

MEASURING THE CULTURE OF C. P. SNOW'S *TWO CULTURES*

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ABSTRACT

C. P. Snow's (1964) *The Two Cultures* has been controversial, and is still much cited in the literature of both the sciences and the humanities. However, there seem to have been no empirical studies of cultural and aesthetic activities in scientists and non-scientists. This study describes a questionnaire which measured 17 different cultural activities in a stratified survey of science and non-science students in London, UK. Science students showed a significantly lower level of activity on 12 of the 17 measures (and were significantly higher on none). Among the scientists, cultural activity overall was lowest in engineering and mathematics students, and highest in medical and biological science students. Cultural activity correlated significantly with the personality measure of Openness to Experience, although the correlation was weaker in scientists than in non-scientists.

In *The Two Cultures*, his famous, much cited and much quoted Rede Lecture of 1959, the physicist and novelist C. P. Snow (1964) described how "the whole of Western Society is increasingly being split into two polar groups—literary intellectuals at one pole—at the other scientists." Forty-five years later, Snow's idea "still resonates" (Anonymous, 1999), continues to attract controversy (Anonymous, 2004a; Katscher, 1997), and is regularly alluded to in the scientific literature. Thus, for instance, there are over 900 citations on Web of Science (excluding translations), the journal *Nature* has mentioned the book 17 times since 1995, including a March 2004 editorial (Anonymous, 2004b), and there were 61 uses of the phrase in *New Scientist* between October 1987 and December 2004, uses which are mainly metaphorical or allusive, or else are pleas for th

removal of the barriers between the arts and the sciences. One of the latter, by a chemist, specifically criticized the “philistinism” of many scientists, described the apparent pride with which a colleague had said that he couldn’t distinguish “Romanesque from grotesque,” and commented on what he called an “astonishing quote” by the physicist Edward Appleton who apparently said, “I don’t mind what language an opera is sung in, so long as it is a language I don’t understand” (Williams, 1994). On Google Scholar (scholar.google.com; accessed 3rd April, 2005), the phrase “The two cultures” identified 3,630 separate items (albeit some of them comparing two bacterial cultures, two societies, or other usages). The extent though to which the phrase has entered into intellectual life is shown by a long run of somewhat clichéd references in titles such as, *Statistical modeling: The two cultures* (Breiman, 2001), *Bridging the two cultures of risk analysis* (Jasanoff, 1993), *Mental retardation’s two cultures of behavioral research* (Hodapp & Dykens, 1994), *The two cultures of medicine* (Wulff, 1999), *Bridging the gap between the two cultures of alcoholism research and treatment* (Ogborne, 1988), and *The two cultures in computing* (Harold, 1988).

Despite 45 years not having diminished the attraction of C. P. Snow’s idea, here is, to my knowledge, no systematic study of the participation in cultural activities of students or professionals from different intellectual disciplines, either comparing scientists with those from the humanities and other disciplines, or comparing those in different scientific and non-scientific disciplines. Here I describe a questionnaire study which validates Snow’s perceptions of “two kingdoms” of intellect (Tallis, 1995), and shows that science students in general have lower scores on a range of cultural activities, with mathematicians and engineers having the lowest scores. Personality factors are thought to relate to cultural and aesthetic activities (Furnham, 1999; Furnham & Chamorro-Premuzic, 2004), and in particular Openness to Experience is said to relate to an interest in the arts. The present study therefore included a measure of personality in order to assess the relationship of cultural activity to Openness to Experience in scientists and non-scientists. There are also large differences in male and female participation in science (for a review see Xie & Shauman, 2003), and so sex was also included as a factor in the analyses.

METHOD

Information about cultural activities was assessed by a questionnaire distributed as part of a second-year psychology laboratory class, each undergraduate distributing the questionnaire to 12 other “students” (loosely defined, but not in the University College London psychology department and where possible outside the university). The study was stratified by sex (male/female) and subject of study (science/other), each student being asked to collect data from three male science students, three female science students, three male non-science students and three female non-science students.

