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# Individual difference predictors of creativity in Art and Science students

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ABSTRACT

Two studies are reported that used multiple measures of creativity to investigate creativity differences and correlates in arts and science students. The first study examined Divergent Thinking fluency, Self-Rated Creativity and Creative Achievement in matched groups of Art and Science students. Arts students scored higher than Science students on two of the three measures. Regression analysis indicated that the educational domain demographic variable was the most consistent predictor of all three measures of creativity. The second study compared natural science, social science and arts students on two performance and two preference measures of creativity, whilst controlling for the effects of general intelligence. Results indicated only Self-Rated Creativity displayed significant group differences, with the regression analysis suggesting a stronger role of personality variables. The differences between the groups and implications for the measurement of creativity are considered.
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## 1. Introduction

There has long been an interest in the different thinking styles of those in Arts from those in Science. This debate was structured by C. P. Snow in his 1959 lecture entitled *The Two Cultures*. He stressed the differences and poor communication between those in the sciences and those in the humanities. This debate has continued for 50 years (Cohen, 2001; de Melo-Martin, 2010; Williamson, 2011).

It was the work of Hudson (1966) that arguably stimulated psychological research in this area. Hudson (1966) was inspired by the book *Creativity and Intelligence* (Getzels & Jackson, 1962). He suggested that those with a bias towards convergent thinking moved towards the physical sciences, whilst those with a divergent thinking bias moved towards the humanities (Hudson, 1973). The book became a citation classic receiving 225 citations up to 1980 (Hudson, 1980) and many hundreds more since then.

The Hudson book and its conclusion attracted criticism (Krisbourne, 1968) but also replication and extension (Child & Smitters, 1973; Hartley & Beasley, 1969; Hocevar, 1980). Hartley and Greggs (1997) gave four groups of students: Pure arts, arts and social science, social science and science, and pure science some divergent thinking tests. The hypothesis that divergent thinking would decline along the arts – science continuum found support in that arts students as a whole scored significantly higher than science students on the four tests.

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Researchers have tested the idea that personality and thinking style differences between arts and science students account for differences in the creativity (Haller & Courvoisier, 2010). However a recent study of 116 British undergraduates found small learning styles differences and no problem solving differences in arts and science students leading the author to conclude that modern students have a more balanced educational profile than their more specialised predecessors (Williamson, 2011).

The question of the domain specificity of creativity continues to attract attention (Kaufman & Baer, 2005) as well as the relationship between creativity and mental illness in arts and science (Claridge & McDonald, 2009; Ludwig, 1998). Baer and Kaufman (2005) noted "perhaps the reason that some researchers find significant correlations between divergent thinking test scores and actual creative performance whilst others find no relationship between the two is due to confusion about the two different meanings of divergent thinking. If we think of divergent thinking as a variety of different skills applicable in different domains, then scores on divergent thinking tests may or may not correlate with creative performance, depending on which domain is being examined and the nature of the divergent thinking test itself. If both the creative performance task and the divergent thinking test happen to focus on the same domain, they will be correlated; but if the task and the test come from very different domains, they may not be correlated at all, or they may have a very minor correlation. At the same time, it may be true that divergent thinking of *some kind* is an important contributor to creativity in virtually all domains, and in that sense divergent thinking could fairly be thought of as a general factor relevant to creative performance in all domains" (p. 318). The notion that divergent thinking is a central component of creativity is accepted by most researchers in the area (Amabile, 1996; Batey & Furnham, 2006; Kaufman, 2009; Runco, 2007), though there are many tests of divergent thinking (Kuhn & Holling, 2009; Tekin & Tasgin, 2009).

