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Breaking away from set patterns of thinking: Improvisation and divergent thinking

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ABSTRACT

This paper explores the relationship between improvisation and divergent thinking in the context of schema theory, where it is suggested that improvisation encourages people to break away from set patterns of thinking. Improvisation is the act of creating something new on the spur of the moment. Verbal improvisation is the act of spontaneously creating strings of new words, while avoiding pre-planned phrases (Sawyer, 2008). Divergent thinking was assessed using the Alternative Uses Task (AUT) before and after a treatment condition of either improvisation or control tasks. Experiment One examined verbal improvisation, while controlling for mood, and observed an increase in divergent thinking scores in terms of fluency, originality and flexibility following improvisation but not a control task. No effects of mood were found. Experiment Two examined music improvisation and also observed an increase in divergent thinking for fluency, originalityand flexibility following improvisation but not following a control condition ($p < .05$ in all cases). The results show that participating in verbal and music improvisation increases scores on a divergent thinking task, suggesting that improvisation may enable people to break away from set patterns of thinking as influenced by schemas (Sawyer, 2001).

1. Introduction

Improvisation is the act of creating something new, on the spur of the moment. The term divergent thinking refers to our mental processes and associated structures of thinking in relation to tasks that have more than one possible solution. This paper explores the links between improvisation and divergent thinking, while determining whether mood is a significant mediating variable in this relationship.

1.1. What is improvisation?

Improvisation falls into the larger category of creativity; the process of creating something different and new, over a period of time. Although discrepancy exists among the definitions of both creativity and improvisation (Chamorro-Premuzic & Furnham, 2005; Sternberg & Lubart, 1999), it is generally agreed that in order for a product to be creative, it must be original and it must be useful (Runco & Jaeger, 2012). The key difference between improvisation and creativity is that improvisation must be carried out spontaneously, on the spot, leaving no opportunity for correction and no time for conscious preparation of material.

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"Improvisation", is derived from the Latin word, "proviso". This means to deal with something that is already thought out in advance. Adding "im" to the word, thus making it "improviso" reverses this meaning. "Improviso" then means to deal with things on the spot that are unexpected (Montuori, 2003; Weick, 1998). Improvisation, therefore, is the process and product of creativity occurring simultaneously (Nooshin, 2003).

This definition of improvisation suggests that key to the production of improvisation is the concept of the unknown (Hargreaves, 1999; Lockford & Pelias, 2004; Sawyer, 2003). Both the performer and the audience cannot predict what will happen in an improvised performance. Moreover, the high pressure involved in the process of improvisation should not leave any time for preplanned material (Sawyer, 2008).

This in turn makes the process of a successful improvisation a hard task to accomplish. In order to enhance the success of improvisation, more often than not constraints are applied (Sawyer, 2000). Too random an improvised piece and the audience will fail to connect. Structures are applied not only to help the audience but to allow performers to access a knowledge base to help with the difficulties faced from improvisation.

This article looks at two domains of improvisation – verbal and music. Verbal improvisation is the act of spontaneously creating something new, using spoken words, and music improvisation is the act of spontaneously creating something new using musical instruments.

1.2. Improvisation and divergent thinking

Improvisation is thought to involve the process of divergent thinking (Medonca & Wallace, 2005; Webster, 1977). Divergent thinking involves coming up with a range of possible solutions for a particular task or problem and thought to be key in problem solving. This is in contrast to convergent thinking, which on the other hand, involves solving a problem, resulting in one definitive, correct solution.

This study looks at a task of divergent thinking. Divergent thinking tasks usually involve thinking of as many possible solutions to a given problem as possible, such as Guilford's (1967) Alternative Uses Task and Goff and Torrance's (2002) consequences task.

It has been suggested that improvisation allows the opportunity to think in a divergent manner (Medonca & Wallace, 2005). In order to improvise successfully, divergent thought is needed in order to continuously think of something new, in a flexible manner (Carr & Borkowski, 1987). It has been suggested that both improvisation and creativity involve an element of problem solving and that the element of novelty could help solve divergent thinking tasks in particular (Getzels & Csikszentmihalyi, 1976). The potential link between improvisation and divergent thinking, however, has seldom been explored. Schmidt, Goforth, and Drew (1975) looked at the potential link between improvisation and creativity scores. Higher scores in a set of simple creativity tests were found in children, approximately six years of age, who had undergone eight weeks of verbal improvisational activities in comparison to children who had not undergone improvisation tasks. Until recently, the idea that improvisation could enhance divergent thinking was neglected until Karakelle (2009) found a creative drama course, focused on verbal improvisation, to increase scores on divergent thinking tasks over a period of ten weeks in adults. However, in both of these studies, no control group was compared to the improvisation conditions.

1.3. Improvisation and schema theory

Walton (2003) suggested that the majority of people adopt a convergent style of thinking in everyday situations, corresponding to set patterns of thought, while the minority adopt a divergent thinking style, suggesting one reason why improvisation is no easy task.

Pressing (1987) proposed a theory in which improvisation occurs by recalling previous information, or schemas, and regrouping the information to form something new. According to Bartlett (1932), schemas are general knowledge structures that we use on a daily basis in order to predict and understand what is expected in different situations. Throughout life we subconsciously build up a large array of schemas that drive our expectations and organize our knowledge of the world. Schemas are divided into more specific definitions of scripts (Bower, Black, & Turner, 1979), frames (Brewer & Treyins, 1981) and slots (Schank & Abelson, 1977).