Cultural activities were assessed using a questionnaire which asked about 17 different activities, including the traditional arts (classical music and opera, museums and art galleries, theater, literature) and popular culture (pop music, going to discos, television), as well as active involvement in the arts (playing music, drawing and painting, acting); see Figure 1 for a list of the 17 cultural activities.

Respondents self-classified their main subject of study using the UCAS (Universities and Colleges Admissions Service) classification (wwwucas.ac.uk/figures/index.html) and here Medical Science, Biological Science, Physical Science, Mathematics, and Engineering are grouped as *Science*, and compared with all *Other Subjects* (of which the majority were Humanities, Languages, and Creative Arts/Architecture). Subjects also provided a brief description of

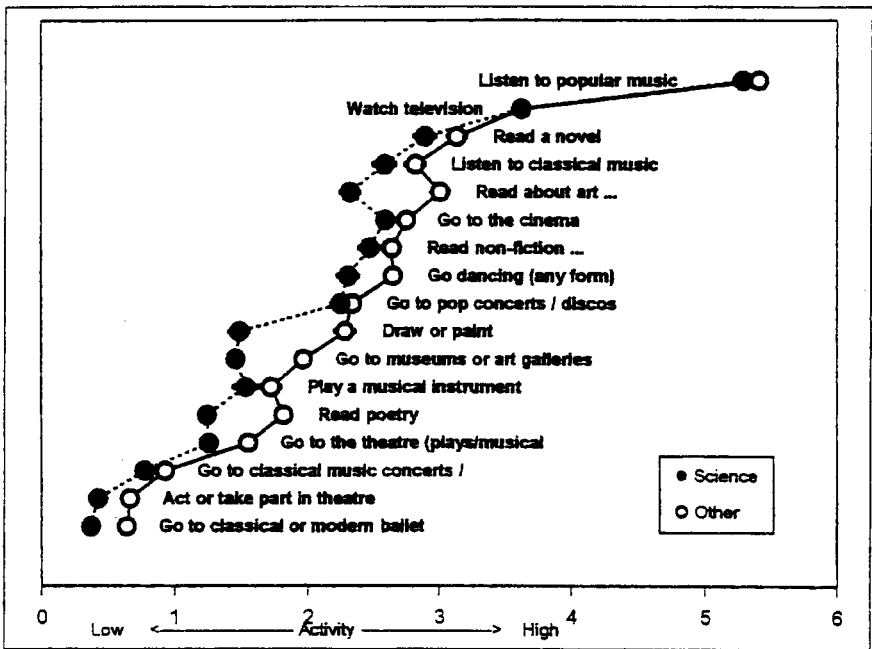


Figure 1. Scores on 17 cultural activities for science students (●) and other students (○). All but one of the 17 items used a common, temporally-anchored, 7-point scale, ranging from 'Never' (scored 0), through "A few times a year" (1), "Once a month or less" (2), "A few times a month" (3), "Once a week" (4), "A few times a week" (5), to "Every day" (6). "Watching television" was scored separately, from "Most days 4+ hours" (6), through "Most 2-4 hrs" (5), "1-2 hours" (4), "Most days 1 hour or less" (3), "2-3 times a week" (2), "Once a week" (1), and "Less often" (0). Error bars (± 1 SE) are plotted for each point, but in most cases are not visible as they are smaller than the symbols themselves.

their degree subject which we used to validate the self-classification on the UCAS scheme.

Background data were also collected on a range of variables, including demography and personality, which was assessed using a brief, 15-item measure of the Big Five personality factors (Costa & McCraw, 1992; Matthews, Deary, & Whiteman, 2003) which has been used in a number of other studies (Furnham & McManus, 2004; Furnham, McManus, & Scott, 2003; McManus, Keeling, & Paice, 2004; McManus, Smithers, Partridge, Keeling, & Fleming, 2003). Other aspects of the study, and in particular attitudes to art (the primary interest of the class), are described elsewhere (McManus & Furnham, submitted 2005).

