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Relationship between field dependence-independence and the g factor: What can problem-solving strategies tell us?

Relation entre la dépendance-indépendance à l'égard du champ visuel et le facteur g : apport de l'étude des stratégies de résolution

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ABSTRACT

Introduction. – Field dependence-independence (FDI) has been the focus of a great deal of research. However, it is generally studied in relation to either personality or the g factor, with far fewer studies of the interconnections between FDI, the g factor and problem-solving strategies.
Objective. – Our first aim was to study the relationship between FDI and the g factor. Our second was to explain this relationship by analysing problem-solving strategies.
Method. – One hundred and seventy 14-year-old performed three tests: the GEFT, the D-70, and a second, prototype g-factor test that enabled us to identify which strategies they used.
Results. – Results confirmed the classic link between FDI and the g factor, and attributed this link to greater use of the most efficient strategies.

Mots clés :
DIC
Facteur g
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RÉSUMÉ

Introduction. – Les recherches sur la dépendance-indépendance à l'égard du champ visuel (DIC) sont nombreuses. En effet, la DIC a souvent été étudiée en relation avec le facteur g ou encore avec la personnalité. Cependant, l'étude des relations entre la DIC, le facteur g et les stratégies de résolution sont beaucoup plus rares.
Objectif. – L'objectif de cette recherche est d'étudier, dans un premier temps, la relation DIC-facteur g et, dans un second temps, d'expliquer cette relation par l'intermédiaire de l'étude des stratégies.
Méthode. – Cent soixante-dix sujets, âges de 14 ans, ont passé trois épreuves : le GEFT, le D70 et une épreuve de facteur g permettant l'évaluation des stratégies utilisées.
Résultats. – Les résultats permettent de confirmer le lien habituel entre DIC et facteur g, et d'expliquer ce résultat par l'utilisation plus massive des stratégies les plus efficaces.

1. Introduction

Cognitive styles are a popular research topic among psychologists, judging by the spate of recent publications (Blazhenkova, Becker, & Kozhevnikov, 2011; Evans & Waring, 2011; Höffler, Prechtl, & Nerdel, 2010; Ling & Salvendy, 2009; Mayer, 2011; Thomas & McKay, 2010; Von Wittich & Antonakis, 2011). Cognitive style refers to the way in which people process information across a wide range of perceptual or intellectual activities, including perceiving, memorizing, and problem solving.

Research in various fields has led to the identification of many different cognitive styles. The most widely recognized are the reflectivity-impulsivity continuum (Kagan, Rosman, Day, Albert & Phillips, 1964; Messer, 1976), the internality-externality dimension of control (Dubois, 1987; Rotter, 1966) and field dependence-independence (FDI; Witkin & Goodenough, 1977; Witkin, Oltman, & Karp, 1971).

FDI occupies a special place in research on cognitive styles, witness the abundant literature on this subject (Damusis & Desjarlais, 2004; Goodenough, Oltman & Cox, 1987; Huteau, 1987; Lecerf &

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de Ribaupierre, 1999; Witkin, Dyk, Fatreson, Goodenough & Karp, 1962; Witkin & Goodenough, 1981; Witkin et al., 1971; Zhang, 2004). It provides a means of distinguishing between individuals on the basis of their ability to analyze a given situation or object and the ease with which they are able to extract key information from it, overcoming any contextual hurdles. There are two components of FDI: the use of visual and spatial frames of reference in perception, and a general perceptual analysis and restructuring ability. On the strength of these components, individuals can be placed on a continuum running from field dependence (FD) to field independence (FI). FD individuals have difficulty separating the information they are given from its context, and exhibit a global or overall (holist) approach to situations. By contrast, FI individuals, who are less homogeneous, have no problem extracting information from its context, and adopt an analytic approach. For example, studies have shown that bodyguards and bomb-disposal experts, both occupations relying on the ability to detect potential dangers in a dynamic setting, belong to the latter category (Glicksohn & Bozna, 2000; Glicksohn & Rechtman, 2011). FI individuals perform elementary tasks quicker and more accurately, especially at the perceptual level (Yan, 2010). They are also better at jigsaw-type games (Hong et al., 2012Hong, Hwang, Tam, Lai, & Liu, 2012).

There is considerable controversy surrounding the nature of FDI. Some researchers claim that it is a fully-fledged cognitive style (Kogan, 1980; Saracho, 1991; Witkin & Goodenough, 1977), based on results indicating that FDI plays a key role in many different types of activities (Saracho, 2001). Others, however, regard it as representing no more than a visual or spatial perceptual ability (Jones, 1997; Zhang, 2004), citing findings that highlight a strong association between FDI and performances on spatial tasks (Richardson & Turner, 2000) and a far weaker one between FDI and performances on other cognitive-style tests (Riding & Dyer, 1983).

