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The Influence of Musical Distraction of Varying Complexity on the Cognitive Performance of Extroverts and Introverts

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Abstract

This study examined the effects of complexity in background music on the performance of four cognitive tasks by extroverts and introverts. In the presence of either 'complex' or 'simple' musical distraction or in silence, 24 introverts and 24 extroverts carried out a reading comprehension test, an observation test, and a memory test (in which recall was measured both immediately and after a six-minute delay). An interaction was predicted such that increasing-complexity musical distraction would result in the increase of extroverts', and the decrease of introverts', cognitive-task performance. A significant interaction was obtained for three of the four tests: the observation test and both memory tests. These findings are discussed with regard to Eysenck's theory of personality. Copyright © *1999 John Wiley & Sons, Ltd.*

INTRODUCTION

The influence of background music upon human performance is a subject which has attracted recent academic research (Furnham and Bradley, 1997; Milliman, 1986; Oldham, Cummings, Mischel, Schmidthe and Zhan, 1995). Through recent technological advances, music has become universally available in many environments (i.e. shops, hotels, even hospitals), and this frequently accompanies various forms of cognitive activity, from educational homework to monotonous tasks in the industrial workplace. The effect of background music in the work environment has stimulated academic research, dating back fifty years (Kirkpatrick, 1943). This has attempted to determine the exact nature of the relationship between task performance in the presence or absence of music. In the process of reviewing the experimental literature, it is evident that no unequivocal conclusion has been reached (Furnham and Bradley, 1997). Instead, a debate concerning the perceived effects of background music has

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evolved, in which arguments are focused on its capacity to relieve boredom, and its potential to distract attention (Salamé and Baddeley, 1989).

Some research has concerned the effects of such 'distraction' upon cognitive indicators (e.g. attention span and memory). Early research indicated that whilst background music resulted in workers reporting more positive attitudes towards their duties, it appeared that its presence elicited no noticeable effects upon task performance. Thus Gladstones (1969) demonstrated that keyboard operators' work rates were unaffected by the presence of background music, despite the employees' requests for the continuation of the music. Smith (1961) proposed that the cognitive complexity of a task may be an important contributor to the extent to which music influences performance. It was contended that the performance of undemanding, monotonous tasks would benefit from music as a relief from boredom, but that in more complex mental activity the presence of music would be more likely to act detrimentally as a distraction. In an experiment in which music was only played during break periods (i.e. not continuously), Smith (1961) found 'uniformly positive responses' from employees to the inclusion of music in their working environment, despite the failure to demonstrate any significant effect upon output rates for complex mental activities. It seems unlikely that the hypothesis was truly tested in a design in which cognitive activity was not performed whilst concurrently listening to music. However, more recent work by Perrewé and Mizerski (1987) found that background music produced no discernible improvement or inhibition of the perception of task characteristics, regardless of task complexity. This research can only substantiate the claim that music is an inert constituent of the working environment.

However, other investigations have demonstrated that background music may impose an active effect upon certain features of human cognition. In a recent study, Kellaris and Kent (1992) demonstrated that temporal perceptions are distorted by the presence of music, whereby individuals' estimates of the duration of a time interval significantly exceed reality. This phenomenon was attributed to the devotion of more attention to the music than to other cognitive processes (such as the internal clock). The limits of human attentional resources have often been referred to in an attempt to explain the detrimental effects of external stimuli upon cognitive task performance. This explanation is not universally applicable, however, as studies advocating the benefits of background music have demonstrated. For example, in a study of personal stereo headset use, Oldham *et al.* (1995) found that the presence of background music resulted in significantly positive effects on performance, organization, satisfaction, and mood state in the office environment. Yet this effect was maintained only for those tasks that had been classified as simple; there was no evident influence upon performance in complex tasks. Furthermore, the result may have been confounded by the active selection of subjects based on their preference for combining work and music. A more substantial piece of research was that done by Fox and Embrey (1972), demonstrating that short periods of stimulating music increase productivity. This was attributed to the introduction of a novel stimulus into a familiar routine which was theorized to increase arousal levels and subsequently alertness.