RESULTS

Of the 1199 respondents, 602 were male (597 female), 513 studied science, and 686 studied other subjects. The mean age of the students was 21.6 (SD 4.61; range 16-65).

Figure 1 shows scores of Scientists and Others on the 17 cultural activities. Scientists scored lower than the others on all but one measure (scoring minimally higher only on watching television), and scored significantly less ($p < .05$ using an unpaired t -test) on 12 of the 17 measures. The size of the Science/Other difference itself differed between the activities, $F(16, 1170) = 4.14, p < .001$, being largest for drawing and painting, going to museums and art galleries, reading about art, reading poetry, and going to the theater, opera and ballet ($t > 4.0$ in each case).

An overall cultural activity score, calculated as the sum of the 17 activity scores (theoretical range = 0-102; mean 37.7, SD 12.1, actual range 8-79; Cronbach's alpha = 0.75), showed significant differences according to subject of study, $F(9, 1150) = 22.0, p < .001$; see Figure 2), but no main effect of sex, after taking subject into account, $F(1, 1150) = 1.22, p = 0.269$, nor an interaction of degree subject with sex, $F(9, 1150) = 0.874, p = .548$). A separate ANOVA comparing Science with Other subjects (a comparison which was *a priori*) showed a main effect of subject, $F(1, 1166) = 51.21, p < .001$, a significant effect of sex, $F(1, 1166) = 4.78, p = .029$, and no interaction between subject group and sex, $F(1, 1166) = 0.666, p = .414$). C. P. Snow suggested that it was physical scientists who were most separate from the humanities, in these data it is engineers and mathematicians amongst the scientists who had the lowest cultural activity scores, and biological and medical scientists the highest, $F(4, 498) = 3.54, p = .007$. In the Other group, the differences were greater, $F(4, 652) = 28.9, p < .001$, with Business Studies scoring particularly low (and lower than the scientists), and creative arts scoring particularly high. A *post hoc* comparison between all ten groups using Tukey's B statistic at the $p < .05$ significance level, showed six homogenous subsets: 1 - Business, Mathematics, Engineering, and Physical Science; 2 - Mathematics, Engineering, Physical Science, and Biological Science; 3 - Engineering, Physical Science, Biological Science, Medical Science, and

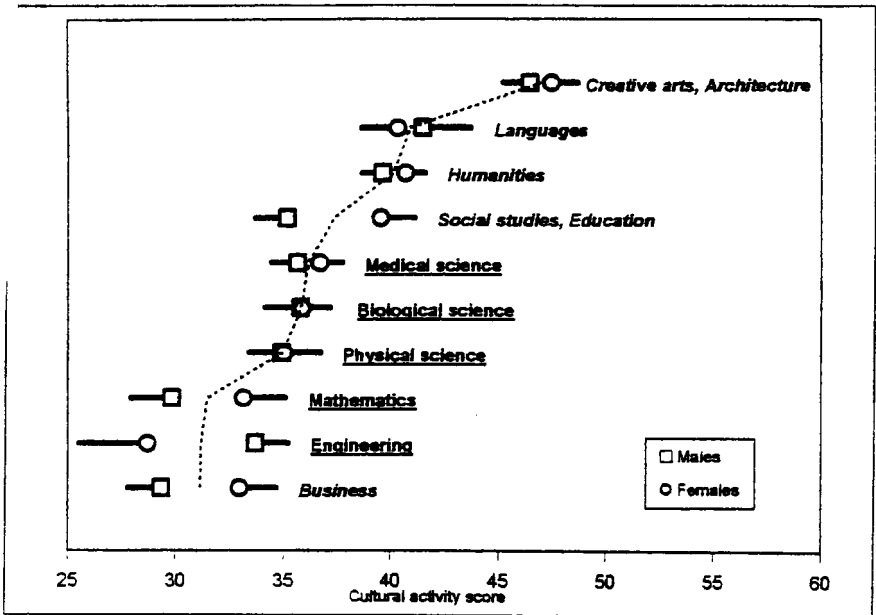


Figure 2. Cultural Activity Score (mean \pm 1 SE) for different subjects of study (sciences underlined, other subjects in italics). Males (□) and females (○) are shown separately.

