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Guttman on Factor Analysis and Group Differences: A Comment

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This interesting article by the late, great Louis Guttman seems to me to involve three major themes: (a) a chiding of social scientists for not reading their primary sources carefully; (b) a bit of evangelism for Guttman's own preferred non-factor-analytic approaches to the analysis of the domain of intelligence; and (c) an examination of between-group within-group relationships -- one which seems to me to fall in the "yes, but..." category (i.e., "yes, Louis, but...").

Item (a) above can be dealt with quite briefly. What Spearman (1927) really meant by *g* or what Thurstone (1935) really meant by *positive manifold* are interesting questions, but they are historical questions. The language of science, like other languages, is dynamic; words do change in usage over time. There is really no reason to upbraid Jensen (1985) for not using *g* in quite the same way that Spearman did, or modern writers for using positive manifold in other than its original Thurstonian sense. Do we fault Einstein for meaning something different by gravity than Newton did? However, it *is* useful occasionally to consider the implications of defining terms in one way or another, and one of the positive contributions of Guttman's article is just this. Obviously, questions of historical accuracy do arise at some point -- Jensen should just say *g*, not "Spearman's *g*," if he departs sufficiently far from Spearman's original notion. (Jensen's usage here doesn't alarm me personally, but I claim no special expertise in Spearmanian nuances.)

Item (b), evangelism, requires no great comment. Guttman's ideas are interesting and his methods ingenious; they are worth thinking about, whether or not one chooses to adopt them lock, stock, and barrel. I hope that others more qualified than I will elect to discuss some of these ideas in detail in their commentaries.

Item (c) is the between- and within-groups issue. This is the core of Guttman's article. He demonstrates algebraically that if an identical factor structure prevails in a combined population and in two subdivisions of it, the differences between the two subgroups' means must reflect that same structure. His proof is for a single *g* factor, but he hints that the theorem may be extensible

to multiple factors. He applies his result to the question of interest to Jensen (1985): Do U.S. black and white average differences on intellectual abilities reflect a single *g* factor? He suggests that Jensen is engaged in a trivial exercise when he asks if the between-group differences on cognitive measures order themselves in accord with the tests' loadings on a *g* factor. If Jensen had done his algebra, Guttman seems to say, he would have realized that this result is an algebraic truism, and hence empirically empty. But this conclusion hinges delicately on the assumptions. Practically everyone who has discussed the problem of race differences in IQ has agreed that between-group differences could logically differ in their causation from within-group differences; if we accept this, the extent to which they actually do is an empirical question. From this standpoint, we might rephrase Jensen's task as one of determining whether, *in fact*, the identical factor structure holds in the combined population as in the subpopulations. If between-groups differences are differently caused than within-groups differences, the total population factor structure should differ from that within groups. If they are similarly caused, if both reflect the same *g*, the factor structures should be the same. This is not an empirically empty question. However, I suspect that Jensen's approach -- a direct comparison of the the group differences on the various tests with the structure of the within-groups covariation -- is a more powerful way to address this question in practice than is a comparison of within-group and total population factor structures.

Apart from the question of within- and between-group relationships, Guttman isn't happy, of course, with a single-factor approximation to the structuring of cognitive abilities. He likes a description in terms of several facets, a view which implies that even if one perversely thinks in terms of abstract dimensions rather than spatial contiguity, one should at least come up with several factors. And of course in practice Jensen (1985), like Spearman's (1927) followers, finds it necessary to supplement the *g* factor with various group factors, in order to encompass the extra relationships among tests captured by the various facets of Guttman's definition.

So far as I know, as long as one remains purely in the realm of psychometrics one is perfectly free to describe the interrelationships among cognitive tests via general- plus group-factors or via correlated multiple factors. Where this becomes an empirical distinction is when one identifies these factors with real-world causes. I venture to say that the Spearmanian/Thurstonian (1927/1935) argument would be virtually over if someone were to come along and convincingly establish that *g* reflected a single major parameter of the nervous system, such as speed of conduction or complexity of neural connection, and the group factors primarily represented differing domains of experience; or if, on the other side, it were to be shown that the primary mental abilities

corresponded to distinct sets of genes, with a correlation among the separate abilities brought about secondarily by some environmental factor such as quality of education or socioeconomic status.

On the whole it would seem that factor analysis in and of itself, although relevant to the study of group differences, is unlikely to be decisive. When the investigator makes a serious effort to give independent empirical status to his factors, as Jensen (1985) certainly has done, matters can get more interesting.

Insofar as Guttman's article stimulates critical thinking about intelligence and its definitions, I applaud it. I'm less happy about the fact that it sometimes appears to juggle assumptions to make empirical issues seem non-issues. But in any event, I would not want to have been deprived of the privilege of reading it.

References

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