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# Psychopathological traits in college students from top-ranking french schools: Do autistic features impair success in science when associated with schizotypal traits?



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## ABSTRACT

The link between personality and the interest of individuals for science has not been thoroughly explored. In this report, we studied psychopathological traits in students studying science in French top-ranking institutions. Three hundred and forty seven individuals answered questionnaires assessing autistic and schizotypal dimensions, as well as anxiety, depression symptomatology and attachment quality. A cluster analysis based on autistic and schizotypal traits led to the identification of 4 distinct profiles: a “low trait cluster”, a “moderate autistic trait cluster”, a “moderate schizotypal trait cluster” and a “high trait cluster” (HTC) composed of individuals with high scores on both autistic and schizotypal scales. Each cluster represented 20.1–27.1% of participants and was clearly different from the three others, both on autistic and on schizotypal dimensions. These groups could be also typified by their level of anxiety, depression or degraded attachment, which are proportional to the extent of psychopathological traits. Moreover, students from the HTC cluster displayed lower academic results, thus implying that autistic traits might impair success in science when they are associated with moderate schizotypal personality features. This study also suggests that depression and anxiety might mediate performance inhibition in the HTC group.

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## 1. Introduction

Personality is considered as a major determinant in individuals involved in scientific activities. Indeed personality is thought to influence individuals at the level of two related but distinct concepts: their interest in science, as well as their aptitudes (Feist, 2006). Nevertheless, the link between psychopathological traits and the involvement of individuals in scientific backgrounds has not been thoroughly examined. In the last decade, a major breakthrough in this field was brought to light by studies showing that personality traits associated with autism spectrum disorders strongly influence the scientific abilities of individuals (Baron-Cohen et al., 1998). This was initially based on the observation of higher frequency of autism cases in families of students involved in mathematics, physics or engineering, in comparison with families of individuals studying literature or humanities (Baron-Cohen et al., 1998, 2007). Following these reports, it was

subsequently shown that students involved in scientific programs display themselves marked features of autistic personality, compared with peers studying literature or social sciences (Baron-Cohen et al., 2001).

Other studies exploring the link between personality and scientific aptitudes suggested that features such as empathy or schizotypy are less frequent in scientific students than in individuals studying humanities. In contrast, students involved in science appeared to be characterized by a more pronounced “systematizing” dimension, which can be defined as an ability to handle any type of system (abstract, mechanical, organizable...) (Nettle, 2006; Wakabayashi et al., 2006; Rawlings and Locarnini, 2008).

To date the link between personality and scientific aptitudes appears to be an open question. For example, recent data suggested that the performance of students in mathematics, an abstract system, does not necessarily correlate with the systematizing dimension of individuals (Morsanyi et al., 2012). Furthermore, the notion that schizotypal traits are low in scientists is somewhat surprising, considering the numerous evidences showing that schizotypal features are highly correlated with the ability of individuals to be creative (Rawlings and Locarnini, 2008;

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Nelson and Rawlings, 2010; MacPherson and Kelly, 2011; Fink et al., 2013). And creativity can be hardly distinguished from aptitudes to achieve scientific discoveries, notably when serendipity (i.e., unexpected inventions) is involved (cf. the discovery of penicillin by Fleming or the medical use of X rays by Röntgen) (Rosenman, 1988; Stoskopf, 2005; Yewdell, 2008).

Other psychopathological dimensions could characterize students involved in science. Indeed, schizotypal or autistic dimensions can be associated with depression symptoms or anxiety in sample of non-clinical students (Lewandowski et al., 2006; Rey et al., 2009; Morvan et al., 2011), comorbidities also observed in individuals with autism spectrum disorders (Greenaway and Howlin, 2010; McPheeters et al., 2011; Pouw et al., 2013). Moreover, attachment security could be an interesting dimension to examine in students involved in science. Indeed, insecure attachment has been linked with autism (Rutgers et al., 2004; Haltigan et al., 2011), which led to a possible treatment of autism with oxytocin, an hormone regulating infant attachment and linking social signals with cognition (Canitano, 2014). Insecure attachment has been also involved in schizotypy (Berry et al., 2008; Meins et al., 2008). Besides examining peer attachment, parental attachment may be of interest in college students. Indeed, a meta-analytic review found a small-to-medium relationship between indicators of parental attachment quality and favorable adjustment outcomes ( $r=.23$ ) in this population (Mattanah et al., 2011). More specifically, a study found that parental attachment contributed to romantic attachment among college students with autistic traits. (Lampert and Turner, 2014). Moreover, besides depression and insecure attachment, schizotypal traits are frequently associated with the use of psychoactive substances including alcohol or cannabis (Nunn et al., 2001; Esterberg et al., 2009; Fridberg et al., 2011).