This paper aims to investigate divergent thinking as a measure of creativity in the arts and sciences, but more besides. All researchers on creativity accept problems with both the definition and measurement of creativity (Batey & Furnham, 2006; Cropley & Cropley, 2008; Kaufman, 2009). Most researchers recommend and use multiple measures of creativity of which divergent thinking is one (Furnham & Bachtiar, 2008; Furnham, Batey, Anand, & Manfield, 2008). In both studies in this paper, multiple measures of creativity will be used to examine differences between students of arts and science. However, both studies will also measure individual difference correlates of creativity.

Various studies and reviews have looked at personality correlates of creativity (Barron & Harrington, 1981; Batey & Furnham, 2008; Furnham, Crump, Batey & Chamorro-Premuzic, 2009). The two dimensions most consistently shown to relate to creativity are Psychoticism (from the Eysenckian Big 3: Extraversion, Neuroticism, Psychoticism) and Openness (from the widely accepted Big 5: Extraversion, Neuroticism, Openness, Agreeableness, Conscientiousness). It has also been established that personality traits predict, in part, along with abilities and values the courses that students choose (Furnham, 2008). Therefore, differences between creativity in the arts and sciences may be a function of differences in ability or personality or indeed thinking style which is related to both.

The two studies reported here are concerned essentially with differences in creativity across students of Arts vs Science with salient individual difference factors controlled for. However, both will also be concerned with personality and ability predictors of different measures of creativity. Whilst there is general agreement about the psychometric validity of cognitive ability and personality tests used in this study, there is less agreement about the validity of all creativity tests. Hence, in both studies, more than one creativity test is used.

This is also a two-study paper to attempt to replicate results over slightly different populations and using different tests.

It should be recorded that classifying disciplines as arts and science is not always that simple. For instance economics or sociology could be classified as either depending on what is taught and how it is taught. Further some students change course from a science to an arts discipline or do a combined subject degree like French and Engineering which combines both arts and science. This is a limitation of most studies that attempt to contrast arts and science groups that are heterogeneous in the sense that they have people from both arts and science.

## 2. Study 1

The first study utilised three commonly used measures of creativity (Divergent Thinking, Self-Reported Creativity and Creative Achievement), one of personality (Big Five) and two groups (Art and Science). This study had three hypotheses all based around the three creativity measures and one with respect to personality.

H1: Art students will score significantly higher on the DT Fluency test than Science students.
H2: Art students will score significantly higher on the Self-Reported Creativity measure than Science students.
H3: Art students will score significantly higher on the Creative Achievement measure than Science students.
H4: Openness will be the strongest personality correlate of all three measures of creativity.

### 2.1. Method

#### 2.1.1. Participants

Participants were 108 adult undergraduate students (81 females and 27 males) aged between 18 and 56 (mean = 22.80; SD = 6.48). The students were from Imperial College London, University College London and University of the Arts. Sixty-five participants (51 females and 14 males) were completing their education in the field of science (Natural, Biological and Social

**Table 1**
Descriptive statistics and Pearson inter-correlations for all measures.

| | *M* (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| DT Fluency | 17.37 (10.35) | .12 | .01 | −.03 | −.12 | .17 | −.04 | .17 |
| 1. Self-Rated Creativity | 6.55 (1.80) | | .45** | −.08 | .16 | .40** | −.01 | .07 |
| 2. Creative Achievement | 10.64 (5.23) | | | −.08 | .27** | .26** | −.06 | .04 |
| 3. Neuroticism | 23.94 (8.61) | | | | −.25** | −.15 | −.01 | −.19* |
| 4. Extraversion | 28.04 (6.70) | | | | | .08 | .41** | .02 |
| 5. Openness | 31.58 (6.31) | | | | | | .05 | −.01 |
| 6. Agreeableness | 29.64 (5.12) | | | | | | | .06 |
| 7. Conscientiousness | 29.82 (6.18) | | | | | | | |

*Note*: $N = 108$. DT = Divergent Thinking.
* $p < .05$.
** $p < .01$.