Although the potential of the audio environment to change arousal levels is significant, it does not take into account a specific base level of arousal intrinsic to each individual. The concept of internal arousal levels is fundamental to Eysenck's (1967) theory of personality, which posits that introverts and extroverts differ in the amount of externally derived stimulation that they require to create the optimum

level of arousal. Introverts experience greater arousal in response to lower-intensity stimulation (because of their lower neurological threshold of arousal) than extroverts, which results in their satisfaction at much lower levels of stimulation. Furthermore, introverts experience an inhibition of excitation once arousal exceeds their optimal level, and therefore exhibit an active aversion to those conditions. It is posited that optimum performance is reached at moderate levels of arousal. It thus follows that the responses of introverts and extroverts to background stimuli (such as music) should differ according to their specific preference of stimulation level. This is extremely pertinent to those experiments monitoring performance in the presence of external stimuli, and may explain the ambiguous results obtained by those psychologists failing to take the personality dimension into account. Early recognition of individual variance in preference for industrial music was evident in Uhrbrock's (1961) paper in which it was claimed that not all workers like music while they work, from 1 to 10 per cent being annoyed by its presence.

Significant differences between extrovert and introvert performance under identical levels of stimulation have been established in various studies. Morgenstern, Hodgson and Law (1974) measured performance of memory under the distracting conditions of background speech, observing the facilitation of the extroverts' functioning in contrast to the impairment of introvert individuals' performance under identical distraction. Further, Campbell and Hawley (1982) found that extroverts preferred and actively sought study conditions with a greater level of background noise and more socializing opportunities. This finding was reinforced by research conducted by Furnham & Bradley (1997), which reported that extroverts were more likely to listen to the radio whilst studying than introverts who found radio excerpts more distracting when engaged in cognitive tasks than did extroverts. The dissimilarity in reaction to external stimulation was also noted by Furnham, Gunter and Peterson (1994), who examined the effects of television distraction upon cognitive task performance, demonstrating that although the functioning of all subjects was better in silence, introverts performed significantly worse than extroverts when subjected to television distraction.

Daoussis and McKelvie (1986) provided subjects with their own preferred music and measured the extent of the distraction from a reading comprehension test. Comparing distracted performances with those undertaken in silence, it was found that although there was no difference in the performance in either condition for extroverts, the performance of introverts was significantly impaired by the presence of low-volume music. Furnham and Bradley (1997) showed that the presence of background radio distraction (consisting of popular music separated by intervals of speech by a male voice) detrimentally affected introvert individuals' performance in both recall and reading comprehension tasks.

The current study investigates the nature of the relationship between the personality and music distraction on cognitive performance. This research extends earlier work by exploring the extent to which *musical complexity* is responsible for variance in introverts' and extroverts' cognitive task performance when subjected to different musical distractions. Although it has been recognized that in conditions with additional environmental stimuli (e.g. music, television) extroverts outperform introverts (Campbell and Hawley, 1982; Daoussis and McKelvie, 1986; Furnham *et al.*, 1994; Morgenstern *et al.*, 1974), little attempt has been made to vary the particular background stimuli responsible for the division of response between the two personality types.

Much of the research into the effect of stimulus information load has been based on a theory proposed by Berlyne (1971; 1974) which relates perceived stimulus complexity to preference. This asserts that the relationship between perceived complexity and liking takes the form of an inverted 'U' function in which optimum preference occurs at a moderate stimulus complexity at which the general population would be neither under- nor over-aroused. Eysenck's (1967) theory would predict the division of this function into two distinct curves for highly extroverted or introverted individuals. The preferred level of stimulus complexity for introverts would occur at a lower (less stimulating) level than that of the stimulus-hungry extroverts who would demand greater levels of externally derived arousal. This preference appears to be manifest in the respective working conditions of the two personality types (Campbell and Hawley, 1982; Furnham and Bradley, 1997). Furthermore, individuals' preferred stimulation levels should also produce their optimum performance as their internal arousal level should be satisfied.