In an unpublished manuscript, Pressing (1998) refers to schemas as "referents"; phrases we store which aid improvisation, as they provide variation to music improvisations while reducing the risks involved. If someone cannot think of anything completely novel at a particular moment in time, referents can be accessed during the performance. Pressing (1987) argues that schema theory explains why improvisations are always different, yet allow for improvisers to have their own identifiable sound. As well as this, it makes sense of a seemingly impossible task by suggesting that people have different schemas that they can activate to provide a basic template for themselves. New ideas can then be integrated into these schemas, which then change the entire performance into something different.

Within the context of verbal improvisation, formulaic speech, set phrases of speech that we use, is used throughout both everyday conversation and improvisation. As Pressing (1987) suggests, Sawyer (2001) says that these preplanned phrases are shared parts of scripts that we share in order to encourage conversation.

This combined with the large constraints that are applied to everyday conversations makes the use of creativity limited in everyday conversation. In contrast, improvised conversation has a larger number of different scripts that can be called upon. Without the constraints of the conversation, the improvisation has the option to take various different routes. A

story plot or event can be made and new characters created (Sawyer, 2001). Therefore, while formulaic speech is utilized in both everyday and improvised speech, improvised speech adds more choice in turn making the speech more creative.

Due to the nature of improvisation involving creating things on the spur of the moment, it is regarded as a high-pressure situation. Kuiper (1996) investigated speech in relation to low and high-pressure situations, finding differences such that people in high pressure situations use more preplanned speech phrases than those low pressure situations but used more creativity in these responses. This suggests that improvised speech is not defined by preplanned phrases but the flexibility that is allowed to be more creative.

However, what this theory of schema processing does not account for is the idea that schemas could in fact hinder improvisation. While it is thought that knowledge is a factor needed to be able to improvise well (Borko & Livingston, 1989; Hinz, 1995), it is possible that over-reliance on one or more schemas could lead to the problem of repetitious behaviour while improvising. While schemas provide an adequate theory of improvisation, relying too heavily on a restricted set of schemas can create problems for improvisers, as this can stop them from thinking freely.

Our organization of everyday life is through the use of schemas. Over-reliance on schemas may account for why people are thought to rely on convergent thinking styles of thinking over divergent thinking styles (Walton, 2003). Our levels of fluency, originality and flexibility are higher when people are used to activities involving creativity, indicating that when this creative pathway is used, it can enhance the fluency, originality and flexibility of our thoughts. Therefore, it is proposed that by engaging in the act of improvisation, under-used pathways are stimulated and increases the activation of one or all of the dimensions involved in divergent thinking. The effect improvisation has on schema processes will subsequently lead to an increase in scores of divergent thinking tasks.

1.4. Improvisation and mood levels

There is a vast amount of literature that suggests a relationship between mood and creativity levels (Adaman & Blaney, 1995; Baas, De Dreu, & Nijstad, 2008; Davis, 2009; Grawitch, Munz, Elliott, & Mathis, 2003; Hirt, Devers, & McCrea, 2008), such that a positive mood can lead to higher scores of creativity (Pannells & Claxton, 2008). However, other researchers have also shown a link showing negative moods increase creativity (Akinola & Mendes, 2008; Anderson & Pratarelli, 1999; Gasper, 2003).

Isen, Johnson, Mertz, and Robinson (1985) showed that participants completing a word association test scored higher in terms of originality when they were in positive moods. Isen, Niedenthal, and Cantor (1992) replicated this effect along with positive mood involving a greater level of flexibility in word association tasks, suggesting that positive mood relates to divergent thinking. Vosburg (1998) confirmed this, finding a naturally positive mood enhanced divergent thinking tasks while a negative mood inhibited this style of thinking.

Fredrickson's (1998, 2001) 'broaden-and-build theory of positive emotions' suggests that a positive mood can enhance or "broaden" people's way of thinking. By being in a positive mood, people are more likely to think in different ways. These ideas can then be used to "build" towards a larger knowledge base. As with the schema theory, one must first break away from set patterns of thinking and then expand on their normal patterns of thinking to create novel ideas. The added element in this theory is the assumption that a positive mood is what influences this increase in divergent thinking.

The action of verbal improvisation is often seen to be "playful" (Hargreaves, 1999; Lockford & Pelias, 2004; Sawyer, 1999). Therefore, if verbal improvisation leads to an increased level of playfulness, it is likely that this element of playfulness will boost mood levels.

To our knowledge there are no published studies regarding the link between improvisation and mood. Within the literature looking at the effects of mood on creativity, divergent thinking tasks have been found to show the same effects of mood (Baas et al., 2008; Vosburg, 1998). It is therefore plausible that mood could be a possible confounding variable such that if improvisation enhances mood, it may then improve scores on the AUT, as opposed to the task of improvisation itself improving scores.

1.5. The effect of improvisation

Previous research (Schmidt et al., 1975; Karakelle, 2009) has suggested that improvisation could enhance scores in tasks of divergent thinking. The present study aimed to identify if there was a difference in scores of a divergent thinking task, the AUT, after a series of improvisation exercises when compared to a control group. Due to the literature surrounding creativity and mood, mood scores before and after improvising were measured to determine if any differences that occurred in the AUT were mediated by mood levels.