Sciences). The mean age of the science students was 20.16 (SD = 4.30). Forty-three participants (30 females and 13 males) were completing their education in the field of the Arts (e.g. art, photography, music, poetry studies). The mean age of the Art students was 26.67 (SD = 7.20). Where English was not the first language, participants achieved a minimum score of 7.0 on a recognised test of English language.

### 2.1.2. Measures

*2.1.2.1. Creativity. Divergent Thinking* was assessed by a variant of the *Consequences Test* (Christensen, Merrifield, & Guilford, 1953). Participants were given three unlikely events (Consequences of sudden (a) deafness, (b) colourblindness and (c) not needing to eat) and were asked to list as many consequences of the occurrence of these events, with 3 minutes provided for each item. Participant responses were counted to produce a Fluency score. DT Fluency has been used as a measure of creativity in many recent studies (Batey, Chamorro-Premuzic, & Furnham, 2009; Batey & Furnham, 2008; Tsakanikos & Claridge, 2005).

*Self-rating of Creativity* was measured on a 10-point Likert type scale (Batey, 2007). The rating for creativity was embedded within 10 other ratings of personal attributes (e.g. intelligent, wise, knowledgeable, and impulsive). Participants were required to rate themselves in comparison with other people with scores of 1 or 10 indicating that the participant considered themselves to be less or more creative (or intelligent, wise, etc.,). Previous studies have reported acceptable reliability indices for this measure and found the scale to correlate with other measures of creativity (Batey & Furnham, 2008; Furnham & Bachtiar, 2008; Furnham et al., 2008). Self-reported creativity has been shown to relate to expert raters of creativity (Kreitler & Casakin, 2009).

*Creative Achievement* was assessed by the *Biographical Inventory of Creative Behaviours* (BICB: Batey, 2007). This is an assessment of everyday creative achievement. Participants were required to indicate, from a list of 34 activities (e.g. Written a short story, Produced your own website, Designed and planted a garden, and Composed a piece of music) those in which they had been actively involved over the past 12 months. The BICB demonstrated adequate reliability ($\alpha = 0.78$) and has been used in recent investigations (Batey & Furnham, 2008; Furnham & Bachtiar, 2008; Furnham et al., 2008).

*2.1.2.2. Personality. Personality* was assessed by the *NEO Five Factor Inventory* (Costa & McCrae, 1992) which consists of 60 items, takes approximately 15 minutes to complete and provides a measure of the Big Five personality traits of Neuroticism (N), Extraversion (E), Openness to Experience (O), Agreeableness (A) and Conscientiousness (C). The NEO-FFI is widely used and possesses adequate reliability and validity (Costa & McCrae, 1992).

*2.1.2.3. Procedure.* Students were recruited by a co-author at the three universities. They were incentivised by the promise of feedback concerning their creativity. They were thus a self-selected sample. All the measures were paper and pencil tests and were administered in groups of 3–5 participants under test conditions by a co-author. Each of the participants worked individually and completed the Consequences tests first. They were then allowed to complete the remaining tests at their own pace. Informed consent was obtained from the participants and the study design was granted ethical approval from the relevant universities.

## 2.2. Results

Means, standard deviations and inter-correlations of the variables in this study are presented in Table 1. Interestingly DT fluency was not significantly correlated with either of the other two measures of creativity.

The means and standard deviations of the variables in the study for the two groups (Art and Science) are presented in Table 2.

In order to assess the differences of the two groups (Art and Science) on the three different creativity measures (DT Fluency, Self-Rated Creativity and Creative Achievement) a MANCOVA was performed where age, gender and the significant correlates of the creativity measures from the Pearson correlations were held constant (Extraversion and Openness). The overall model was significant (Hotelling's Trace; $F(3,98) = .34$, $p < .001$).