Early investigations into specific features of music compared exemplars of contemporary musical genres such as 'popular' and 'classical', for example the investigation conducted by Freeburne and Fleischer (1952). In an experiment which did not specifically examine personality differences, it was established that whilst classical, semi-classical, and popular background music produced no effect, jazz music significantly increased reading rates. However, a musical genre such as jazz may contain within itself a great variety of style, tempo, tonal and rhythmical range. It must therefore be conceded that this form of classification does nothing to indicate the exact characteristics resulting in a particular level of stimulation or distraction. However, the attribution by Freeburne and Fleischer (1952) of the observed cognitive superiority in the jazz music condition to 'the marked and regular rhythm of the music' may inadvertently provide details of the distinguishing feature of the jazz music stimulation level. Their description of the jazz music used suggests that it was not overly stimulating, its outstanding feature being an emphasized and regular beat. Thus this piece of music carried a low information load not resulting in over-arousal, and the simple, repetitive rhythm may be described as being a feature of a low-complexity stimulus. In combination with other more interesting features, this music may have provided moderately complex stimulation, offering an optimal balance to a population comprising both extroverts and introverts.

Research has frequently demonstrated that the complexity of specific musical features of background distraction can affect cognitive task performance. Mayfield and Moss (1989) revealed that background music with a quick tempo improved the subjects' cognitive performance in a task involving the calculation of stock market price changes. Furthermore, this particular investigation noted that subjects reported a significantly higher level of distraction for fast music, suggesting that this music induced greater levels of arousal and carried a higher information load to be processed by the listener. Milliman (1982; 1986) also reported that faster tempo was perceived to be more complex.

Further, meaningful information appears more distracting, and therefore more likely to impair cognitive performance (Martin, Wogalter and Forlano, 1988). Salamé and Baddeley (1989) demonstrated that vocal music and unattended speech were considerably more disruptive than instrumental music or silence in a memory task involving visually presented verbal material. From this it may be possible to conclude that vocal features of background noise would increase the information load.

Furthermore, there is also evidence to suggest that tonal sequences which are composed of more individual components and a wider variety of tones are considered more complex, indicating that background music fitting this definition would prove to offer greater stimulation and therefore have a greater intrinsic potential to stimulate.

The implication of Eysenck's (1967) theory is that the amount of stimulation offered by a piece of music would be 'enjoyed' differently by the two personality types. Indeed, preference for music type may be related to personality traits as well as many other factors (Furnham and Avison, 1997). One possible method of categorizing music in terms of the stimulation offered is through the measure of its information load. Kiger (1989) reported that background music categorized as being 'low information load' facilitated reading comprehension, with individuals achieving superior results to those achieved when the task was performed in silence. In contrast, the presence of 'high-information-load' music detrimentally affected performance of the same task. Although Kiger (1989) did not qualify the criteria upon which the categorization of the music was based, the 'low-information-load music' was described as 'highly repetitive ... with a narrow tonal range', and it was implied that the presence of this music induced the optimum arousal level for the subject group, and would meet the criteria for low-complexity stimulation. In comparison, the high-information-load piece was portrayed as being 'dissonant, rhythmically varied and highly dynamic' and was hypothesized to over-arouse, participants, resulting in tension and impaired concentration. The impaired performance in the 'high-information load' condition as a result of over-arousal corresponds to the low preference for complex stimuli illustrated by the inverted 'U' function (Berlyne, 1971; 1974).