This paper takes verbal improvisation to be different to that of everyday speech (Lockford & Pelias, 2004; Mackenzie, 2000; Pawley & Syder, 1983) such that due to the constraints of everyday conversation, it does not involve the act of creating something new, but talking about events and situations that have occurred (Ryle, 1979).

It is thought that the act of improvisation will stimulate pathways in our schemas that are underused, resulting in an increase of fluent, original and flexible thinking.

1. The first experimental hypothesis is that for the AUT scores there will be a significant interaction between condition and time of testing, such that there will be a larger increase in AUT scores following 20 min of improvisation condition than the control condition.
2. Mood scores have been found to improve after various forms of social interaction and therefore, from an a priori perspective, there will be no difference in changes in mood scores as a function of treatment condition.

2. Experiment 1

2.1. Method

2.1.1. Participants

Forty-one Psychology undergraduate students took part in the experiment in return for course credit. There were 33 females and eight males with a mean age of 22 years (SD = 7). Students took part in groups of between three and eight people. Groups were randomly divided by condition, resulting in 21 (female = 17, male = 4) participating in the experimental condition and 20 (female = 16, male = 4) in the control condition. Participants were recruited through the University of Hertfordshire's research study participation system.

This study received ethical approval from the University of Hertfordshire.

2.1.2. Design

A 2×2 mixed design was implemented in the current research. *Factor one*: condition was a between groups measure with two levels (improvisation and control). *Factor two*: time was a repeated measure with two levels (pre and post treatment). The treatment was either 20 min of improvisation or 20 min of a verbal discussion. The independent variable was the treatment condition. The dependent variables were scores on the AUT (fluency, originality, elaboration and flexibility) and scores on a mood questionnaire.

2.1.3. Treatment conditions

2.1.3.1. Improvisation condition. The improvisation condition consisted of a set of standard verbal improvisation exercises derived from Johnstone (1981). These exercises were designed to encourage people to spontaneously produce speech that, as far as possible, could not be planned in advance. The improvisation exercises lasted for 20 min. For a full description of all tasks please see Appendix A. The improvisation tasks started at a basic level, with exercises (1 and 2) designed to prevent people from people thinking in patterns. These tasks increased in complexity ranging from telling stories (tasks 3 and 4) through to having improvised conversations with one another (tasks 5–7). Improvisation tasks required participants to either work in groups or in partners (Appendix A). This was carried out to provide variety and formed a base for what was required of each improvisation task. For each task that required working with a partner, the partner changed between each task in order to ensure the ability of one person did not interfere with the ability of another.

2.1.3.2. Control condition. The verbal control condition consisted of a set of verbal interactions that were similar in structure to the improvisation exercises. For example, instead of random letter generation, participants were asked to recite the alphabet one letter at a time. The verbal control condition exercises lasted for 20 min and a full list of tasks are available in Appendix A. These exercises were designed to encourage people to interact with other people in a similar way to the improvisation condition and to produce speech which could be planned in advance, and which required minimal spontaneous creation.

2.1.4. Measures

2.1.4.1. Alternative uses task (AUT). The AUT required participants to write down as many different uses for a common object within 3 min. Instructions for the AUT were:

> "You will be given the name of a common object. I would like you to list as many different uses for it as you can. This can be anything other than what the object was originally intended for. You will have three minutes to complete this task and write down as many alternative uses as you can. Are there any questions?"

Two versions of the same test were used and were counterbalanced. The two objects given to participants were a *remote control* and a *paperclip*.

The AUT was scored using an objective scoring method due to its use in the most common creativity tests such as the Torrance Tests of Creative Thinking (Torrance, 2008) and the Abbreviated Torrance Test for Adults (Goff & Torrance, 2002) as well as due to its extensive use within the AUT or task equivalents (Shamay-Tsoory, Adler, Aharon-Peretz, Perry, & Mayseless, 2011; Torrance, 2008; Wallach & Kogan, 1965; Webster, 1977) and high levels of reliability reported (Fink et al., 2010). The AUT was therefore scored for *Fluency*, *Originality*, *Elaboration* and *Flexibility*. *Fluency* refers to the number of legal responses that are created when performing a divergent thinking task. For example, while thinking of alternative uses for a paperclip, 'clipping paper together' would not be considered as a valid response, while 'as a hairclip' would be. *Originality* refers to how unique an answer is in comparison to responses given by the current sample. Participants were allocated one point for responses in the top 5% of the sample. For example, less people used the response 'to tidy up nail polish' than those who said

'as a hairclip' and the first response would therefore be scored as more original. *Elaboration* refers to the level of detail given in an answer. The more one elaborates on a response, the more creative they are seen to be. Each time the rater notices an extra feature beyond the basic use given, a point is allocated. For example, someone who say 'as a decorative clip to make hair look nicer' would score higher than someone who simple said as a hairclip'. *Flexibility* refers to the number of different categories responses fall into. For example, 'hairclip' is seen as a different category to both 'piercing ears' and 'making holes'.

The AUT was chosen due to its previous use in improvisation related studies (Karakelle, 2009; Schmidt et al., 1975). No norms regarding the AUT have been found to date. However, this is one of the most widely used tests in creativity (Kim, 1998; Mayer, 1999) and high levels of reliability have been established, with correlations of .8 and above (Fink et al., 2010; Hocevar, 1979; Runco, 2004).

