of the tenets of folk psychology in favor of scientific psychology.

Method

Participants

Participants consisted of freshmen and sophomores (lower-division students) and juniors and seniors (upper-division students) from the Psychology, Sciences, and Arts and Humanities who were paid \$5.00 for their participation. Sixty students (10 lower-division and 10 upper-division students from each group) were interviewed. The sample was selected from over 400 screened students who were initially approached in upper- or lower-division classes in each

discipline. The upper-division classes in which the screening questionnaire was distributed included Research Methods (Psychology), Advanced Anatomy (Science), and an upper-division Creative Writing course (Arts and Humanities). These courses were selected because they included junior and senior majors in the targeted disciplines. The lower-division courses included General Education courses in English, Psychology, and Zoology, which included many freshmen and senior potential majors. The screening questionnaire was a demographic survey that posed questions concerning students' gender, age, year in college (freshman, sophomore, junior or senior), and major/minor declaration or anticipated major or minor. Students who had yet to declare a major were asked the top two disciplines they were considering as majors.

From these screening questionnaires, students were identified who fit the profile for inclusion into one of six groups: Lower-division (freshmen or sophomore) students with an interest in declaring a major in either Psychology, Sciences (Zoology, Physics etc.), or Arts and Humanities (English, Communication, Performing Arts, etc.) and upper-division (junior or senior) students with a declared major in Psychology, Science, or Arts and Humanities. Students who fit one of the groups were contacted via telephone and either invited to participate in face-to-face interviews or interviewed on the telephone. Despite an attempt to match each group on demographic variables, there was a disparity in the distribution of gender by Major Status and Discipline (see Table 1). As a result, gender was used as a covariate in all subsequent analyses.

Place Table 1 about here

Procedure

The 60 participants' judgments of similarities between humans and animals were assessed in an interview format. Two male interviewers conducted all the interviews. Participants were first asked a general question of how similar human beings are to animals. Specifically, they were asked, *To what extent are human beings like animals, say great apes?* They were asked to make their similarity judgment on a seven-point scale with each point being labeled (not at all alike, a little alike, somewhat alike, moderately alike, a good deal alike, very alike, and identical).

After the ratings were collected, a series of follow-up questions were posed to assess participants' justification of their judgment. Participants were asked, *Why do you say that human and animals are (rating score label)?* After a participant's initial response to a question, the interviewers then asked him or her to expound upon their answer so that they would be able to code the justification as either a physical similarity or relational analogy. The interviewers were trained to ask: *What makes them (rating score label)? What exactly are you saying is (rating score label) about humans and animals? Are you saying _____ is the basis for thinking that humans and animals are (rating score label)?* The interviewers also tried to mirror the participant's responses in order to avoid a testing bias.

After the initial general question, participants were asked to make and justify judgments regarding the similarity of humans and animals (particularly great apes) with regard to other features. These included, in fixed order, emotions (*To what extent are human beings like animals, say great apes, in having emotions?*), consciousness (*To what extent are human beings like animals, say great apes, in having consciousness?*) and rationality (*To what extent are human beings like animals, say great apes, in being rational?*). Participants were asked other questions regarding computers and human beings which were not analyzed for the present

analysis. Half the participants in each group received the animal questions first and other half received the machine questions first.

Coding

Participants were interviewed in a manner to allow coding of their justifications as either literal similarity or relational analogy (Gentner & Wolff, 2000). Literal Similarity was defined as identifying corresponding features or objects between entities that are inherently similar (e.g., *apes and humans have hands*). Relational Analogy was defined as identifying a similar underlying relational structure between entities (e.g., *humans and apes live in communities with social hierarchies*). However, not all justification could be easily categorized, so a third category (Partial Analogy) was created, which has properties of both justifications (e.g., *both humans and apes have evolved opposable thumbs, allowing tool use*). Inter-rater reliability based on all the responses of 12 (30%) of the participants was 96%. Justifications were coded on an interval scale indexing conceptual nature of the response, with Literal Similarity coded with a value of 1, Partial Analogy with a value of 2, and Relational Analogy with a value of 3.