The present experiment examined the performance of introverts and extroverts in cognitive tests performed in the presence of background music of two different complexities (simple and complex) and in silence. The music for the two treatment conditions was selected on the basis of tempo; rhythmic, tonal, and melodic complexity; vocal meaningfulness; and overall complexity, as these attributes of musical complexity have been shown to exact significant effects upon cognitive performance (Freeburne & Fleischer, 1952; Kiger, 1989; Milliman, 1982; 1986; Mayfield and Moss, 1989; Salamé and Baddeley, 1989). It was hypothesized that there would be a significant interaction between the dimension of introversion–extroversion and the complexity of the background distraction.

METHOD

Design

The experiment is of 2×3 mixed factorial design, comprising one between-subjects and one within-subjects factor: the between-subjects independent variable of extroversion (introvert/extrovert) and the within-subjects variable of background music condition (silence/simple music/complex music). Subjects were required to complete three tasks (reading comprehension/memory test/APM observation test), the separate scores of which were analyzed as the dependent variable. All subjects experienced all three background music conditions, completing a different cognitive task in each. The introversion–extroversion dimension, music, and task conditions were counterbalanced so that four introverts and four extroverts participated in each music–task combination. The order of the tasks was randomized.

Subjects

One hundred and sixty-three undergraduate psychology students completed the Eysenck Personality Questionnaire (Eysenck and Eysenck, 1975). Forty-eight of those individuals who achieved either extremely high or low scores on the extroversion dimension, based on the semi-inter-quartile range, were selected to participate further in the experiment. Twenty-four of these subjects were classified as 'extrovert' (mean EPQ score, 18.91; mean age, 21.41 years). The remaining twenty-four subjects (mean EPQ score, 7.73 mean age, 22.32 years) were classified as 'introvert'. The overall male to female ratio for the two subject groups was 1 : 2.4. The subjects were unaware of the experimental hypothesis throughout, and were paid a small amount at the end of the experiment in return for their participation.

Materials

The music used in the treatment conditions of the current study was chosen by a panel of six individuals who had all achieved at minimum Grade 5 Music Theory, and thus possessed a certain level of musical expertise and were qualified to select the sample music. These experts rated 14 contemporary music compositions for tempo, repetition, rhythmic complexity, melodical complexity, vocal meaningfulness, instrumental layering, and overall complexity. Pieces that were rated as being extremely familiar were automatically excluded from the experiment. Those pieces achieving the lowest scores were categorized as 'simple', the three simplest being selected for use in the experiment: 'Low' by REM; 'You have been loved' by George Michael; and 'Only the wind' by Pet Shop Boys (total length of 'simple' music, 13 min 18 s; mean tempo, 64 bpm). The pieces achieving the highest ratings were categorized as 'complex'. 'Scream' by Michael Jackson; 'Runnin' for the red light' by Meatloaf; and 'Poison' by Alice Cooper (total length of 'complex' music, 12 min 5 s; mean tempo, 118 bpm) were selected as being exemplars of complex music.

Music on cassette format was presented to subjects by means of a cassette player. To eliminate other possible distractions, subjects listened to the music in the treatment conditions through stereo headphones, but also wore the headphones in the control condition (silence).

All subjects completed three cognitive tests which were of an appropriate level of difficulty for the sample. They were the same materials as used by Furnham and Bradley (1997) in their experiment. The selected tests placed demands upon a variety of cognitive activities, including language-related abilities, observation, logical deduction, and memory. One test was completed in silence, another in the presence of 'simple' background music, and the other in the presence of 'complex' background music.

(i) The reading comprehension test was extracted from the book of Graduate Admission Tests (GMAT; Martison, 1992). This consisted of a 400-word passage and six multiple-choice questions based on the text. Subjects were allocated ten minutes in which to complete this test, scoring two for a correct answer and zero for an incorrect answer, allowing a maximum possible score of 12.
(ii) The memory test was taken from the British Ability Scales (1977) range of tests. In this, subjects were required to study a sheet upon which 20 familiar objects had been depicted in the form of simple line drawings. Subjects recalled as many

of these objects as they could, both immediately and after a six-minute delay, scoring one for each item recalled correctly: subjects could therefore achieve a maximum score of 20. In the six-minute interval, subjects were requested to complete a simple arithmetic test taken from *Know Your Own IQ* (Eysenck, 1981). The purpose of the arithmetic test was to divert the subjects' attention from the objects they had previously memorized, and therefore subjects' results from this test were not included in the analysis.