2.1.4.2. AUT-inter-rater reliability. A test of inter-rater reliability involved three independent raters scoring the AUT fluency and flexibility scores. Scorers were known as experts in the academic field of creativity and scored both conditions. Scorers were blind to both condition and pre/post condition. Guidelines given to raters for the AUT along with the definition of each subscale to score. As with Amabile's (1982) Consensual Assessment Technique (CAT), scorers used their own definition of creativity. Originality scores were calculated by the first judge only, as originality is a concrete score relative to the frequency of responses. Inter-rater reliability was investigated using intraclass correlations (ICC) across the three judges' scores. ICC across all three judges' scores of fluency revealed a strong, positive correlation, $r(82) = .89$, $p < .001$ suggesting a high level of agreement on fluency scores across the judges scores. ICC across all three judges' scores of elaboration revealed a strong, positive correlation, $r(82) = .83$, $p < .001$ suggesting a high level of agreement ... on elaboration scores across the judges scores. ICC across the three judges' flexibility scores also revealed a positive correlation, $r(82) = .71$, $p < .001$, suggesting a high level of agreement on flexibility scores across the judges ratings.

2.1.4.3. Profile of mood states (POMS). The profile of mood states (POMS; McNair & Heuchert, 2003).

POMS is a widely used mood questionnaire and is particularly good for the current study as it is able to measure mood in the present moment. It consists of a 65-item questionnaire using six subscales along with a Total Mood Disturbance (TMD) score and asks people how they feel in the present moment. The six subscales are labelled as "Tension-Anxiety (T), Depression-Dejection (D), Anger-Hostility (A), Vigor-Activity (V), Fatigue-Inertia (F) and Confusion-Bewilderment (C)". Participants are asked to rate how they feel on a 5-point likert scale, ranging from 0 (*Not at all*) to 4 (*Extremely*) for single word items or short phrases, e.g. "Unhappy", "Lively", "Ready to Fight".

The POMS is scored by calculating the individual subscores according to the corresponding items. The TMD score is then calculated by subtracting the Vigor factor from the sum of the remaining five factors, leaving a score between 0 and 200.

POMS internal consistencies are high with all six factors reporting values of between .87 and .95 (McNair & Heuchert, 2003). It was chosen to measure levels of mood for a variety of reasons. The POMS was chosen over other mood scales, such as Beck's Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the Positive And Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) due to the type of positive affect that is assessed and a greater variability in the results that can be produced. While the PANAS simply produces a positive and negative score, the POMS produces six separate scores, of which these can be divided to provide positive and negative affect scores, found to be equivalent to the PANAS (Sharpe & Gilbert, 1998). Full construct validity has been established for POMS but not for the PANAS (Meek et al., 2000). Finally, McChargue, Cohen, and Cook (2004) noted that positive mood on the PANAS referred to "low activation positive mood states" (p. 289) while the POMS positive affect result, also referred to as vigor, assessed positive affect as being active, lively and "full of pep". This refers to items that are more likely to make people act in the positive ways as indicated by the POMS, such as whether people feel encouraged, determined or proud. For the purposes of this study, the authors were interested in determining an increase in active words, which are more likely to change in a short time frame.

2.1.5. Procedure

Participants read an information sheet and gave informed consent. In the pre-test phase, all participants completed the POMS questionnaire and one version of the AUT. The treatment phase followed where participants were randomly allocated into either the experimental group, engaging in 20 min of group improvisation exercises or the control group, taking part in 20 min of verbal discussion. Participants either worked as part of the whole group or were allocated partners. Partners were continuously changed in order to control for individual differences in improvisation ability. Finally, in the post-test phase, all participants completed the POMS questionnaire followed by the second version of the AUT.

2.2. Results

The mean scores and standard deviations for fluency, originality, elaboration and flexibility are shown in Table 1. Independent samples *t*-tests were carried out between condition for all pre-AUT scores. There were no significant differences ($p > .05$ in all cases).

2.2.1. Alternative uses task

One-way ANCOVAs were carried out on each average AUT score with condition as the between subjects factor (improvisation and control). Pre-test scores were taken as the covariate. Preliminary checks revealed no violation of assumptions.

Table A1
Treatment condition tasks and descriptions.

	Group/partner	Improvisation		Control	
		Task	Description	Task	Description
1	Group	Random number generation	Shout at a random number each time the experimenter claps (highlighting how easy it is to get in patterns).	Sequence number generation	Count up and down in numbers
2	Group	Random letter generation	As with random number generation but with letters	Sequence letter generation	As with sequence number generation but with letters
3	Group	Word at a time	Going around in a circle, one person says a word at a time to form a coherent story.	Word at a time rhyme	Going around in a circle, one person says a word at a time from the nursery rhymes humpty dumpty or twinkle twinkle
4	Partner	Unrelated words story	Tell a story using three unrelated words (given by experimenter)	Three key things part 1	Find out 3 key things about your partner
5	Partner	Three words at a time	Have a conversation using three word sentences	Recent events	Discuss recent events - last holiday, hobbies
6	Partner	Characterization	Give each other a character, accept and continue story.	Three key things part 2	Relate 3 key things of partner back to group
7	Group	Exit on fourth line	Two people start characterization. When experimenter claps, another member of the group takes the place of one of the two people.	University life	Discuss how they find university life.

Table 1
Mean (S.D) AUT scores pre and post verbal intervention.

