The Relationship Between Improvisation and Cognition

By

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Contents

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Abstract

"After the group had played [improvisation] game[s]...colours became brighter, people and spaces seem of a different size, focus is sharper. Our normal thinking dulls perception…" *Keith Johnstone (1979, pg. 131)*

Improvisation is considered to be both the process and product of creativity. It involves the creation of new ideas, on the spur of the moment that are novel and unplanned. Spontaneity, the ability to do something on the spot with no prior preparation is seen as a key element of improvisation and distinction in relation to creativity.

The process of improvisation involves thinking in different ways and as a result, could influence our thought processes. It is important to note here that while we are interested in the process of improvisation, it is only possible to measure this through the product. The product is therefore seen as a direct outcome of the process of thinking that occurs during improvisation.

It has been suggested that improvisation could relate to cognitive processes (Karakelle, 2009; Schmidt, Goforth & Drew, 1975; Scott, Harris & Rothe, 2001). This program of research therefore aims to identify the cognitive changes in relation to the process of improvisation. This is measured by looking at cognitive tasks pre and post improvisation. Several studies were therefore conducted investigating the effects of improvisation on various cognitive abilities, with a focus on differences between divergent and convergent thinking; (i) the Effect of Verbal Improvisation on Mood, Creativity and Cognition; (ii) verbal improvisation in relation to divergent and convergent thinking; (iii) dance improvisation in relation to divergent and convergent thinking; (iv) Divergent thinking; Differences among expert and novice improvisers and (v) length of Treatment; Cognitive effects following a shorter improvisation treatment length.

As a result of the above experiments, results were extended to a clinical sample of Parkinson's disease. An extensive investigation was also carried out investigating the scoring of method of the Alternative Uses Task (AUT; Guilford, 1957b). Furthermore, the level of cognitive load as a result of improvisation was investigated by observing gesture in improvisation.

Taken together, results showed that after a series of verbal improvisation activities, participants improved in scores of divergent thinking tasks. However, this was not observed in scores of convergent thinking tasks. Issues surrounding reliability of the scoring method

of the AUT were also discussed. However, this did not affect the consistency of the results observed in this program of research.

A theory of schemas was applied to the process of improvisation as a result of the cognitive changes that occured, such that improvisation helps people think in more original and flexible ways by improving access to schemas and working memory.

Chapter 1: What is Improvisation and to what Extent is it Different to Creativity?

This program of research aims to look at the impact of improvisation on cognitive, problem-solving tasks. Improvisation shall be approached through the domains of verbal, dance and music improvisation. Furthermore, the type of cognitive ability that improvisation has an impact on will also be investigated. A theory of schemas is applied to the process of improvisation as a result of the cognitive changes that occur.

This chapter will discuss the various definitions of improvisation, both as a general construct and within the specific domains of verbal, music and dance improvisation. The meaning of the term creativity shall also be discussed. Finally, the similarities and differences between the two constructs shall be addressed, leading to a general definition of improvisation for the purpose of this thesis.

1.1 WHAT IS IMPROVISATION?

Improvisation is the ability to create something new, on the spur of the moment. However, the definition surrounding improvisation and what is needed in order to be able to improvise varies among researchers (Crossan, 1998; Mirvis, 1998; Montuori, 2003; Pressing, 1987, 1998a; Sawyer, 2000; Sawyer, 2008) and domains.

1.1.1 The meaning of 'Improvisation'

"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). From these definitions of improvisation, the Italian word "improvvisatore" was formed. This was a term used to describe poets who made up verses on the spot, while performing. The English form of this word is what came to be known as improvisation (Alterhaug, 2004).

This has influenced and provided the dictionary definitions used today. The Oxford English dictionary states improvisation to be "to create and perform spontaneously or without preparation".