(iii) A test of observation and clear thinking was made using the *Advanced Progressive Matrices: Set I* comprising 12 multiple-choice problems (APM: Raven, 1981). Subjects were required to examine a pattern with a piece cut out of it, and select the one piece (from a collection of eight) that would correctly complete the pattern. Subjects then marked their choice on a standard multiple-choice answer sheet, scoring one for a correct answer and zero for incorrect answers, the maximum possible score being 12. Five minutes was allocated for this test.

Procedure

Subjects completed the experiment in individual sessions. Subjects first completed a pre-test questionnaire which requested personal details and information about subjects' fatigue level. All subjects completed the reading comprehension test, memory test, and APM observation test. Each subject conducted one of the tests in the presence of 'complex' background music; another test in the presence of 'simple' background music; and the other test in silence. The music condition (simple/complex/silence) was counter-balanced with the test type (reading/memory/APM) so that all combinations of music and test type occurred with equal frequency. In the treatment conditions, music was presented to subjects at a moderate and constant amplification through stereo headphones.

Before each subject carried out the reading comprehension test, the experimenter gave verbal instructions explaining that the passage should be read carefully, and that after this the subject should attempt to answer the questions as accurately as possible. The participant was also informed of the ten-minute time limit for the test. Subjects were requested to don the headphones when the test began. In the memory test, each subject was requested to don the headphones when the test began. The subject was presented with the sheet depicting 20 objects, and instructed that two minutes would be allowed to memorize those items. After this time had elapsed, the sheet of pictures was removed from the subject's sight and the subject was requested to recall and write down as many of the objects as they could remember. No time limit was placed on this part of the task. The subject was then presented with the simple arithmetic test, and informed that there was a six-minute time limit. After the six minutes had elapsed, the subject was again requested to recall the objects they had memorized previously. The subject was unaware that recall would be required a second time. On completion of the three tests, subjects were asked to rate on a ten-point scale how distracting they found each of the two music treatment conditions. The average session length was approximately 35 minutes.

The experimental data separately yielded from each cognitive task (shown in Table 1) was analysed using a 2 (introversion/extroversion) $\times$ 3 (complex/simple/silence) mixed ANOVA.

Table 1. Means and standard deviation scores for each task for introverts and extroverts in each background music condition

	Introvert			Extrovert		
	Complex	Simple	Silence	Complex	Simple	Silence
Reading comprehension[a]						
mean[a]	6.88	7.50	8.00	9.00	8.25	8.00
SD	0.99	1.41	2.83	2.67	2.25	2.88
APM test[a]						
mean	8.00	9.25	10.50	10.01	10.88	9.13
SD	2.33	1.83	1.31	1.69	1.96	0.93
Immediate recall[b]						
Mean	10.63	11.00	15.75	17.63	17.38	13.88
SD	3.02	5.01	2.05	2.20	1.92	2.70
Delayed recall[b]						
mean	10.13	12.75	15.88	17.13	14.88	12.13
SD	2.95	3.92	2.53	1.96	2.90	2.42

[a]Maximum possible score 12.
[b]Maximum possible score 20.

For the *reading comprehension test*, there was no main effect of extroversion ($F(1, 42) = 2.10$; ns), no main effect of background music condition ($F(2, 42) = 0.01$; ns) and there was no interaction between the two factors ($F(2, 42) = 0.88$; ns). The *APM observation test* yielded no significant main effect of extroversion ($F(1, 42) = 2.30$; ns) nor background music ($F(2, 42) = 1.63$; ns). The interaction between background music and introversion/extroversion was, however, significant ($F(2, 42) = 4.66$; $p < 0.01$). This was due to the linear decline in the performance of introverts from the silent condition, through the simple to the complex music background condition.