**Table 2**
Descriptive statistics for Art and Science students.

| | Art ($n$ = 43)Mean (SD) | Science ($n$ = 63)Mean (SD) |
|---|---|---|
| DT Fluency | 17.56 (11.95) | 17.51 (9.25) |
| Self-Rated Creativity | 7.58 (1.42) | 5.83 (1.71) |
| Creative Achievement | 13.00 (5.88) | 8.97 (4.10) |

No significant differences were observed for DT fluency ($F(1,106) = 3.86$, $p > .05$) so H1 was not confirmed. There was a significant difference between the Art and Science groups on Self-Rated Creativity ($F(1,106) = 20.48$, $p < .001$) with Art students scoring higher. This confirmed the H2. There was a significant difference between the Art and Science groups on Creative Achievement ($F(1,106) = 12.56$, $p < .001$) with Art students scoring higher. This confirmed the H3 hypothesis.

Following the MANCOVA analysis, regressions were performed to determine how much demographics, academic discipline and personality accounted for variance in the creativity scores. DT score, Self-Rated Creativity, and BICB were regressed in block 1 onto age, gender and type of the degree (Art or Science). The Big Five Factors were entered in block 2 in order to evaluate the incremental predictive power provided by the personality variables.

The first regression showed that age and degree accounted for 17% of the variance in the DT scores ($F(3,102) = 8.26$, $p < .001$), both age ($\beta = .04$, $t = 2.05$, $p < .05$) and degree ($\beta = -.55$, $t = -2.23$, $p < .05$) were significant predictors. The addition of the personality variables failed to significantly increase the percentage of variance explained by the model ($F_{change}(5,97) = .974$, $p = .438$).

The second regression showed that type of degree ($\beta = -2.13$, $t = -5.90$, $p < .001$) accounted for 25% of the variance in Self-Rated Creativity ($F(3,102) = 12.74$, $p < .001$). The addition of the Big Five accounted for an additional 1% of the variance, but this was an overall non-significant increase ($F_{change}(5,97) = .047$, $p = .251$). Examination of the beta coefficients indicated that Openness to Experience was the only significant predictor out of the Big Five traits ($\beta = .06$, $t = 2.11$, $p < .05$).

The third regression showed that type of degree was the only significant predictor ($\beta = -4.97$, $t = -4.43$, $p < .001$), and accounted for 15% of the variance in BICB ($F(3,102) = 6.99$, $p < .001$). The addition of the Big Five accounted for a further 5% of the variance in BICB, which was significant ($F(5,97) = 4.27$, $p < .05$). Examination of the beta coefficients indicated that Extraversion ($\beta = .25$, $t = 3.16$, $p < .01$) was the only significant predictor of BICB.

### *2.3. Discussion*

The initial hypothesis, that Art students would be more fluent on DT tests than Science students was not supported. There are a number of explanations for this finding. First, the nature of modern science subjects at university, is such that DT preferences can be accounted for in both the Sciences as well as the traditionally divergently oriented Arts domain. Such that, having a preference for DT would not lead a modern student to choose one domain over the other. Second, the choice of Art vs Science students, is not the same as looking at occupational groups who have committed to a career in the Arts or the Sciences. Such that, the samples are unlikely to be representative of "pure" artists or scientists.

Considered alongside the results from the regression analysis, which indicated that both age and domain of study were the only significant predictors, it may be that, in the current study, simply being a university student accounted for the observed DT Fluency scores.

When controlling for age, gender, Extraversion and Openness there is still a significant difference on both Self-Rated Creativity and Creative Achievement between the Art and Science groups. This suggests that differences on the two significantly different creativity measures were because of group membership, rather than due to individual differences. However, it may be that variance could be accounted for by variables not included within this study. This contention is supported to some extent by the results in the regression analysis which indicate that only 25% and 20% of the variance in Self-Rated Creativity and Creative Achievement respectively, are accounted for by the current set of variables.

These findings may be explained thus. Art students, it may be argued, are more inclined to base their identities on the notion of being creative, than Science students. Therefore, when asked to respond to statements about perceived creativity they will be more inclined to acquiesce. With regards to the results for the Creative Achievement scale, it may be argued that many of the items to constitute the scale, would be more easily endorsed by Art-based students (e.g. written a poem, written a short story and choreographed a dance).