1.1.2. Improvisation – Is it Planned?

The definitions above lead to the idea that improvisation is a concept that is unexpected with no use of pre-planned material. This is summarized by Snowber (2002) who describes "surprise, wonder, mystery and discovery" to be "at the heart of improvisation"(p. 6). Creating something that is unexpected is seen to be central to the definition of improvisation. Many researchers (Hargreaves, 1999; Lockford & Pelias, 2004; Sawyer, 2003) refer to improvisation as performing without a sense of knowing. In other words, because nothing is planned, both the audience and the performer do not know where the improvisation will take them, whether it will be successful or even when it will end. This sense of not knowing is defined in a variety of ways including performing in an unscripted manner (Hargreaves, 1999), as involving an element of surprise (Lockford & Pelias, 2004) and as being unplanned (Sawyer, 2008). This suggests that unplanned material is an essential part of improvisation (Montuori, 2003). Improvisation is all about entering a place that is unfamiliar, where there is no plan and one does not really know where they are going throughout the performance. Furthermore, Sawyer (2008) states that there should not be enough time to have a plan when improvising as the product is emerging too quickly.

However, having no plan does not mean that there is no structure in an improvisation (Sawyer, 2000). Sawyer (2008) believes improvisation involves a balance between having "structure and freedom." The performer still has a choice about what to do, but these choices should be in different and unexpected ways (Lockford & Pelias, 2004). As much as improvisation involves using unplanned material and being unexpected, it is also not completely random. The improviser is still faced with possible choices according to the context they are in (Montuori, 2003). Therefore, the conclusion that we can draw from this is that improvisation is unplanned, yet not without constraints applied to the framework (Lockford & Pelias, 2004).

Unplanned material is therefore seen as an important dimension of improvisation. However, is this still the essence of improvisation? Pressing (1987, 1998a) says improvisation is made up of phrases that people have already acquired through previous experience. Even when trying to create a performance known as 'free improvisation,' where the aim is to for everything to be completely novel, some form of framework is applied, for example, in music improvisation it shall be played in a particular style or in a particular key. Although many people aim to achieve free improvisation, the concept is impossible. For example, a music performer will always bring an element of their own style into an improvisation, or play a phrase that has been done before even if they do not realize it. This then prevents the improvisation from being truly 'free.' Kenny and Gellrich (2002) state that the only way to avoid predictable improvisations is by taking risks and by analyzing what they play in order to realize when they are playing something that has been played before. Barrett (1998b) and Mirvis (1998) support the idea of preplanned phrases by saying that it is possible to prepare for improvisation. In this way, they believe "preparing to be spontaneous" (Barrett, 1998b; p606) is possible. Unplanned material can be one of the largest problems that people face when trying to improvise, such that improvising without planning is difficult and can lead to repetitive material and patterns. This suggests that there are other elements that contribute towards what improvisation is.

1.1.3 The Elements of Improvisation

There are various elements that have been suggested in order to define improvisation including knowledge, social skills and intuition. One set of elements considered to have a strong impact on both the process and product of an improvisation includes the improviser's knowledge and technical quality. Crossan and Sorrenti (1997) believe choice comes with knowledge and skill. The more that is known about one's area of improvisation, the more things that can be done. This in turn leads to a greater choice in a performance of improvisation. According to Crossan and Sorrenti (1997) this choice along with a greater skill level also results in a higher quality improvisation. A degree of knowledge is essential in order to improvise (Alterhaug, 2004) although the amount of knowledge needed is unknown. However, being able to verbally improvise without knowing how to speak, being able to dance without knowing how to move and being able to improvise through playing an instrument without any knowledge of how to play that instrument would be near to impossible. A degree of knowledge that is very simplistic is likely to result in limited improvisations. Montuori (2003) believes that the core feature of improvisation is drawing on prior experiences. However, it is also possible that too much knowledge could inhibit true improvisation. If people rely too heavily on prior experiences and knowledge this takes away the unplanned aspect of an improvisation. While improvisation that draws on a wide range of knowledge may make the process easier, this does not necessarily result in the best product nor produce what originally was meant by the term improvisation (Weick, 1998).

It is therefore feasible that to produce a good product of improvisation, a certain amount of both knowledge and flexibility is needed. Flexibility refers to the ability to be able to use different styles of thinking and therefore reflects the potential to think in a variety of ways. It is thought that a certain degree of flexibility helps the quality of the product when improvising (Berliner, 1994), in order not to fall into predictive and repetitive patterns, a problem commonly associated with improvisation (Kauffman, 1980; Pressing, 1988; Rice, 1994). It is for this reason that people participating in group improvisation often assign a 'leader' who can signal when the style needs to change.