Results

Two analyses tested the prediction that only psychology students would demonstrate an increase from low-division to upper-division in similarity ratings and justification sophistication. The first analysis was a 3 (Discipline: Psychology, Arts and Humanities, and Science) by 2 (Major Level: Lower-division Non-majors and Upper-division Majors) by 4 (Features: General, Emotions, Consciousness, and Rationality) Repeated Measures ANCOVA on similarity ratings, with sex as a covariate and Features as the repeated measure. The average similarity rating across all participants and all features was 3.81 on the 7-point scale, which lies between “somewhat alike” and “moderately alike.” There was a statistically significant Discipline effect,

$F(2,53)=4.44, p<.05, \eta_p^2 = .14$. Science students ($M=4.37$) had higher average similarity scores than did Arts and Humanities students ($M=3.56$) and Psychology students ($M=3.43$), with the latter two groups being no different from each other. The analysis also showed that Upper-division Majors in the targeted disciplines had a higher average similarity score ($M=4.04$) than did Lower-division students who expressed interest in majoring in the targeted disciplines ($M=3.58$), an effect which only approached significance, $F(1,53)=3.68, p=.061, \eta_p^2 = .07$.

The ANCOVA also identified a Feature effect, $F(3, 159)=2.72, p<.05, \eta_p^2 = .05$. Bonferroni comparisons revealed lower average similarity scores for Rationality ($M=3.30$) than all other Features (Emotion $M = 3.95$, Consciousness $M = 3.82$, and General $M = 4.16$), $ps<.05$. The Feature effect on similarity ratings was modulated by a Feature by Discipline interaction effect, $F(6, 159)=2.20, p<.05, \eta_p^2 = .08$. To further explore the interaction effect, similarity ratings regarding each Feature were compared by Discipline in four separate one-way ANCOVAs, with Gender as a covariate. The findings revealed that similarity ratings for both Emotions and Consciousness failed to show an effect of Discipline. In contrast, Science students had higher similarity judgments Overall ($M=5.11$) and for Rationality ($M=3.97$) than did Arts and Humanities students (Overall $M=3.55$, Rationality $M=3.21$) and Psychology students (Overall $M =3.85$, Rationality $M=2.71$), with the latter two groups not differing from each other.

The second major analysis was a 3 (Discipline) by 2 (Major Level) by 4 (Features) ANCOVA on justification score, with Features as the repeated measure and Gender serving as the covariate. The average justification score across all participants and all features was 1.57 on the 3-point scale which lies between “Literal Similarity” and “Partial Analogy.” There was a main Major Level effect, $F(1,53)=13.43, p<.01, \eta_p^2 = .20$, with Upper-division Majors ($M=1.79$) having a higher average justification score than Lower-division Potential Majors ($M=1.43$).

There was also a Major Level by Discipline interaction effect, $F(2,53)=15.05$, $p<.001$, $\eta_p^2 = .36$. As can be seen in Figure 1, Psychology students are the only group who showed an increase in justification scores from Lower-division Potential Majors to Upper-division Majors.

Place Figure 1 about here

The ANCOVA also identified a main effect of Features $F(3,159)=2.92$, $p<.05$, $\eta_p^2 = .05$. There were no significant Bonferroni comparisons between the means, although mean justification scores were lowest for Consciousness ($M=1.47$), followed by Rationality ($M=1.57$), with Overall and Emotions ($M=1.67$) having the highest justification score.

Finally, a partial correction was run between participants' average similarity rating and their average justification score, independent of gender, major level, and discipline. The correlation was significant ($r = .36$), suggesting that more conceptually sophisticated justifications were associated higher similarity ratings between human beings and animals.

Discussion

The study addressed the nature of and change in psychology students' misconceptions about the discipline from relying on principles of folk psychology to scientific psychology. Specifically, it was predicted that, compared to students in other disciplines, upper-division Psychology majors would judge humans and animals, particularly great apes, to be more similar and do so by forming relational analogies more often than lower-division students interested in majoring in psychology. The ranking and justification data provide equivocal evidence for the predicted conceptual change in psychology students. Although there was evidence of the predicted increase in use of conceptually-based relational analogical justifications by psychology

majors, there was no evidence of the predicted increase in their similarity judgments. That is, despite finding an overall correlation between similarity ratings and justifications, upper-division psychology majors had higher justification scores than lower-division potential majors, but largely gave the same similarity rankings. The discussion focuses on each of these findings separately and then draws general conclusions about each finding.

Across features, the participants judged human beings to be between “somewhat” and “moderately” like great apes. The similarity scores were somewhat higher for some features (Consciousness and Emotions) than others (Rationality), and somewhat higher for some students (Science) than others (Arts and Humanities). Science students in particular scored higher than others when rating the similarity of the rationality and general features of great apes and human beings. The variations in similarity scores by discipline and features was perhaps due to the predominance of Science students majoring or interested in majoring in Zoology, a department which features many Biologists and Ethologists who address the literal similarities (although species-specific differences as well) in humans and animals.