In the *memory test*, *immediate recall* produced a strong main effect for extroversion $F(1, 42)$, 20.57, $p < 0.001$), no main effect of background music ($F(2, 42) = 0.27$; ns) with a significant interaction effect ($F(2, 42) = 11.45$ $p < 0.001$). The interaction was a classic 'cross-over' interaction, with introverts scoring highest in silence and lowest with complex music, while the opposite was true of the extroverts. For *delayed recall*, there was a marginally significant main effect of extroversion ($F(1, 42) = 4.76$; $p < 0.05$) no background music effect ($F(2, 42) = 0.07$; ns), but the interaction between personality type and music was found to be significant ($F(2, 42) = 14.32$; $p < 0.01$). Again, extroverts scored marginally higher than introverts and, again, there was a clear cross-over interaction, with introverts scoring least in the complex-music condition and extroverts scoring most. Overall, extroverts scored higher than introverts.

An independent *t*-test revealed that the level of distraction reported by introverts and extroverts in the post-test questionnaire differed significantly in the presence of complex background music ($t46 = 4.11$; $p < 0.01$), but not when the distraction consisted of simple background music ($t46 = 1.09$; ns). In addition, a paired sampled *t*-test demonstrated that introverts perceived complex music to be significantly more distracting than simple music ($t46 = 5.53$; $p < 0.001$) whereas extroverts did not report any significant difference in distraction between two types of music ($t46 = 0.99$; ns).

DISCUSSION

This experiment investigated the cognitive performance of introverts and extroverts under conditions of simple and complex musical distraction. Subjects' performance in three different tests was examined, and it was found that in all tasks there were two significant overall differences between the scores attained by introverts and extroverts, particularly with extroverts performing better in a short-term memory task. This result was similar to that of Howarth and Eysenck (1968) who found extroverts' paired associate recall was better than introverts', in short term intervals (0–5 min), but inferior at long term intervals (30 min–24 h). This was also in accordance with studies by Kleinsmith and Kaplan (1963) who found associations learned under low arousal showed poor immediate recall which fell over the course of several days, whereas items learned under high arousal showed poor immediate recall which improved with the passage of time. Clearly, in this study, the delay of six minutes was not enough for extroverts to demonstrate a superior effect.

The experiment revealed no significant main effect of background music condition, indicating that the presence of either simple or complex music neither enhanced nor inhibited performance in the three tests beyond the scores achieved in silence. This experimental finding lends support to the earlier research (Gladstones, 1969; Smith, 1961) which asserts that background music elicits no main effect upon task performance per se.

The experimental hypothesis was supported by the results from both memory tests and the observation test, which produced a significant interaction between background music type and extroversion. Overall, tests in the presence of increasingly complex background music was shown to facilitate extroverts' scores. In comparison to the silence condition, the performance of extroverts was somewhat improved in the presence of simple background music, but the greatest recall was achieved in the complex-music condition. The performance of the introvert subjects, in direct contrast, was impaired by the presence of any musical distraction, most significantly by that music categorized as complex. The superior performance of extroverts when subjected to more complex distraction (hypothesized to be more arousing) corresponds to previous experimental findings (Furnham *et al.*, 1994; Furnham and Bradley, 1997; Morgenstern *et al.*, 1974), and is consistent with Eysenck's theory of personality (1967). No such interaction was observed in the results of the reading, although the trends were in the same direction.

