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Rule dependence and Flynn effects: some elaboration

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Abstract: Michael Woodley and myself [1] present a theory of rule dependence and the Flynn effect. This brief paper presents some elaboration of the rule-dependence theory.

Keywords: IQ, rule dependence, Flynn effect

1. What are 'rules'?

In [1], we define a *rule* as a re-applicable solution or piece of information. This is similar to the treatment of rules in Carpenter et al. [3], which identifies seven re-applicable rules on the Raven's. On a weakly rule-dependent test, rules may not be present at all (such as on the Draw-a-Person), or they may be present, but only as relatively loose heuristics (such as on Block Design, where the designs that form particular patterns may be remembered for use on later items). On a strongly rule-dependent test, rules are strongly emphasized and vital to the solutions of items.

2. Why are rule dependence numbers correlated with Flynn effects?

We present a few theories about why rule dependence is related to Flynn effect sizes. These are as follows. (The theories are presented in more detail, and with more extensive citations, in [1]. The citations in this paper are relatively cursory.)

2.1. People are exposed to the specific rules on IQ tests, through, e.g., improved education. This is Richard Lynn's [6, 7] theory: he believes that Raven's increases have been so high because the Raven's utilizes rules of addition, subtraction and distribution, and that exposure to math classes acquaints students with these specific rules. Tests that are strongly rule-dependent show higher Flynn effects because exposure to rules increases performance more, and because less exposure is necessary to improve performance.

2.2. People have become better at initially inferring rules. This is related to "scientific spectacles": perhaps the widespread use of scientific "habits of thinking" have helped testees initially induce rules from data [4, 5]. It is also related to the improvement in implicit learning that we postulate, since an increase in this ability may allow testees to better implicitly acquire and reapply rules without cognitive effort.

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2.3. People have improved in the ability to re-apply rules. If working memory has improved over time, as we speculate, then people should be better able to hold several rules in mind at once, and hence to re-apply them. It is also related to the improvement in implicit learning that we postulate, since an increase in this ability may allow testees to better implicitly acquire and reapply rules without cognitive effort.

3. Testing hypotheses

Some hypotheses for testing the rule-dependence model are as follows:

3.1. Raven's scores and educational quality. If the educational exposure hypothesis is correct, education should have a large effect on Raven's scores (and, to a lesser extent, other rule-dependent tests). Cahan and Cohen [2] showed that educational effects on the Raven's were stronger than those on other fluid tests (that were generally less rule-dependent), but weaker than those on verbal or crystallized tests. Further replication of this theory is needed.

3.2. Item-level Raven's data. Items in the Raven's Standard Progressive Matrices are arranged by rules, such that items in a given set share rules. If part of the Flynn effect on the Raven's comes from increased ability to re-apply rules, the items later in a set should show stronger Flynn effects and a greater decrease in *g* loading, all else being equal.

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