Social Science; 4 - Biological Science, Medical Science, Social Science and Humanities; 5 - Medical Science, Social Science, Humanities, and Languages; and 6 - Creative Arts.

The study also found, as expected, that the personality dimension of 'Openness to Experience' (McCrae & Costa, Jr., 2003) correlated with cultural activity (Figure 3; $r = .216$, $p < .001$; disattenuated correlation = .339). However, despite Scientists and Others not differing in mean Openness score ($p = .49$), the relationship with Cultural Activity was less strong in Scientists (Science/Non-science \times linear Openness interaction, $F(1, 1166) = 8.01$, $p < .001$).

DISCUSSION

Although much discussed, C. P. Snow's (1964) idea of "two cultures" has been surprisingly little investigated using empirical methods. The two cultures, in one form or another, have been cited many times in the scientific literature, but, as far as I can tell, none of those papers contain empirical data comparing the cultural activities of scientists and non-scientists. Claims about Snow and the two cultures are, however, extremely common, an example being that of Stephen

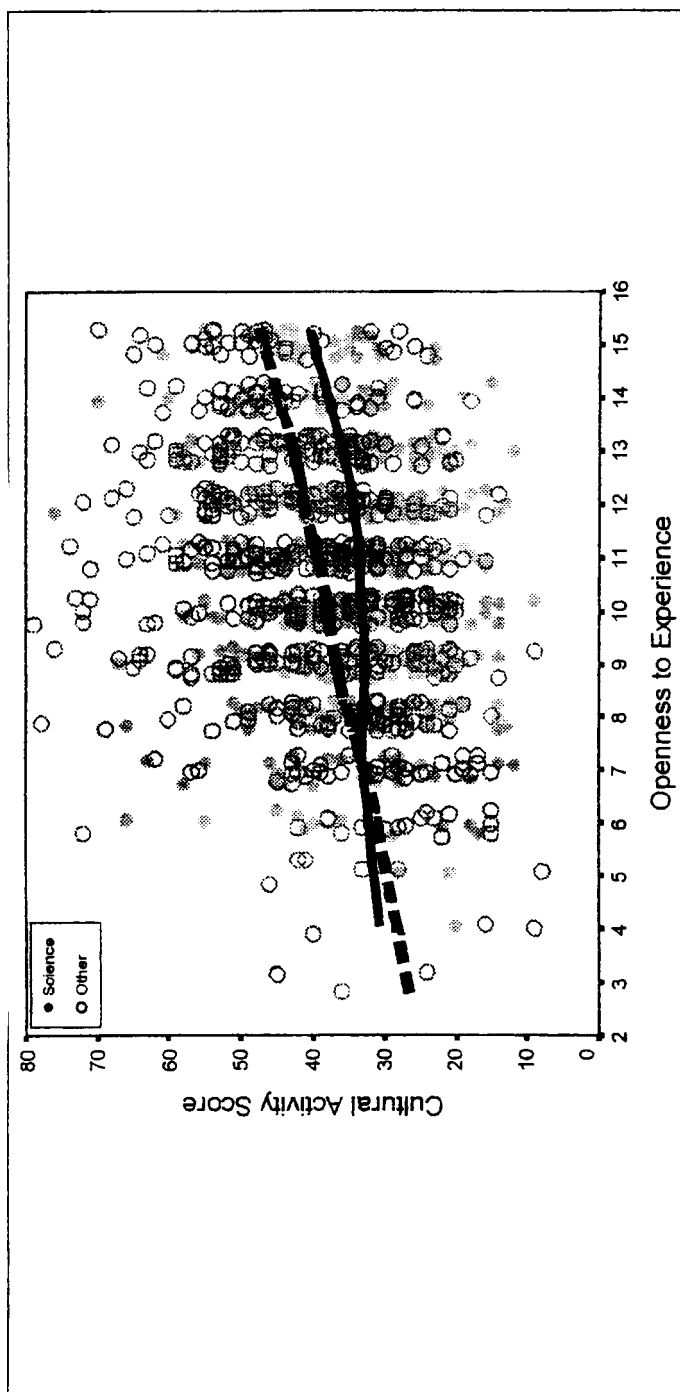


Figure 3. Relationship of Cultural Activity Score to Openness to Experience (assessed using an abbreviated 15-item Big Five questionnaire also used elsewhere (Furnham et al., 2004; McManus et al., 2004); Cronbach's $\alpha = 0.54$). A small amount of random jitter has been added to Openness scores to prevent overlap of individual points. Those studying Science subjects are shown as solid points and a solid line, and those studying Other subjects are shown as open points and a dashed line. The lines are fitted using the lowest procedure in SPSS 17.5.

Jay Gould (2003) who suggested that, "Snow had identified a local English phenomenon—and largely a snooty Oxbridge parochialism at that—and elevated his observations into a fallacious general case." Certainly the data reported here, more than 40 years after Snow and in the cosmopolitan world of the University of London, would seem to suggest some broader generality beyond that of Gould's perception of the cloistered, enclosed world of post-war Oxbridge. Whether the phenomenon is more general than that will require further empirical studies on a cross-cultural basis, and the present data provide a clear methodology for such comparative studies.

Gould (2003) was correct in criticizing Snow for creating a strict dichotomy, when in reality a continuum is likely to provide "a richer and truer model than a dichotomy," for, as Figure 3 shows, even if the mean scores of science and non-science students are clearly different, there is much overlap of the distributions, with many scientists having a broader interest in the arts than many of the non-science students.