Other elements seen to be important to the definition of improvisation include intuition and playfulness. (Also discussed within the specific domains of improvisation.) The idea of intuition being involved in improvisation was put forward by Crossan and Sorrenti (1997) and is supported by Weick (1998). Intuition means to work according to instincts, without conscious reasoning. According to Crossan and Sorrenti (1997) and Weick (1998) intuition is needed to guide our actions in improvisation. If we had no intuition when we are faced with choices, we would not know which decisions to make. For example, it is important to identify when an improvisation should finish and a new one begin (Crossan, 1998). However, intuition does not always occur in a positive manner. Improvisations do go wrong and if intuition is always used, then people are not always making the right decisions in regards of what to do next. Finally, as mentioned earlier, improvisation occurs at a fast pace; does this give us enough time to use our intuition? However, Crossan and Sorrenti (1997) acknowledge that sometimes improvisations do go wrong and rightly suggest more understanding of improvisation is needed to know how to improve the quality of improvisations.

Improvising, as discussed earlier, is unpredictable. In a group, to make an improvisation work, everyone needs to make an individual contribution (Hargreaves, 1999) and obtain good communication between each other regarding who is to take a lead and when. According to Hargreaves (1999) it also promotes problem solving skills as well as developing social skills between others in situations outside of the improvisational context. Snowber (2002) also emphasizes social skills through listening. All improvisations require listening to the surrounding information in order to be able to produce a smooth, good quality improvisation. Improvisation can also be referred to as "playful" (Hargreaves, 1999; Sawyer, 1999) due to its unpredictability. When children improvise, they often impersonate adult roles and this can be replicated in group adult improvisations where roles are soon taken (Goncu & Perone, 2005).

Finally, a key idea involved in the definition of improvisation involves a relation to the term creativity; such that improvisation is creating while performing (Miner, Moorman, & Bassoff, 1996; Montuori, 2003; Sawyer, 2000). Creating while performing thus involves reacting to unknown material, just as one would react to an unforeseen event in their life (Montuori, 2003). One of the key characteristics of improvisation, according to Dewey (1934) and Collingwood (1938) is the need to focus on the creative process.

Creating while performing links in with producing unplanned material. In relation to improvisation being unplanned, one of the most used definitions involves improvisation being novel and spontaneous (Berkowitz & Ansari, 2008; Crossan & Sorrenti, 1997; Miner, et al., 1996; Montuori, 2003; Peters, 2005; Weick, 1998). By novelty, it is meant that in order for a product or idea to be creative, it has to be a new idea. Spontaneity refers to making these ideas up on the spot, as you perform (Napier, 2004) and being spontaneous is therefore very similar to that of creating while performing. This idea of being novel and spontaneous can also be seen through the work of musicians, such as David Bowie, who would only let musicians improvise to a particular piece twice, in order to ensure that the musicians did not become too familiar with the music and chord changes.

According to Pressing (1987), the quality of improvisation is determined by how well people can achieve the above elements, with the best improvisers producing the most unique and novel improvisations. Originality, the uniqueness of a creative product, is therefore also likely to be linked to these defining elements of improvisation. Originality is either used as an individual construct or as part of the notion of novelty. When describing originality, the Oxford dictionary uses the adjectives 'unusual' and 'novel', backing up the idea that the novelty and originality are linked. As a result, some researchers class originality and novelty to have the same meaning (Alencar & Fleith, 2003; Amabile, 1983; Butler & Kline, 1998; Dijksterhuis & Meurs, 2006; Eysenck, 1995; Maltzman, 1960; Runco, 2004; Sternberg, 1999, 2005).

The above definitions of improvisation have looked at improvisation as a general trait. However, these definitions of improvisation are not necessarily applicable to specific domains of improvisation nor necessarily transferrable across these domains (Priest, 2001). The different domains of verbal, dance and music improvisation shall be used throughout this thesis and they shall therefore be discussed separately to indicate whether there are any underlying differences across any of the domains.