The significance of this finding suggests that complex music exacts an immediate effect on test performance, and it may be possible to attribute this to the introverts' excitation-inhibition mechanism when subjected to over-arousal. Furthermore, it appears that, although the effects of the highly stimulating complex music are immediately apparent, the delay of six minutes plays an important role in the subjects' adherence to the performance predicted by the experimental hypothesis. During this six-minute interval subjects may have adjusted to their environment, and thus the results obtained for the delayed recall test may reflect more accurately the effects of background music upon memory-related activities at home or at the workplace.

These results may also be interpreted in terms of Eysenck's reminiscence theory, which asserts that the lower arousal in extroverts produces weaker consolidation

processes which interfere less at short-term intervals, but which do not facilitate long-term recall (Howarth and Eysenck, 1968).

No significant interaction between the personality dimension of extroversion–introversion and background music condition was shown in the results obtained from the reading comprehension task though the results were the in predicted direction. However, reading comprehension has previously been shown to produce significant interactions between the presence of a musical stimulus and extroversion (Furnham and Bradley, 1997). Furthermore, the existence of trends in the data contradict those conclusions. In every cognitive task, introverts outperformed extroverts in silence, whilst the performance of extroverts was superior in the presence of complex musical distraction. This contrasting performance of extrovert and introvert subjects in the two conditions, confirms Eysenck's (1967) hypothesis.

Indirect support for the experimental hypothesis appears initially to be provided by the results of the post-test questionnaire. It was established that extroverts rated the complex music as less distracting than the introverts; a finding which conforms to the pattern predicted by Eysenck's (1967) theory of personality. As distraction is thought to interfere with cognitive performance, this finding indicates that extroverts considered complex music to affect their performance less detrimentally than introverts did, a belief which is reflected in the trend of consistently superior performance of extroverts in the presence of complex music. Furthermore, introverts reported that they found the complex music to be significantly more distracting than the simple music, whilst extroverts perceived no significant increase in the distraction caused by the complex music when compared to that resulting from simple stimulation.

It would thus appear that simple music could offer the most suitable balance of stimulation for populations consisting of both introvert and extrovert individuals, a state which would be predicted by the experimental hypothesis.

However, data from the cognitive tests reveal that performance in the presence of simple music follows no systematic pattern. One explanation for this phenomenon may be that the variable of music has interacted with some other unspecified variable, such as musical preference or previous exposure. Indeed, these may be a complex set of interacting factors, such that introverts may find pop music more irritating, and hence distracting, than extroverts, play it less and be less familiar with it, and hence like it less. Alternatively, when the circumstances produced by simple music are examined, it is evident that this form of stimulation was unique in that the arousal it evoked could easily be tolerated by both subject groups, whilst it would not offer optimum conditions to any introvert or extrovert. A state of mild dissatisfaction may be induced in all subjects; a state in which unanticipated factors (such as individual preference for a particular musical genre) may be more influential. It may be necessary in future studies to try to control for subjects' liking of, and previous exposure to, particular music chosen in the distraction task, as these factors may affect its ability to distract.

Indeed, an alternative explanation for some of the findings may be offered through the criticism of the music selected to represent each treatment category. Music was characterized by a modern, popular style to prevent the over- or under-arousal of both subject groups. However, it is possible that the selection from the popular music genre may not have provided a wide enough range from which to draw samples significantly differing in complexity, and thus account for the lack of difference in distraction perceived by extroverts between the two types. Furthermore, this style of

music would be familiar to those who listen to contemporary music. Here, important differences between the usual study habits of subjects may account for certain patterns in the findings: studies by Campbell and Hawley (1982) and Furnham and Bradley (1997) have demonstrated that extroverts actively seek environments containing such stimuli as socializing opportunities and radio. Thus extrovert subjects in this experiment would be more familiar than introverts with the perceptually stimulating environment provided in the complex music condition. The reverse may explain the relatively poor performance by extroverts in silence. Further experiments should attempt to reduce the difference between subjects in the familiarity with experimental conditions. This may be achieved to some extent by presenting subjects with entirely novel musical stimuli which vary in complexity.

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