

Recruitment modeling: An analysis and an application to the study of male–female differences in intelligence[☆]

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Abstract

Studies of group differences in intelligence often invite conclusions about groups in general from studies of group differences in selected populations. The same design is used in the study of group differences in other traits as well. Investigators observe samples from two groups (e.g. men and women) in some accessible population, but seek to conclude something about a wider, general population. The most frequent case is probably a study contrasting undergraduate men and women. The investigator will know the method by which people are recruited from the accessible population. However the methods by which the members of each group enter the accessible population from the general population is not under the control of the investigator. Call this the *recruitment process*. The recruitment process may introduce differences between groups in the accessible population that do not occur in the general population. Continuing the example, the recruitment processes that draw men and women from the college-age population into the population of students may not be the same. Therefore, in order to draw an inference about group differences in the general population from group differences in samples from the accessible population it is necessary to have a model of the recruitment process. We develop such a model, and present data showing that it appears to be valid for the case of recruitment into the population of youth who consider post-secondary education. We illustrate use of the model by analyzing findings from a widely publicized study of differences in intelligence between men and women, and show that the conclusions from that study are modified by consideration of the recruitment process.

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1. Introduction

Many studies of intelligence, and indeed, many studies in psychology in general, use the following paradigm. The researcher wishes to draw an inference about differences between two or more groups along some trait (here

intelligence). Because it is often infeasible to construct a true random sample of the general population, the researcher observes the difference in a sample from some population that can readily be tested (e.g., college students, military personnel, or public school students). We will refer to this as the *accessible population*. The problem is that recruitment from the general population to the accessible population may be different for each group within the overall population. To take an obvious case, compared to their frequencies in the general population, men are overrepresented and women are underrepresented in the United States Armed Services. It is highly likely that

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the psychological factors that influence a man's decision to enlist are not the same as those that influence a woman to enlist. It would be inappropriate to draw an unqualified conclusion about a psychological difference between men and women based upon observations of differences between service men and women. More abstractly, when there are inter-group differences in recruitment from the general to the accessible population, it is inappropriate to generalize results about group differences observed in the sample to the general population, even if the sample is a random sample of the accessible population.

Once stated, the problem is obvious. But what can we do about it? In this paper we approach the problem by constructing mathematical models of the process by which members of different groups are recruited from the general population to the accessible population. We will refer to them as *recruitment models*. These models can be used to generalize results based upon a sample of the accessible population to form a conclusion about the general population.

We will illustrate our methods by considering a much-studied, much debated topic: differences in intelligence between men and women. More particularly, we will examine a highly publicized recent finding claiming that there are such differences, in favor of men, and will show that when recruitment effects are considered the conclusion of the original authors must be substantially modified. We regard this finding as interesting in itself. However we believe that in the long run the methodology behind our reasoning is likely to be of more importance than the specific finding, because it provides a potential solution to the recruitment problem.

We will first describe the example. We then consider briefly a simple recruitment model that has been previously applied to the study of group differences in intelligence. The reason for doing so is because this model has been used before. We then consider a more realistic recruitment model, provide data showing its validity, and then apply it to the example.

2. The example

Jackson and Rushton (2006) claimed that there is approximately a 4 IQ point (.24 SD units) male–female difference in general intelligence, in favor of males. They based this conclusion on an analysis of approximately 100,000 examinees in the Scholastic Assessment Test (SAT) validation study sample of 1991. Jackson and Rushton extracted a general factor from individual item scores on the math and verbal subsections of the SAT, and then compared the scores of men and women on that general factor. They also found that there was a higher

percentage of men than women in all score ranges above the mean, and a higher percentage of women than men in ranges below the mean. Jackson and Rushton argued that this rules out the possibility that male scores are higher because males have higher variability in intelligence (e.g. Jensen, 1998, pg. 537), on the grounds that they did not observe an excess of males in both the high and low scoring categories of the SAT. They included in their paper the caution that it would be interesting to see if this finding could be repeated in a more general population.

Their paper generated a good deal of attention in the popular press. Rushton was interviewed on television. Jackson and Rushton's conclusion was also mentioned, usually with skepticism, in a number of editorials in the popular press. To the best of our knowledge, none of these interviews or commentaries questioned whether the validity study sample was representative of the general population, or included the original authors' caution that the finding should be repeated in a more general population.

There is reason to believe that Jackson and Rushton's study was influenced by substantial recruitment effects. The accessible population, students who take the SAT in a given year, is constructed by self selection from the general population of students in their last two years of high school. In Jackson and Rushton's data set, which we assume was an appropriate sample of the accessible population, approximately 55% of the examinees were women. However, according to the US census approximately 49% of people aged 15–19 are female. This suggests that for some reason women are more likely to choose to take the SAT than are men.

We shall show, by applying recruitment models, that the Jackson and Rushton results could be produced even if the mean intelligence of women was equal to the mean intelligence of men in the general population.

3. The recruitment issue illustrated by the Jackson and Rushton dataset

Jackson and Rushton examined a 1991 validity study sample of the Scholastic Assessment Test (SAT). This set contained scores for 46,509 men and 56,007 women. They describe the sample by saying “about 50% of the US population now go to college and SAT test takers are representative of those who aspire to do so.” (Jackson & Rushton, 2006, pg. 480).¹ There is a disparity between

¹ We accept Jackson and Rushton's statement. We have been unable to reanalyze their data directly as the College Board does not have this data in their current archives. According to Rushton (personal communication, April 8, 2007) Jackson, who is now deceased, had physical custody of the data and it is no longer available.

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