1.2 VERBAL IMPROVISATION

Verbal improvisation is the act of creating a verbal performance in real-time, with no pre-planning. Guidance, however, can be given, with the most common example being the televisions show, 'Whose line is it anyway?' Whose line is it anyway is a famous American TV show that uses verbal improvisation games in a comedic fashion. Verbal improvisation has no script. It is imaginative (Goncu & Perone, 2005) and often takes place through story telling (Gerber, 2007). The terms 'role-play' and 'verbal improvisation' are used within the same context by some researchers (Forrester, 2000). The key difference between these two concepts lie in the idea that role-playing involves applying larger constraints in acting when compared to improvisation. Furthermore, improvisation can only be carried out in real-time while role-plays allow time to correct for mistakes (Medler & Magerko, 2010). For the purpose of the research, only verbal improvisation shall be looked at.

Verbal improvisation is social (Boesen, Herrier, Apgar, & Jackowski, 2009; Lockford & Pelias, 2004; Pina e Cunha, Vieira da Cunha, & Kamoche, 1999; Sawyer, 2000) and usually occurs in a group setting. It has been likened to pretend play (Goncu & Perone, 2005; Lockford & Pelias, 2004) such that verbal improvisations often represent the role-plays that children carry out. Furthermore, verbal improvisation can be performed as either short-form or long-from. Short-form verbal improvisation is often referred to as a series of games (Goncu & Perone, 2005; Johnstone, 1979; Spolin, 1963) which are designed to last no longer than ten minutes. The constraints applied allow improvisers to take part in many games, making them different all the time. Long-form improvisation, however involves sticking to the same character for a longer period of time.

1.2.1 Key Elements of Verbal Improvisation

Spontaneity, as with a general construct of improvisation, is seen as a key element of verbal improvisation (Crossan, 1998; Crossan & Sorrenti, 1997; Gerber, 2007; Vera & Crossan, 2005). What happens occurs in real time and within the domain of verbal improvisation, it is thought that spontaneity is reflected through pauses, repetition and utterances that are used to buy the improviser some time, such as "erm" (Pressing, 1987). Being spontaneous enables people to react to unplanned material (Gerber, 2007), react to audience response and respond differently to the normal associations we would make with certain things.

It has been suggested that spontaneity can still occur while implementing structure at the same time. Introducing the element of structure into improvisation does not necessarily mean taking novelty, originality and spontaneity away from the improvisation. Frost and Yarrow (1990) referred to improvisation as a recipe that happens all in one, specific moment. Others however suggest that improvisation involves completely “letting go” (Vera & Crossan, 2005) so that improvisation can become an unconscious process and should ideally not have any structure to it. One method that is used within verbal improvisation is a “planned set” (Crossan, 1998). This is when an improvisation is created on the basis of a previous, successful improvisation. By being spontaneous with this basic structure in place, individuals are then able to create an entirely new improvisation. Spontaneity is therefore essential to improvisation as it enables the creation of something new (Vera & Crossan, 2005), in a variety of contexts.

Both novelty and unpredictability are mentioned in the definition of verbal improvisation by a number of researchers (Boesen, et al., 2009; Lockford & Pelias, 2004; MacKenzie, 2000; Vera & Crossan, 2005). Novelty and spontaneity are key to verbal improvisation as people are expected to make things up, on the spot, as they improvise (Vera & Crossan, 2005). As well as being spontaneous, flexibility and unpredictability are key elements for verbal improvisation (Crossan & Sorrenti, 1997). The definition of unpredictable and novel is often used to elicit a similar meaning. A small difference, however, does lie between the two. While both refer to the product of the improvisation, unpredictability refers to an element of surprise being involved in what occurs. This in turn will result in something novel. In other words, in improvisation, anything can happen (Vera & Crossan, 2005). Gerber (2007) points out that in order for verbal improvisation to remain unpredictable and original, it is sometimes achieved by doing things that are considered normal. For example, improvisers often try to be dull as the opposite usually occurs in the majority of improvisations.

Finally, the audience is particularly crucial in the use of verbal improvisation (Crossan & Sorrenti, 1997; Sawyer, 2000). In a performance of verbal improvisation, audience suggestions are often relied upon to provide a context for the improvisation to be based upon (Seham, 2001). This is particularly important when discussing the process of improvisation as it emphasizes the idea of the unknown.