FDI has been extensively explored in relation to cognitive dimensions, with frequent reports of close links between FDI and IQ. For instance, correlations ranging from +55 to +73 have been observed between the Rod and Frame Test (RFT), Body Adjustment Test (BAT) and Embedded Figures Test (EFT), combined in an index of FDI (Witkin et al., 1962), and the Wechsler Intelligence Scale for Children (WISC), with the Picture Completion, Object Assembly and Block Design subtests being most closely linked to FDI (Huteau, 1985). Similar results have been reported for the g factor (Gardner et al., 1960; McKenna, 1983, 1984, 1990), especially when FDI is assessed with the EFT (Huteau, 1981). Correlations with conative dimensions indicate that FI individuals are "more active, more self-aware, and better at controlling their impulses, exhibiting a stronger ego, and displaying greater self-acceptance" than FD individuals (Damusis & Desjarlais, 2004). More recently, a relationship was confirmed between FDI and the reflective-impulsive cognitive style (Rozencwajg & Corroyer, 2005). It worth noting, however, that FD individuals outdo their FI counterparts in the social domain (Gilles & Ohlmann, 2008).

There have been far fewer studies of the relationship between FDI, the g factor and problem-solving strategies, although sparse results indicate that FD individuals find it harder to relinquish the use of external cues that have proved helpful for solving problems in the past (Massari & Mansfield, 1973). They also display greater rigidity in their learning experiences (Nebelkopf & Dreyer, 1973). For their part, FI individuals exploit their prior knowledge more frequently to structure material they have to memorize (Spiro & Tirre, 1980). Lastly, when asked to resolve the Kohs Block Design Test, FI participants tend to use analytic and synthetic strategies, and FD participants holist strategies (Rozencwajg, Corroyer, & Altman, 2002; Rozencwajg & Fenouillet, 2012).

A great many studies have, however, been carried out to detect the different strategies used to resolve g-factor tests (Marquer & Pereira, 1990; Reichle, Carpenter, & Just, 2000; Rémy & Gilles, 2000; Rozencwajg, 1991; Rozencwajg & Corroyer, 2002; Rozencwajg & Huteau, 1996), witness the research on progressive matrices (De Shon, Chan, & Weissbein, 1995; Hunt, 1974; Van Der Ven & Ellis, 2000; Vigneau, Caissie, & Bors, 2006), as well as on the D-70 and D-2000 (Chartier, 2009; Dickes & Martin, 1998), two g-factor tests used in France. This work has shown that it is possible to improve on existing tests in order to measure problem-solving strategies more accurately (Lautrey, 2001, 2003; Lautrey & de Ribaupierre, 2004). The SAMUEL computerized cognitive test, for instance, is derived from the Koh block test (Rozencwajg, Corroyer, & Altman, 2002), and the Dominos Test from the D-70 (Rémy, 2002; Rémy & Gilles, 2000).

The aim of the present study was to explore the relationship between FDI and three different g-factor measures. First of all, we set out to replicate the findings reported in the literature and ascertain whether the Dominos Test does indeed allow for the detection of different strategic profiles (Rémy, 2002; Rémy & Gilles, 2000). We also checked that FI participants do indeed perform better on g-factor tests (Huteau, 1981; McKenna, 1990).

The use of the Dominos Test allowed us to formulate a series of original hypotheses. Our first hypothesis was that FI individuals make greater use of spatial strategies than FD participants, given that FDI is clearly associated with the spatial factor (Huteau, 1996; Zhang, 2004). Our second hypothesis was that FI individuals exhibit greater strategic variability, with the prediction that they would make greater use of the various strategies induced by the Dominos Test items than their FD counterparts.

2. Method

2.1. Participants

Participants were 170 children in their third year of secondary education. They were all drawn from the same middle school in an urban area of Northern France. The sample had a mean age of 13 years and 11 months (SD: 8 months), and comprised 86 girls (M: 13 years 11 months; SD: 8 months) and 84 boys (M: 13 years 10 months; SD: 8 months). They all took part on a voluntary basis after their parents had given their written informed consent. The tests were administered in a classroom by two psychologists, in the absence of a teacher.

2.2. Measures and procedure

The children underwent the following battery of tests.

2.2.1. Group Embedded Figures Test

Group Embedded Figures Test (GEFT; Witkin, Oltman, & Karp, 1971). The collective form of the EFT, this FDI test probes participants' ability to spot a simple shape hidden within a complex figure. The material consists of eight simple shapes and 25 complex figures. Participants have to locate and draw around as many simple shapes within the complex figures as they can in three timed sections (the first section consists solely of examples). The GEFT score corresponds to the number of correctly traced shapes in the last two sections (max. possible score: 18). A high score is indicative of FI, and a low score of FD.

2.2.2. D-70

D-70 (Kourovsky & Rennes, 1970). This test measures general nonverbal intelligence. More specifically, it is designed to assess the eduction of relations and correlates, based on Spearman's notion of the g factor. Each item features a series of dominoes arranged in a particular configuration (line, circle, etc.). One domino is blank, and participants have to infer the number of missing dots using either