	Improvisation ($n = 21$)		Control ($n = 20$)	
	Pre	Post	Pre	Post
Fluency	5.33 (2.16)	7.46 (2.42)	5.12 (2.72)	5.63 (2.41)
Originality	1.33 (1.24)	3.43 (1.66)	1.95 (1.54)	2.30 (2.21)
Elaboration	2.14 (1.24)	2.57 (1.94)	2.11 (1.88)	2.05 (1.43)
Flexibility	3.49 (1.06)	4.87 (1.57)	3.57 (1.55)	4.02 (1.51)

Table 2
Summary ANCOVA table for study 1 AUT scores, where pre-score is the covariate.

AUT subscore	Covariate – pre-score	ANCOVA (partial η^2)
AUT fluency	$F(1, 38) = 13.86^{**}$	$F(1, 38) = 6.8^{*}$ (.27)
AUT originality	$F(1, 38) = 21.34^{**}$	$F(1, 38) = 10.61^{**}$ (.36)
AUT elaboration	$F(1, 38) = 2.64$	$F(1, 38) = 1.21$
AUT flexibility	$F(1, 38) = 12.34^{**}$	$F(1, 38) = 4.51^{*}$ (.25)

* $p < .05$.
** $p < .01$.

When AUT pre scores were covaried out, the main effect on AUT post scores were significant for AUT Fluency, AUT Originality and AUT Flexibility. No significant results were found for AUT Elaboration. ANCOVA results and effect sizes are displayed in Table 2.

For AUT Fluency, Originality and Flexibility subscores, the means in Table 1 indicate that participants scored significantly higher post improvisation when compared to the control condition. For the adjusted means following the ANCOVAs, please see Table 2.

2.2.2. *Profile of mood states*

Table 3 displays the means and standard deviations for participant's mood scores pre and post treatment condition.

One-way ANCOVAs were carried out on each average POMS score, as well as TMD with condition as the between subjects factor (improvisation and control). Pre-test scores were taken as the covariate. Preliminary checks revealed no violation of

Table 3
Mean (S.D) scores for POMS scores pre and post verbal intervention.

	Improvisation ($n = 21$)		Control ($n = 18$)	
	Pre	Post	Pre	Post
Tension	6.29 (4.64)	2.67 (3.31)	4.83 (3.54)	2.50 (2.31)
Depression	3.52 (4.42)	.81 (1.50)	3.00 (5.38)	.72 (1.74)
Anger	2.52 (3.06)	1.24 (2.19)	3.94 (5.19)	1.44 (2.38)
Vigor	13.29 (6.69)	18.71 (6.23)	14.11 (4.65)	17.67 (5.35)
Fatigue	3.90 (2.81)	2.14 (3.12)	5.44 (3.93)	2.06 (1.98)
Confusion	6.43 (2.87)	4.29 (2.78)	6.39 (3.27)	4.56 (1.89)
Total mood	36.38 (16.42)	19.43 (10.91)	35.28 (18.07)	20.61 (10.80)

assumptions for the total mood score as well as all subscales other than that of Confusion. A preliminary analysis evaluating the homogeneity of regression slopes revealed a significant interaction between Confusion and condition, $F(1, 35) = 6.44$, $p = .016$, suggesting that adjusted pre-intervention scores of confusion differed as a function of the independent variable. Confusion was therefore excluded from the analyses.

One-way ANCOVAs revealed no significant differences on post-intervention scores with pre-intervention scores as a covariate. The results of the ANCOVA are displayed in Table 4.

Results show that there were no differences in scores between the two treatment groups. However, the covariate of mood was significant in all cases, with the means suggesting that the mood of all participants increased, irrespective of what condition they were in (see Table 2).

Previous research (Adaman & Blaney, 1995; Grawitch et al., 2003) has suggested that mood could be linked to higher scores in divergent thinking. To test this theory, total mood pre-scores and AUT pre-scores were analysed by the means of Pearson product-moment correlation. Correlations between AUT fluency scores and the POMS TMD score were weak, $r(39) = -.1$, $p > .05$, as were correlations between POMS TMD and AUT Originality, $r(39) = -.05$, $p > .05$, POMS TMD and AUT elaboration, $r(39) = .1$, $p > .05$ and POMS TMD and AUT Flexibility, $r(39) = -.17$, $p > .05$. Moreover, these did not differ between condition ($p > .05$ in all cases), suggesting this task of divergent thinking is not related to participants current mood state in the present sample.

2.3. Discussion

The results of the current study indicate a difference in the fluency, originality and flexibility components of the AUT scores following improvisation but not the control condition. Inter-rater reliability was found to be a strong, positive correlation in all cases. Mood, as measured by POMS, was found to change significantly in a positive direction after participation in either condition. Furthermore, baseline scores of divergent thinking and mood were not found to relate to one another. The observed differences in the AUT scores as a function of treatment condition cannot therefore be attributed to differences in mood between groups.

It is worth noting that effect sizes were substantial across these results, with partial eta squared revealing that these group differences account for 26.7% of AUT Fluency scores, 36% of AUT Originality scores and 24.5% of AUT Flexibility scores respectively.

These findings are in line with the theory of improvisation and schemas, suggesting that improvisation helps people to break away from set patterns of thinking such that they are either able to switch between schemas more efficiently or they are able to update slot information more efficiently, or both. This in turn improves scores on tasks of divergent thinking.

The results of the POMS also provide evidence against the idea of the broaden and build theory of positive emotions (Fredrickson, 1998, 2001) such that it was not being in a positive mood that broadened one's knowledge base resulting in a wider range of thinking.