The variations by discipline and feature in similarity judgments, while statistically significant, were small as reflected by low partial η^2 values, suggesting little systematic variability in students' similarity ratings. It is difficult to know from these data alone exactly what rating of similarity reflects a continued belief in folk psychology, with its implications of the uniqueness of human beings compared to other species. Nonetheless, the overall average similarity rating of somewhere below “moderate similarity” seems to be relatively low, given the evidence of human-like qualities of mind of the great apes (Gagneux, Moore, & Varki, 2005; Povinelli & Bering, 2003; Russon & Bard, 1996; Savage-Rumbaugh, Shanker, & Taylor, 1998; Suddendorf & Whiten, 2001). Future research could further explore students' ratings of both

similarities and differences between human beings and animals, including great apes and other species, to more systematically assess students' endorsement of human uniqueness. Such data may well provide further evidence of the so-called "human exception" bias, which is a tendency, even among college educated individuals, to treat human beings as fundamentally different from other species in the attribution of biological and psychological features and processes (Brem, Ranney, & Schindel, 2003, Evans, 2001).

Despite evidence of students holding fast to their beliefs about human uniqueness, there is evidence that psychology students learn to think differently about the relation between humans and animals than other students. Only the justification scores of upper-division psychology majors were higher than lower-division anticipated majors. The higher justification scores index students' greater conceptual sophistication by basing judgments on relational analogies rather than literal similarities. Such data are consistent with a conceptual change account of psychology students' learning to *think* like academic psychologists. Specifically, psychology major students' use of relational analogies about psychological phenomena reflects their commitment to rely on abstract relations over perception or intuition. Such relations are typically unavailable to untutored perceptions or intuitions but rather based on scientific evidence. The increase from lower- to upper-division in psychology students' commitment to relational analogies reflects a learned appreciation of the epistemological foundations of scientific psychology (Friedrich, 1996; Stanovich, 2007).

Perhaps the more important and interesting finding of the research is the disconnection between the change in psychology students' thinking and beliefs. We do not know of a similar result in other research addressing psychology students' conceptual change. One implication of the findings is that conceptual change in students learning psychology may not parallel the

process of students learning other scientific disciplines. On the one hand, it can be argued that perhaps the change in students' thinking merely precedes changes in their specific beliefs. As students learn to think like psychologists in constructing relational analogies about disciplinary phenomena, they may be more likely to change their specific beliefs about these phenomena. Gentner et al. (1997) specifically address the importance of relational analogical thinking as an underlying mechanism for restructuring knowledge and beliefs. Perhaps psychology students just need more time and support to accept their chosen discipline as scientific and learn to think in a scientific manner compared to student in physics or biology.