The results of the regression analysis indicate that type of degree is the single most significant variable for predicting creativity in any of the three forms in which it was measured. These to a large degree support the findings of group differences from the MANCOVA analysis.

Of the personality variables, Openness, within the analysis of Self-Rated Creativity, and Extraversion, within the analysis of BICB, were the only significant predictors. This offers only a small degree of support for H4. In general, the personality variables of the Big Five were poor predictors of creativity in each of the forms with which it was measured within the study.

## 3. Study 2

Study 2 allowed a more in depth investigation of differences between domains with regards to creativity variables. First, more creativity variables were investigated. Second, the inclusion of IQ allowed for this variable to be controlled. Third, in this study there were three groups: Science, social science and arts.

### 3.1. Hypotheses

H1: Art students will score significantly higher on the DT Fluency test than Social Science students who will score higher than Natural Sciences.
H2: Art students will score significantly higher on the Barron-Welsh Art Scale than Social Science students who will score higher than Natural Sciences.
H3: Art students will score significantly higher on the Self-Reported Creativity measure than Social Science students who will score higher than Natural Sciences.
H4: Art students will score significantly higher on the Creative Achievement measure than Social Science students who will score higher than Natural Sciences.
H5: Openness with be the strongest personality trait correlate of all creativity measures.

### 3.2. Method

#### 3.2.1. Participants

Participants were 90 adult undergraduate students (52 females and 38 males) aged between 18 and 29 years (mean = 20.12; SD = 1.95). The students were from Imperial College London, University College London and University of the Arts, London. A stratified sampling technique was employed to recruit participants from the Natural Sciences (Chemistry, Biology, Physics, Medical Sciences and Mathematics), Social Sciences (Psychology and Economics), or Arts (Fashion, Fine Art and Design). There were 30 participants in each 'experimental' group. All participants spoke English as a first language.

#### 3.2.2. Measures

*3.2.2.1. Creativity. Divergent Thinking* was assessed by the *Alternate Uses test* (Guildford, 1967). Alternate uses were sought for 3 objects (a paperclip, blanket and barrel) with participants asked to write down as many uses as they could consider in the 3 minutes provided for each object. Participant responses were counted to produce a Fluency score.

*Creative Judgement* was assessed by the *Barron Welsh Art Scale*. This measure involved participants indicating whether they liked or disliked 86 different pictures. Test–retest reliabilities and internal consistencies of this measure range from 0.84 to 0.92 (Welsh, 1987).

*3.2.2.2. Self-Rating of Creativity (see study 1).* Creative Achievement was assessed by the Biographical Inventory of Creative Behaviours (BICB: Batey, 2007).

*General Intelligence* was assessed by the *Wonderlic Personnel Test* (WPT: Wonderlic, 1983) which was administered in 12 minutes. It has been found to have a test-retest reliability of 0.94, evidence of long term stability (Dodrill, 1983) and it correlates highly with the WAIS (Dodrill & Warner, 1988).

*3.2.2.3. Personality. Personality* was assessed by the *NEO Five Factor Inventory* (Costa & McCrae, 1992). See study 1.

*3.2.2.4. Procedure.* All the measures were paper and pencil tests and were administered in groups of 3–5 participants under test conditions. Each of the participants worked individually and completed the timed Wonderlic and Alternate Uses tests first. They were then allowed to complete the remaining tests at their own pace. Informed consent was obtained from the participants and the study design was granted ethical approval from the relevant universities.

### 3.3. Results

The current study represents the first use of the Self-Rated Creativity scale. Prior to conducting the MANCOVA and regression analysis, an exploratory factor analysis was conducted to assess scale suitability. A maximum likelihood factor analysis with direct oblimin rotation was conducted. A single factor solution emerged which accounted for 43.6% of the variance with an eigenvalue of 5.2. All communalities (.26–.70) and factor loadings (.26–.79) fall within generally accepted guidelines (Kline, 1994). The 12-item scale demonstrated excellent reliability with a Cronbach alpha of .88.