Taken as a whole, the available literature on the subject thus suggests that empirical data on personality traits in students studying science are rather scarce and poorly consistent. Therefore, this current study aims at identifying a typology of scientific students on the basis of psychopathological traits, using a cluster analysis approach rather than a factorial/correlational approach. Indeed the variable-centered approach may underestimate the heterogeneity of individuals and proposes general findings and theoretical elaborations that might be somewhat artificial and inaccurate, as they result from the examination of samples combining dissimilar and disparate groups of individuals. Unlike this approach, the person-centered one, unraveling homogeneous groups of individuals, may reveal group-specific relations between variables that are obscured or masked by a globalizing variable-centered approach. It is important to note that cluster analyses are useful for determining the presence of subgroups of individuals with specific profiles of personality traits. In addition, these analyses are valuable for assessing whether these subgroups are varying in frequencies of behaviors and/or symptoms. We thus expected to obtain clusters differing on autistic and schizotypal traits and we next examined whether these clusters could be differentiated on other variables, including attachment, anxiety and depression and academic results.

## 2. Methods

### 2.1. Participants

Participants were recruited through seven most famous French scientific schools, selected according to the international classification of Shanghai (2012). The schools used in this study are highly specialized in sciences and do not provide teachings in non-science matters (except English or other foreign languages as minor

**Table 1**  
Sample characteristics (N=347).

Variable:		n	%
Gender	-Female	153	44.1
	-Male	194	55.9
Age	M=21.84	S.D.=2.04	
Personal situation	-Single	156	45.0
	-In a civil partnership	79	22.8
	-Living with a roommate	61	17.6
	-Living with parents	51	14.7
Discipline	-Mathematics	27	7.8
	-Computer Sciences	92	26.2
	-Biology	173	49.9
	-Engineering	20	5.8
Academic level	-Physics	35	10.1
	-B.A.	171	49.3
	-B.A., final year	74	21.3
Academic performance	-M.A.	102	29.4
	-Failed	22	6.3
	-Passed	74	21.3
	-Cum laude	113	32.6
	-Magna cum laude	75	21.6
	-Summa cum laude	63	18.2

courses). Therefore, students from these schools are almost exclusively involved in studying scientific matters, with 90% of their classes and exams related to these disciplines. Informed consent was obtained from all participants and no compensation was offered. The procedures were approved by the ethics committee of the research ward. The sample was composed of 347 students (Mean age=21.8; S.D.=2, 44.1% female, 55.9% male; Table 1). Regarding their personal situation, 45% of participants lived by themselves, 22.8% were living with a partner, 17.6% with a roommate and 14.7% with their parents. About the discipline studied, 50% of students had a major in Biology, 26.2% in Computer Sciences and the rest studied Mathematics, Physics or Engineering (Table 1). A large majority (70.9%) of participants were B.A. students, the rest being involved at the M.A. level. About academic performances, only 6.3% of participants failed during the last semester. For others, the distinction “cum laude” was the most frequent (32.6%).

### 2.2. Measures

#### 2.2.1. Autistic traits

Autistic traits were measured using the Autism spectrum Quotient (AQ) (Baron-Cohen et al., 2001). This questionnaire includes 50 items (e.g., “I find social situations easy”). For each statement, participants indicated their extent of endorsement on a 4-point Likert scale ranging from “definitely agree” to “definitely disagree”. “Definitely disagree” or “slightly disagree” responses were scored 1 point, except for the following items inversely scored: 2, 4, 5, 6, 7, 9, 12, 13, 16, 18, 19, 20, 21, 22, 23, 26, 33, 35, 39, 41, 42, 43, 45, and 46. A score above 25 is considered as a cutoff for distinguishing individuals with significant level of autistic traits, whilst a score above 32 characterizes individuals with autism spectrum disorder. Cronbach's  $\alpha$  coefficient ranged from 0.63 to 0.77 in the report by Baron-Cohen et al. and it was 0.68 in this current study.

#### 2.2.2. Schizotypal traits

Schizotypal traits were evaluated using the Schizotypal Personality Questionnaire (SPQ) (Raine, 1991; Raine and Benishay, 1995) under its French adaptation (Dumas et al., 1999). This self-report questionnaire is constituted of 74 items under the Yes/No format (e.g., “People sometimes find me aloof and distant”). Each item is scored 0/1 (No/Yes) and thus the total score ranges from

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