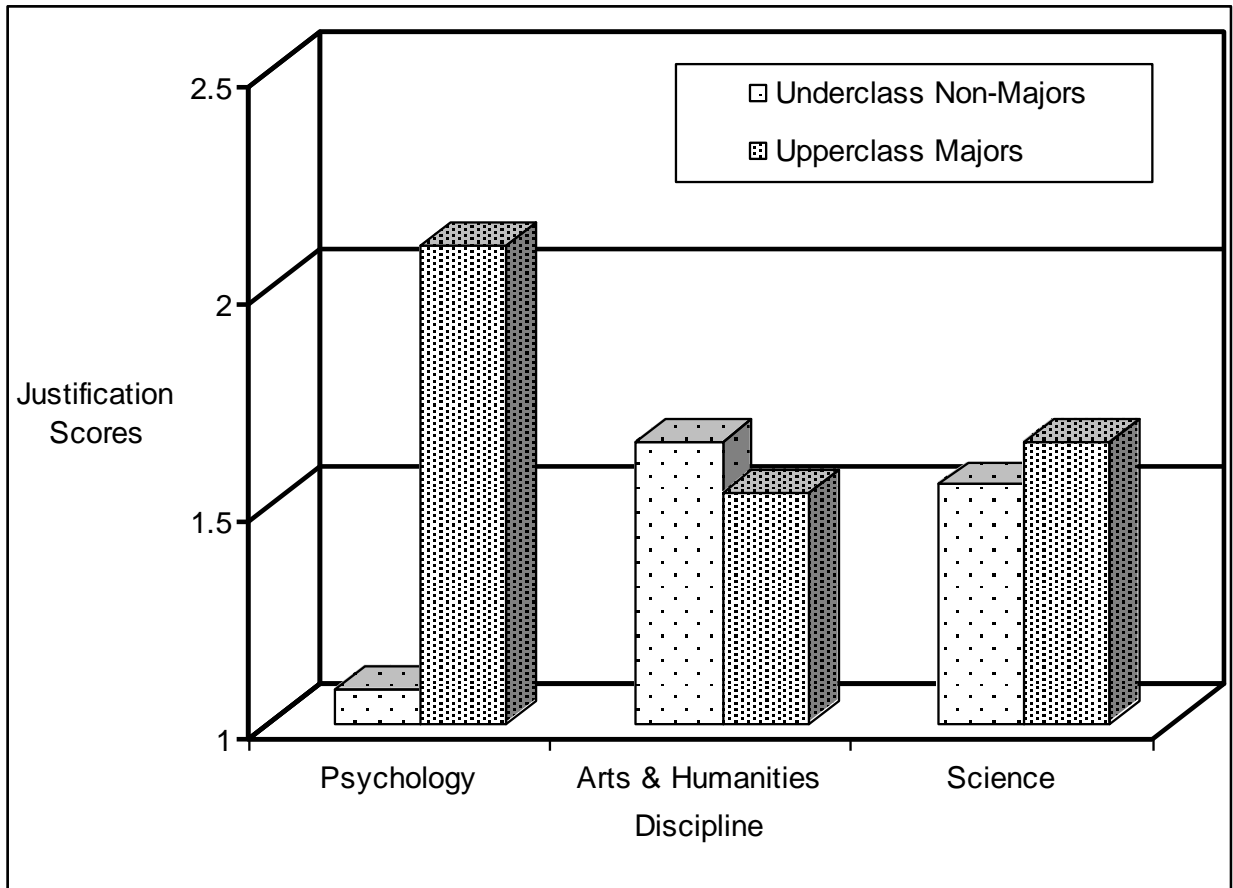
On the other hand, perhaps the finding that psychology students demonstrate change in discipline-appropriate thinking but not beliefs suggests that students do not literally reject folk psychology in favor of scientific psychology. That is, despite acquiring many of the assumptions of scientific psychology, psychology majors may retain some or even all their beliefs in folk psychology. There are strong arguments that folk psychology should be considered to have functional value as a way to explain and predict behavior in certain contexts and for certain purposes, rather than being rejected altogether and replaced by scientific psychology (Danto, 1984; Dennett, 1971; Hogan & Woodward, 1985). We are not aware of a defense of the cultural value or importance of folk physics, biology, or chemistry or for their retention by science students learning the discipline. Yet such arguments have been made in favor of folk psychology. Among other functions, folk psychology may provide the philosophical and psychological foundation for many moral, ethical, and legal concepts upon which social interaction depends (Chandler, Sokol, & Wainryb, 2000; Morton, 2002; Perner, 1991). We are testing this conception of learning psychology in a series of studies in which we are exploring the possibility that the tenets of folk and scientific psychology coexist in psychology students.

In summary, the findings of the present study suggest that, compared to students in other disciplines, psychology students' change from lower-division to upper-division in their thinking but not beliefs about human uniqueness. Psychology majors continue to hold onto folk psychological beliefs, with its assumption of the uniqueness of humans, despite adopting the tenets of scientific psychology with its assumption of relationally-based continuity between humans and animals. Future misconceptions research needs to better address the nature of psychology students' commitment to folk psychology and not just any culturally accepted claim which psychological research has proven false. Future research should additionally explore the various ways in which students may overcome their folk psychological commitments in favor of scientific psychology. However, a process which highlights students' rejecting folk psychology in favor of accepting scientific psychology, and the replacement of the former by the latter may not be a viable account of how undergraduate students learn psychology.

Table 1: The Distribution of Gender by Students Status and Discipline

Discipline	Major Status			
	Lower-division		Upper-division	
	Non-majors		Majors	
	Males	Females	Males	Females
Psychology	5	5	3	7
Arts and Humanities	4	6	4	6
Science	9	1	8	2

Figure 1: Mean Justification Score by Discipline and Major Status



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Notes

2. A Google search of the term *parapsychology* returned 2 million hits whereas a search of terms *scientific psychology* returned 250,000 hits.