Experiment 1 used verbal improvisation exercises and a language based AUT task. It is possible therefore that those people in the improvisation treatment condition used a wider range of language than those people in the control condition and as such this wider language use may have primed a wider network of verbal tokens in the lexicon. It may have been this priming which led people to be more flexible, fluent and original in the AUT task. Furthermore, improvising in groups may have influenced improvisation such that those who struggled with improvising could have hindered other members of the group. In order to test this assumption Experiment 1 was replicated using non-verbal treatment conditions and individual improvisation.

3. Experiment 2

3.1. Introduction

Music improvisation involves spontaneously creating novel phrases or pieces of music and is perhaps the most widely researched area of improvisation (McPherson, 1995; Medonca & Wallace, 2005; Nettl, 1974). Areas of research in music

improvisation focus on methods of music improvisation (Berliner, 1994; Nettl, 1974; Pressing, 1987), as well as organizational improvisation (Weick, 1998).

As with verbal improvisation, few researchers have investigated the relationship between music improvisation and divergent thinking. Koutsoupidou and Hargreaves (2009), however, looked at creativity levels following music improvisation lessons in primary school children. They found that scores in both originality and flexibility of a creative thinking task was significantly different to those children who took part in music lessons without any element of improvisation.

Pressing (1987) suggested that musicians use schemas in their improvisations. Previous phrases that have been acquired through practice act as musical versions of schemas. By using this idea of musical schemas, it is possible to apply the schema theory to music improvisation. While it may again be that people need these schemas in order to be able to produce a successful piece of improvisation, using pre-conceived phrases could in fact inhibit the quality of improvisation. By improvising with constraints applied, it may encourage people to break away from phrases that are often used, encouraging people to think differently and therefore produce more original improvisation. This is in line with the work carried out by Stokes (2001) who suggests that creativity can become more varied when constraints are applied. By constraints, it is meant that people improvise according to certain criteria, for example, to the twelve bar blues or to represent a season of the year.

In Experiment 2 musicians took part in either 20 min of musical improvisation tasks or they did 20 min of music practice, and they completed the AUT task both pre and post treatment. If the effects observed in Experiment 1 were due to the treatment condition being based on verbal improvisation then we should not expect to see changes in AUT scores as a function of musical treatment condition in Experiment 2. However, if the effects were due to improvisation in general facilitating processing at the schema level then we should expect to see changes in divergent thinking scores as a function of musical improvisation. The experimental hypothesis is that people who improvise through music will significantly improve in scores of divergent thinking.

3.2. Method

3.2.1. Participants

A specialized sample of 36 musicians, who had achieved grade 6 standard or above in their principal instrument, were recruited from the Guildhall School of Music and Drama and the Department of Music from the University of Hertfordshire. No incentives were used for the present study. Participants were randomly assigned to condition resulting in twenty-four musicians (13 male and 11 female; 12 classical musicians and 12 jazz musicians) who participated in 20 min of music improvisation, and 12 musicians in the control condition (nine male and three female). The mean age was 32 (SD = 14).

3.2.2. Design

The design was the same as Experiment 1, with one exception; the removal of the mood scale. The experimental hypothesis is that there will be a significant increase in AUT scores for those in the improvisation treatment condition compared with the control condition.

3.2.3. Materials and procedure

The same materials and instructions were used for the AUT as described in Experiment 1. The improvisation condition consisted of two separate tasks. The first was the Questions and Answers (Q&A) task. The Q&A task consisted of 18 short musical phrases, each lasting between 10 and 15 s. These phrases were pre-recorded from an electric piano. The 18 phrases varied in terms of key signatures, tempo, pitch and technical difficulty, such that the musical phrases became more complex. Each phrase was played, in order of complexity, to each musician who in turn had to provide an answering phrase to what they had just heard. The second was the emotional response task (ERT). The ERT involves musicians responding musically to one of six emotional stimuli. Participants are shown visual representations of anger, disgust, fear, joy, sadness and surprise for 15 s and they respond by improvising around the emotional theme. Each emotion was displayed six times and the musicians were told to use a different improvised response for each emotional repetition. There was a 15 s interval between each emotion. Participants in the control condition practiced a known piece of music. Participants were tested individually and, as in Experiment 1, they completed the AUT pre and post treatment.

3.2.3.1. AUT inter-rater reliability. As with Experiment One, three raters individually rated the AUT scores of fluency and flexibility. Inter-rater reliability was investigated using ICC. ICC across all three judges fluency scores revealed a strong, positive correlation, $r(72) = .82$, $p < .001$ showing a high level of agreement on fluency scores across the judges ratings. ICC across all three judges' scores of elaboration revealed a strong, positive correlation, $r(72) = .89$, $p < .001$ suggesting a high level of agreement . . . on elaboration scores across the judges scores. ICC across all three judges flexibility scores also revealed a strong, positive correlation, $r = 71$, $n = 72$, $p < .001$ suggesting a high level of agreement on fluency scores across the judges ratings.

Table 4
Summary ANCOVA table for study 1 POM scores, where pre-score is the covariate.

POMS subscore	Covariate – pre-score (partial η^2)	ANCOVA (partial η^2)
Tension	$F(1, 36) = 13.29^{**}$ (.27)	$F(1, 36) = .19$
Depression	$F(1, 36) = 20.47^{**}$ (.36)	$F(1, 36) = .002$
Anger	$F(1, 36) = 13.71^{**}$ (.28)	$F(1, 36) = .1$
Vigor	$F(1, 37) = 9.49^{**}$	$F(1, 36) = .67$
Fatigue	$F(1, 36) = 6.76^{*}$ (.16)	$F(1, 36) = .49$
Total Mood Disturbance	$F(1, 36) = 14.95^{**}$ (.29)	$F(1, 36) = .28$

* $p < .05$.
** $p < .01$.