1.2.2 Is Speech Improvisation?

Improvisation occurs on the spot and, as mentioned above, is thought to be at its best when it does not involve conscious thought. In verbal improvisation, people are encouraged not to think about what they are going to say in advance (Gerber, 2007; Izzo, 1998). Professional improvisation classes often incorporate the element of spontaneity with a key rule in class being to say what comes straight to your head, as opposed to planning something to say as another member is improvising (Sawyer, 2008). By doing this, people are not as limited by their "cognitive restraints" (Lockford & Pelias, 2004).

This raises the question of whether speech is improvisation. Some researchers (Gould & Keaton, 2000; Sayer, 2003, Wittgenstein, as cited in Gould & Keaton, 2002) suggest that verbal improvisation is presented everyday in our speech. According to Chomsky's (1964) theory of language, the majority of conversations are not learnt but made up on the spot. In favour of this theory, Montuori (2003) states that speech is a version of improvisation with extremely broad rules, while Sawyer (2008) argues that speech encourages verbal improvisation such that if something new occurs while talking, this can be saved and built upon for improvising in the future.

However, the idea that all speech is improvisation is not agreed upon (MacKenzie, 2000; Pawley & Syder, 1983). Lockford and Pelias (2004) suggest that improvisation does not follow the same process that speech does, although there is no quantifiable evidence to support this. They believe that the rate of novel ideas is a lot faster in improvisation when compared to everyday speech. Mackenzie (2000) also raises the point that the majority of language that we use are made up from fixed phrases. People rely on these phrases more heavily throughout everyday speech than improvisation. In support of this argument, Pawley and Syder (1983) suggest that the fluidity in speech differs according to whether it is improvised such that the more fluent the speech is, the less spontaneous it is. Improvisation therefore tends to involve more use of pauses and fillers, e.g. "aah" or "umm". Although there is no quantifiable data to support this, it is clear that there is a difference between something made up on the spot such as "How is your bleublepip" and simply greeting someone with "Hello, How are you?" The key difference here is that the latter hold nothing novel and involves little, if any, spontaneity. This phrase exhibits a very generic pattern, referred to by Mackenzie (2000) as "institutionalized expressions" (p.174) and believes that a lot of our speech is made up of these kind of phrases. This is supported by Nattinger and DeCarrio (1992) who suggest that language is broken down and rearranged to form a slightly different form of what has already been said. This, it is argued, is different to verbal improvisation and the question of whether speech is improvisation is due to, as with the definition of role-playing, how many constraints are applied to an individual's definition.

1.2.3 Elements that Influence the Quality of Verbal Improvisation

As the definition of improvisation unfolds, it is clear to see that some of the defining elements are concerned with what makes an improvised performance good. For example, it is suggested (Baum, Owen, & Oreck, 1996; Crossan & Sorrenti, 1997; Kenny & Gellrich, 2002; Nagrin, 1994) that taking risks and making mistakes is an essential part of verbal improvisation (Crossan & Sorrenti, 1997). Performers are often worried about making mistakes and being laughed at, but when performing, this can often make an improvisation of better quality or influence the other improvisers to take new routes (Barrett, 1998a; Crossan, 1998; Crossan & Sorrenti, 1997). The quality of improvisation also depends on the improviser's skills of which the majority are learnt "from the environment" (Crossan, 1998; Vera & Crossan, 2005). Commitment (Crossan, 1998), expertise and knowledge (Vera & Crossan, 2005) are all suggested to influence and improve the quality of verbal improvisations as the more people know and understand, the more options that they have in their future improvisations (Hermans, 2003; Lockford & Pelias, 2004; Vera & Crossan, 2005). When a mistake or problem is encountered, the more experience that they have, the better it is thought they will cope with the situation.

1.2.4 Conclusion: Verbal Improvisation

In conclusion, verbal improvisation involves a large amount of spontaneity and should not be preplanned. It occurs without the use of a script and involves a large amount of novelty and flexibility. Expertise including skills and knowledge are thought to influence the quality of the improvisation. When improvising in this domain, it is important to say the first thing that comes into one's head as it is thought the less conscious someone is, the more likely something original and new will occur. The audience is seen as particularly valuable within verbal improvisation, due to their role in suggesting a context within which to improvise.