Descriptive statistics: Means, standard deviations and inter-correlations of the variables in this study are presented in Table 3. The three tests of creativity were all significantly positively correlated. DT fluency was also highly positively correlated with Openness. Indeed Openness was positively correlated with all the creativity measures. This partially confirmed H4.

**Table 3**
Descriptive statistics and Pearson inter-correlations for all measures.

| | *M* (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| DT Fluency | 54.90 (18.88) | .32** | .28** | .40** | .12 | −.01 | .20 | .43** | .22* | .42** |
| 1. Barron-Welsh | 34.32 (7.28) | | .28** | .17 | −.12 | .12 | −.11 | .43** | −.00 | .08 |
| 2. Self-Rated Creativity | 31.94 (6.22) | | | .04 | −.11 | .12 | −.02 | .47** | −.19 | .15 |
| 3. Creative Achievement | 8.26 (3.11) | | | | −.24* | .33** | .06 | .30** | −.02 | .02 |
| 4. Wonderlic | 30.67 (6.40) | | | | | −.40** | .18 | −.06 | .26* | .29** |
| 5. Neuroticism | 20.73 (9.85) | | | | | | −.50** | .35** | −.21* | −.37** |
| 6. Extraversion | 31.87 (5.56) | | | | | | | −.03 | .22* | .33** |
| 7. Openness | 31.09 (4.96) | | | | | | | | .09 | .09 |
| 8. Agreeableness | 31.89 (5.47) | | | | | | | | | .36** |
| 9. Conscientiousness | 33.43 (6.94) | | | | | | | | | |

*Note*: $N = 90$. DT = Divergent Thinking; Barron-Welsh = Barron-Welsh Art Scale.
* $p < .05$.
** $p < .01$.

The means and standard deviations of the variables in the study for the three groups (Natural Science, Social Science and Art) are presented in Table 4. It is noted that the standard deviations in the DT fluency task are somewhat larger than may normally be expected.

In order to assess the differences of the three groups (Natural Science, Social Science and Art) on the four different creativity measures (DT Fluency, Barron-Welsh Art Scale, Self-Rated Creativity and Creative Achievement) a MANCOVA was performed where age, gender and the significant correlates of the creativity measures from the Pearson correlations were held constant (Intelligence, Neuroticism, Openness, Agreeableness and Conscientiousness).

The overall model was significant (Hotelling's Trace; $F(4,77) = .21$, $p < .05$). No significant differences were observed for DT fluency ($F(2,89) = 1.21$, $p > .05$), the Barron-Welsh Art Scale ($F(2,89) = 1.12$, $p > .05$) or Creative Achievement ($F(2,89) = .18$, $p > .05$). Thus, the first three hypotheses were rejected. There was a significant difference between the three groups on Self-Rated Creativity ($F(2,89) = 5.84$, $p < .05$) with Art students scoring highest, followed by Natural Science and then Social Science students. This partially confirmed H3.

Once again, a series of regressions were performed to determine how much demographics, academic discipline, personality and intelligence accounted for variance in the creativity scores. DT score, the Baron-Welsh, Self-Rated Creativity, and Creative Achievement were regressed in block 1 onto age, gender and type of the degree (Art, Natural Science & Social Science). The Big Five Factors were entered in block 2 in order to evaluate the incremental predictive power provided by the personality variables. In addition in study 2, we entered intelligence, in the form of the Wonderlic Test into block 3 in the regression models.