Table 5
Mean (S.D) AUT scores pre and post music intervention.

	Improvisation ($n = 24$)		Control ($n = 12$)	
	Pre	Post	Pre	Post
Fluency	8.0 (4.37)	9.56 (3.71)	8.50 (4.25)	7.75 (3.85)
Originality	2.58 (2.48)	4.5 (3.78)	2.67 (2.61)	2.0 (1.48)
Elaboration	3.46 (2.41)	3.5 (2.06)	4.17 (2.95)	3.17 (2.21)
Flexibility	7.21 (3.21)	5.96 (2.29)	7.08 (3.26)	5.54 (2.75)

Table 6
Summary ANCOVA table for study 2 AUT scores, with pre-score taken as covariate.

AUT subscore	Covariate – pre-score	ANCOVA (partial η^2)
AUT fluency	$F(1, 33) = 56.68^{**}$	$F(1, 33) = 9.0^{**}$ (.214)
AUT originality	$F(1, 33) = 60.85^{**}$	$F(1, 33) = 6.87^{*}$ (.172)
AUT elaboration	$F(1, 33) = 2.25$	$F(1, 33) = .42$
AUT flexibility	$F(1, 33) = 79.98$	$F(1, 33) = 4.14^{*}$ (.112)

* $p < .05$.
** $p < .001$.

3.3. Results

The means and standard deviations for fluency, originality and flexibility scores of the AUT pre and post treatment shown as a function of treatment condition are shown in Table 5.

One-way ANCOVAs were carried out on each average AUT score with condition as the between subjects factor (improvisation and control). Pre-test scores were taken as the covariate. Preliminary checks revealed no violation of assumptions. When AUT pre scores were covaried out, the main effect on AUT post scores were significant for AUT Fluency, AUT Originality and AUT Flexibility. No significant results were found for AUT Elaboration. ANCOVA results and effect sizes are displayed in Table 6.

For AUT fluency, originality and flexibility subscores, the means in Table 5 indicate that participants scored significantly higher post improvisation when compared to the control condition. For the adjusted means following the ANCOVAs, please see Table 6.

3.4. Discussion

In general terms, the results of Experiment Two replicate those of Experiment 1. Scores of AUT fluency, originality and flexibility all revealed significant results, such that scores increased in the improvisation condition and not the control group.

Effect sizes were again substantial across these results, with partial eta squared revealing that these group differences account for 21.4% of AUT Fluency scores, 17.2% of AUT originality scores and 11.2% of AUT flexibility scores,

respectively. Although AUT Originality and Flexibility are slightly lower, effect sizes are still large. Comparison between the results of this experiment and experiment one however, should be taken with caution due to the participant characteristics in the two studies. It is worth noting that the musicians used in this sample could be classed as experts in their area. Jazz and classical musicians were used in the present sample to ensure a mix of musicians who are either likely or unlikely to practice improvisation. However, all musicians could still be classed as experts within their principal instrument indicating a potential confounding variable when compared to Experiment 1 (using novice improvisers).

Overall, it is concluded that musicians who improvised for 20 min showed an increase in scores of divergent thinking when compared to a control condition. These findings suggest that the results obtained in Experiment 1 were not due to the effects of verbal priming between the improvisation condition and the AUT.

4. General discussion

The present paper has found that divergent thinking scores based on fluency, originality and flexibility as measured by the AUT increase after both verbal improvisation and music improvisation as compared with control conditions. These effects remained, after controlling for mood in experiment one.

One explanation for why improvisation improves divergent thinking scores is due to breaking away from set patterns of thinking. The increase in scores of fluency suggests that people are accessing more alternative solutions after improvising. This is likely to be related to the cognitive process involved when having to generate items for the AUT and an increase in scores of flexibility and originality suggest this could be happening in two possible ways. In relation to the schema theory, it is proposed that when having to think of alternative uses, people adopt a schema to come up with their first answer. In order to create a different response, this schema then needs to be suppressed in order to be able to adopt a new schema to think of a new answer.

However, people may not always be able to accurately suppress previous schemas when trying to generate new items for the AUT. This is what the scoring of flexibility appears to demonstrate. Flexibility scores refer to the number of different semantic categories that are used across all the alternative uses produced. In relation to the schema theory, these categories could refer to the number of different schemas that are produced. If people are not able to suppress schemas of previous answers, they may use previous schemas to create a new use, for example, for a brick, 'to stand a coffee on' and 'to stand a lamp on' are two ways of using the brick as a table. When schemas are not fully suppressed they may be used to create a similar alternative use straight away, as in the above example, resulting in proactive interference, such that the previous answer influences the next answer of the AUT. However, previous schemas may also be re-used when people run out of ideas. In this way, people may go through the schemas that they have already used to try and generate new answers. The scoring of flexibility therefore reflects people switching between a wider range of ideas and therefore schemas. As well as fluency, scores of flexibility and scores of originality in verbal improvisation in both experiments were found to significantly increase after a series of improvisation tasks, supporting the idea that people are thinking in different ways to gain more solutions in tasks that involve divergent thinking.