A key debate in verbal improvisation concerns whether everyday speech is improvisation. For the purpose of this research, everyday speech is not regarded to be improvisation. The element of creating material that is novel, unplanned and spontaneous is the aim of verbal improvisation in this research.

1.3 DANCE IMPROVISATION

Dance improvisation can be taken to be improvisation using a variety of different dance styles including ballet, jazz, classical and contemporary dance. Contact improvisation, on the other hand is a specific form of dance, created for dance improvisers. Contact improvisation almost always involves more than one person and explores dance and movement, where a large amount of bodily contact is encouraged. First introduced by Jeremy Paxman in 1960, the idea of contact improvisation involves freely exploring movement and focusing on physical touch (Novack, 1990). This is usually performed as a group activity, due to the physical contact that this type of improvisation is based upon, and often no music is used. However, for the purpose of this literature review, improvisation shall be looked at from a more general sense of dance improvisation.

Dance improvisation is one of the smallest areas of improvisation to be explored in the literature. The majority of dance improvisation definitions agree that it is unique and is not planned (Baum, et al., 1996; Blom & Chaplin, 1988; Hermans, 2003; Sheets-Johnstone, 1981; Snowber, 2002). In this sense, it cannot be reproduced and it does not follow a particular step routine. Dance improvisation is social but with a very different meaning. By being social in dance improvisation, it involves physical contact and a sense of physical awareness of the person you are performing with (Blom & Chaplin, 1988).

1.3.1 Key elements of Dance Improvisation

Spontaneity is seen as a key element of dance improvisation (Baum, et al., 1996; Blom & Chaplin, 1988; Carter, 2000; Kaeppler, 1987; Minvielle-Moncla, Audiffren, Macar, & Vallet, 2008; Novack, 1990; Sheets-Johnstone, 1981) as it is needed to create something original (Carter, 2000). In dance this can be through spontaneous orders of dance movements or through spontaneous creations of novel dance moves (Kaeppler, 1987), with or without constraints (Minvielle-Moncla, et al., 2008).

However, the definition of novelty tends to be broader within dance improvisation. Using a different combination of previously used movements can make a performance unique, even if no new material is actually being produced. Blom and Chaplin (1988) as well as Kaeppler (1987) therefore state that creating something new should not necessarily be a defining element for improvisation. Kaeppler (1987) however, emphasizes that the need for spontaneity remains as instead of novelty, dance sequences that are already known are rearranged to form different orders and the choice of the order of these is made on the spot.

Constraints, however, can still be applied to dance improvisation and these can even be made up (Hagendoorn, 2003; Hermans, 2003). Constraints such as a certain dance style or certain movement sequences can be applied (Nagrin, 1994; Sheets-Johnstone, 1981). What remains the same is that no matter what constraints are applied, the moves that occur are still unknown in advance. This is also known as moving extemporaneously (Carter, 2000; Sheets-Johnstone, 1981).

1.3.2 Dance Improvisation and Consciousness

In dance improvisation, choreography occurs while performing (Kaeppler, 1987) and part of this performing involves playing around with movement (Blom & Chaplin, 1988; Snowber, 2002). Blom and Chaplin (1988) state that improvisation is a natural process, where the improvisation that is produced is completely separate to the improviser's thoughts. This results in spontaneous improvisation and therefore in a creative product. For improvisation to be natural, unconscious thought processes occur. The body is no longer thinking as a result of the mind, often termed as "thinking in movement" (Sheets-Johnstone, 1981, p. 399; Snowber, 2002). This kind of unconscious thinking is also thought to have an impact on the quality of improvisation (Hermans, 2003) with many dance improvisers saying that one cannot truly improvise until one reaches this state of mind.