The first regression showed that none of the demographic variables were significant predictors, as the block 1 overall model was non-significant ($F(3,86) = 1.11$, $p = .351$) and accounted for only .4% of the variance in DT Fluency. With the addition of the Big Five, the overall model was significant ($F(8,81) = 5.93$, $p <$ ,001) and accounted for 31% of the variance. Examination of the beta coefficients indicates that both Openness ($\beta = 1.30$, $t = 3.36$, $p < .001$) and Conscientiousness ($\beta = .964$, $t = 3.41$, $p < .001$) were significant predictors of DT Fluency. The addition of intelligence explained no further variance in scores.

The same pattern was evident in the regression for the Baron-Welsh scale. Once again, the initial demographics model was non-significant ($F(3,86) = .71$, $p = .55$). However, with the addition of the Big Five, the overall model was once again significant ($F(8,81) = 2.79$, $p < .01$), accounting for 14% of the variance in scores. In this instance, only Openness was a significant predictor ($\beta = .66$, $t = 3.98$, $p < .001$). Intelligence did account for a further 2% of variance explained, but this was non-significant in terms of the overall model ($F_{change}(1,80) = 2.58$, $p = .11$) and for the individual predictor ($\beta = -.21$, $t = -1.61$, $p = .11$).

Once again, in the analysis of Creative Achievement, only personality variables were significant predictors. The demographics model was non-significant ($F(3,86) = .63$, $p = .60$), whilst a model which included the Big Five was significant ($F(8,81) = 2.60$, $p < .01$), and accounted for 13% of the variance in scores. Neuroticism ($\beta = .13$, $t = 2.99$, $p < .01$) and Extraversion ($\beta = .14$, $t = 2.08$, $p < .05$), were the two significant personality predictors. Once again, intelligence contributed to explain a further 1% of the variance but this was non-significant.

Finally, Self-Rated Creativity showed a slightly different pattern. Despite once again the overall model for the demographic analysis (block 1) being non-significant ($F(3,86) = 2.45$, $p = .07$), the model accounted for 5% of the variance with type of degree as an individually significant predictor ($\beta = 1.92$, $t = 2.42$, $p < .05$). Again the addition of the personality resulted in an overall

**Table 4**
Descriptive statistics for Natural Science, Social Science and Art students.

| | Natural Sciences ($n = 30$)Mean (SD) | Social Science ($n = 30$)Mean (SD) | Arts ($n = 30$)Mean (SD) |
|---|---|---|---|
| DT Fluency | 60.17 (14.28) | 52.83 (23.05) | 51.70 (17.77) |
| Barron-Welsh | 34.60 (5.41) | 31.90 (9.42) | 36.47 (5.80) |
| Self-Rated Creativity | 8.23 (1.55) | 7.17 (2.12) | 8.87 (1.43) |
| Creative Achievement | 7.70 (1.86) | 7.77 (3.83) | 9.30 (3.15) |

model which was significant ($F(8,81) = 6.79$, $p < .001$) accounting for 34% of the variance in Self-Rated Creativity. Extraversion ($\beta = .32$, $t = 2.74$, $p < .01$), Openness ($\beta = .48$, $t = 3.85$, $p < .001$) and Agreeableness ($\beta = -.35$, $t = -3.20$, $p < .01$) were all significant predictors. Once again intelligence accounted for no additional variance in Self-Rated Creativity.

### 3.4. Discussion

When controlling for age, gender, relevant personality traits and intelligence there were no significant differences in DT fluency, Creative Judgement nor Creative Achievement between the Art vs Social Science vs Natural Science students. These results were contrary to the hypotheses. The failure to find differences in terms of DT fluency, may be explained with reference to the arguments ventured for the first study in this paper. Namely, that a preference for DT no longer leads students to gravitate towards any specific domain. Also, as the groups were comprised of students, these groups cannot be considered to be "pure" examples of artists or scientists. Once again, further support for these findings were provided within the regression analysis, where domain of study failed to be a significant predictor of these three measures of creativity.

However, there were still significant differences on Self-Rated Creativity. Yet, this was not in the order predicted (Natural Scientists scored higher than Social Scientists). This again suggests that differences on Self-Rated Creativity were as a result of group membership, rather than because of individual differences accounted for in this study.