Originality scores reflect the idea of a schema theory in two possible ways. Firstly, people may be using a set of different, more unique schemas once they have improvised, which in turn would increase originality scores. Alternatively, the same schemas may be utilized but with slots being filled in a more unusual manner. The scoring of the originality component itself, however needs further investigation. Variability still occurs within this dimension as to the exact point system being used. With the current sample, a normative approach was used (Milgram & Milgram, 1976; Torrance, 2008), where items that were considered original (top 5%) were simply allocated one point – the total is then divided by the number of responses made. The problem with this approach is that it may over estimate originality scores, particularly in small samples. A new scoring system should therefore be developed in future in order to assess originality in more detail and to address recent problems that have been identified with these originality scores. Silvia et al. (2008) identified that the larger the database of original responses, the less likely an answer will be original. As well as this, Silvia et al. (2008) noted that originality often correlates highly with scores of fluency. The higher the score of fluency, the higher the likelihood of obtaining a higher score of originality. Fluency scores therefore need to be taken into account when scoring for both originality and flexibility as the number of responses will reflect both of these scores.

It is now becoming recognized in the field that problems and disagreements occur in the scoring of the AUT and that this largely focuses on the definition of fluency (Hocevar, 1979; Shamay-Tsoory et al., 2011; Silvia et al., 2008) such that the agreement of what counts as an alternative use as well as how the term fluency differs to originality varies. These issues of scoring in the AUT should be raised and studied in future. This study employed a commonly used objective scoring method. However, more recently, attempts at using a subjective scoring method have been made (Silvia, 2011). However, these subjective methods are relatively new, still time intensive and the reliability yet to be established. Future research could employ one of the subjective methods suggested by Silvia et al. (2008) or Silvia (2011) and compared to the objective scoring method utilized in the present study. Employing a different research method may avoid the high correlations often found among the different dependent variables when scoring the AUT.

Although not large enough to be significant, small increases did occur in AUT scores of the control group, suggesting practice effects are occurring. Replicating these effects in other tasks of divergent thinking would confirm the current findings as well as eliminate any carry over effects that could have occurred as a result of having two different version of the AUT.

It would be interesting to develop the idea that improvisation can lead to cognitive benefits by using more cognitive tests which are both more sophisticated and measure convergent as well as divergent thinking. While in the current experiment improvisation has been shown to improve scores of a divergent thinking task, this may not generalize to convergent tasks due to the type of thinking required to perform such tasks. As it is thought that improvisation helps scores of a divergent task due to being able to access a greater variety of schemas, then this method of thinking would not help a convergent task, which requires people to come up with the one possible solution available. If Walton (2003) is correct in hypothesizing that highly creative people exhibit a divergent style of thinking, then improvisation, which is seen as a creative task, would therefore help divergent thinking as opposed to convergent thinking. However, both convergent thinking and an evaluative abilty have been linked to the usefulness of creative ideas (Runco, 2008). This subsequently leads on to the question of whether improvisation simply helps with idea generation in divergent thinking tasks due to the similarity of the tasks of improvisation and the AUT, or whether it helps with other aspects of creativity. Replicating the effect with different types of thinking tasks is therefore necessary to establish the cognitive processes mediating the relationship between improvisation and divergent thinking.

Other areas of cognition that could be assessed include tests of memory. A link between improvisation and memory has been hypothesised by Weick (1998), who stated that "to improve improvisation is to improve memory" (p. 547). This hypothesis was tested by Scott, Harris, and Rothe (2001) who found verbal improvisation based on a character from a monologue participants had just read, elicited a higher level of recall accuracy when asked to recite the monologue.

No significant differences between condition were found between condition for the effects of mood, suggesting that this is not a mediating factor in the results. However, mood did have a significant impact following both treatment conditions and this should be controlled further in future studies. Firstly, the effect of mood should be confirmed to follow the same patterns for music improvisation as it did for verbal improvisation. Secondly, it should be noted that the POMS scale does not identify deactivating mood states, an affect which the PANAS could identify in future studies.

Finally, the improvisation tasks themselves would be of benefit to explore further. While the current studies carried out improvisation tasks for a period of 20 min, it would be useful to look into whether the length of improvisation has an impact on the benefits of cognition, as well as the actual task(s) being undertaken. While looking at the length of improvisation, it would also be interesting to look at the length of the effect that improvisation has following a series of improvisation tasks. It may be that the less constraints improvisation has on participants, the more it will help them to expand their patterns of thought or, alternatively, by introducing constraints this can in turn increase the amount of variability used within improvisation, as suggested by Stokes (2001).

These exploratory studies pose interesting questions for future research. How much improvisation is needed to produce this effect? How long does the effect last for? Can the results be replicated in various domains of improvisation and what cognitive domains are affected? Can improvements be seen with numeracy or visual spatial tests? How does convergent thinking play a part in these results? In conclusion, the present investigation provides interesting results to support the idea that improvisation has cognitive benefits for divergent thinking. One way that this could be explained is by looking at the schema theory. It is thought that improvisation helps us break away from our everyday thinking patterns, enabling us to think in more diverse ways. If improvisation does help our divergent thinking, it would therefore be beneficial to introduce more tasks of improvisation into the educational system in order to encourage children to think in more diverse ways. There are, however, many areas to explore to determine what these results truly show us, including the use of different cognitive tests, the improvisation tasks used and any potential underlying factors.

Appendix A. Treatment condition tasks

See Table A1.

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