It should also, perhaps, be emphasized that although there are undoubted differences in the average cultural activity of students studying different subjects, and in particular the Science and non-Science subjects, it cannot be emphasized enough that the means conceal much variation. Figure 3 not only shows that scientists have lower cultural activity than non-scientists on average, but it also shows that there is a large variation within each group. The total variance in the summed activity score is 12.08, whereas the scientists and non-scientists differ by 5.219. The averaged variance within the groups is 11.63, giving a relatively small effect size of 0.45. Science/non-science therefore accounts for only 4.6% of the variance in cultural activity. Elsewhere we present a structural equation model of some of the other factors determining cultural activity, including personality and education (McManus & Furnham, 2005).

The origins of the lesser cultural activity of scientists, compared with non-scientists, is not clear. C. P. Snow may have been correct in blaming the intense educational specialisation, whereby "at eighteen, our science specialists know more science than their contemporaries anywhere, though they know less of anything else" (Snow, 1964). Our data on Openness to Experience show that Science and non-Science students have similar scores on this personality dimension. However, the correlation of Openness with Cultural Activity is lower in the Scientists, suggesting that the Experience to which they are Open is being acquired from other domains, possibly from science itself, as Snow implied. Of course, although some scientists, as was said by Nicholas Murray Butler (1862-1947), know "more and more about less and less," concentrating on sub-fields of astrophysics or molecular biology, others range broadly across the entire scientific domain, from atoms to anthropology. A future study should, perhaps, look at the other half of Snow's equation, and assess knowledge of science in different disciplines, although it would seem almost self-evident that in general science students will know more about science than do non-science students.

However the *breadth* of scientific activities may well differ both between and particularly within Science and non-Science students, making it possible to assess how disciplines differ in their breadth as well as in their depth.

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