The regressions from study 2 indicate that personality variables are the strongest predictors of creativity, but which personality variables is somewhat contingent on the *type* of creativity we are purporting to measure. In three out of the four analyses, Openness was a significant predictor, offering some support for H5. However, the results indicate that Openness was not significant in the prediction of Creative Achievement.

The analysis in study 2 also provided evidence to suggest that type of degree under study is not a significant predictor of creativity. Only for Self-Rated Creativity was type of degree significant, but it did not explain enough variance for the overall demographics model to be significant. The results seem to provide counter evidence to the model of Hudson (1966). However, caution must be exercised in extending these conclusions. In the current sample, the number of participants in each educational domain was small, thus reducing the power to firstly locate differences between groups, and adding a sampling variance which may have distorted the results of the regression analysis.

The final notable finding from the series of regression was that intelligence, measured using the Wonderlic Test, failed to add significant predictive power over and above personality variables, for any of the four creativity types used in the current study.

## 4. Overall discussion

These two studies yielded some similar results although they tested different groups and used slightly different creativity methods. In both studies Arts, as opposed to Science students scored higher on Self-Rated Creativity, but also in terms of Creative Achievements in study 1. In neither study did DT fluency differ between the groups. There could be three reasons for this. First, as is noticeable in Tables 2 and 4 the standard deviations are very high suggesting a great range of scores between individuals in the same group. This is a widely reported finding and it may be that giving participants more time with this task actually reduces the variability. The reduction in variability would lessen the chances of revealing significant differences between the domains. Second, in both studies we only used a few DT tasks which differed slightly (i.e. Consequences vs Unusual Uses). It may be better to use a wider battery of DT tests to get a more robust finding. However, the third reason is that once personality factors have been controlled for the group differences disappear. There is another possibility suggested by the recent paper by Williamson (2011) in this journal: that changes in the educational system over the last 15–20 years has influenced and changed the problem finding and solving approaches and skills of arts and science students so that they are less polarised.

When we control for significant predictors of Creativity in each study, namely ability and personality we still found some effect of disciplinary group membership. The study suggests as we already knew – that personality variables are by far one of the best predictors of Creativity measures (Haller & Courvoisier, 2010). However they do not "explain away" differences between domains in the regressions and it was apparent that personality traits, particularly Openness consistently accounted for more variance than either demographics, or intelligence (study 2). It is possible that the curiosity associated with Openness expresses itself differently in the Arts vs the Sciences. However, the results pertaining to DT Fluency in study 1, do suggest that some of the traditional distinctions made between the Arts and Science domains, warrant further study.

It is of note that across both studies, the regression models accounted for between 14 and 35% of the variance in the creativity measures. Though these values are population adjusted, they are only moderate in proportion, indicating that a much wider selection of variables is required to predict creativity.

All studies have their limitations. This study had relatively small student samples and it would have been desirable to have had larger samples. This is particularly important for locating meaningful group differences. With larger samples, multi-group invariance analysis within structural equation modelling offers a powerful test of group differences. The current sample sizes prohibited invariance testing, but such investigations may be fruitful in future research.

Next, there was an inconsistent measurement of variables both independent and dependent. On the one hand this is advantageous because it reveals the robustness of findings using the famous multi-trait multi-method approach, but on the other hand if there is non-replicability of findings it is not clear whether this is due to methodological variance.

Third, the domain groupings were not as distinct as they might be. That is to find "pure" Arts and Science students is difficult and rare. Ideally, in future research we would use larger samples from different universities as well as more comprehensive measures of both Creativity and individual difference variables. It is important to ensure good quality allocation of art/science groups as well as occupational groupings rather than students.

Studies such as these may also usefully employ other measures like learning or thinking style, mental illness measures (like hypomania and schizotypy) as well as preferred leisure activities to attempt to understand the complex processes underlying creativity.

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