1.3.3 Conclusion: Dance Improvisation

A key distinction with dance improvisation is that a huge range of bodily actions are essential for dance improvisation (Carter, 2000). Repetition is one of the biggest problems of dance improvisation and new ideas must therefore be applied all the time. As with a general definition of improvisation, Blom and Chaplin (1988) suggest that dance improvisation is a combination of creating and performing. It is creating in the present time where the person performing has to constantly think of something new (Carter, 2000; Engel, 2001). Improvisation encourages unconscious thought processes, making the performance spontaneous (Hermans, 2003) and encouraging novelty (Blom & Chaplin, 1988; Carter, 2000). While skill and knowledge is seen as essential by some (Carter, 2000; Hanna, 1983; Snowber, 2002), it has been argued that this is not necessarily needed for dance improvisation (Morgenroth, 1987). However, the more skill that is acquired, the more risks dance improvisers will take (Blom & Chaplin, 1988) and the higher their technical ability will be (Carter, 2000). This in turn, is likely to have an impact on the quality of the improvisation.

Differences of opinion in the meaning of the word novelty are present in dance improvisation (Blom & Chaplin, 1988; Carter, 2000; Engel, 2001; Kaeppler, 1987), with the idea that putting known sequences together can result in a novel product, as can an improvisation with completely new dance sequences.

1.4 MUSIC IMPROVISATION

Music improvisation is perhaps the most common domain of improvisation. However, with this comes more controversy with its definition. Music improvisation is demonstrated in all kinds of music, although it has a greater association with jazz. Classical musicians, however, are particularly known for using very little improvisation. Historically, it is thought that improvisation was one of the first forms of music to be created (Blom, 1946; Prevost, 1995). Composition came after this time, as when music was first produced, notating did not exist (Prevost, 1995). Before the use of notation, classical music was heavily improvised. As notation was introduced, the idea of improvisation remained in the use of a classical cadenza – where musicians were to improvise something according to the tone of the piece before ending it. However, even the cadenza is now very rarely improvised and over time classical music has heavily removed the use of improvisation (Blom, 1946).

1.4.1 – The Use of Novelty in Music Improvisation

Music improvisation involves making up something new, unpredictable and original (Barrett, 1998a, 1998b; Hargreaves, 1999; Johnson-Laird, 2002; Koutsoupidou & Hargreaves, 2009; Limb & Braun, 2008; Montuori, 2003; Pasmore, 1998; Pressing, 1988; Prevost, 1995; Sawyer, 1999). The more novel the performance, the closer one is getting to a free improvisation (Hinz, 1995). It has also been suggested that this is most likely to occur when thought processes are unconscious (Hinz, 1995; Prevost, 1995) as attention to what is being played is thought to have a negative impact on the spontaneity of a performance (Limb & Braun, 2008).

As with other forms of improvisation, music improvisation does not have a plan and what is to be played is unknown. However, it has also been argued that music improvisation does not involve as much new material as indicated by these definitions when being performed (Pasmore, 1998). Furthermore, in relation to other areas of improvisation, novelty is not as heavily used with definitions of music improvisation (Nooshin, 2003). It is widely agreed that musicians have phrases that they use in improvisations repeatedly. Jazz improvisation in particular relies on motifs (Johnson-Laird, 2002; Sawyer, 2000) and chord sequences (Johnson-Laird, 2002). How and in what order they use them is different and this usually involves novel material being introduced along with the prepared phrases they have (Nettl, 1974). Pressing (1987) refers to these as referents, discussed further in Chapter Two. In other words, improvisation involves some level of structure - a musician always has something to work from (Barrett, 1998b; Nettl, 1974) whether that be for the basis of an improvisation or for times when thinking of novel material is particularly difficult. Constantly creating new material is an ongoing battle (Sayer, 2003).

Using known material will have an impact on the quality of the improvisational performance in both a positive and negative manner. The amount of known material is likely to have an impact on multiple improvisations, as will the improviser's ability to vary the phrases that are known (Velleman, 1978). As a result, when performing, musicians are often accused of repetition and sticking too much to their own style (Nettl, 1974). The majority of musicians having a particular style and this does often provide a constraint to the improvisation (Dobbins, 1980). It is therefore not surprising material is repeated at some points. Furthermore, improvisation does have limits. Within music improvisation, the faster the pace of the music, the harder it is to constantly produce novel material (Weick, 1998). Finally, while it is not intentional if music that is produced is not novel, musicians sometimes use the technique of bringing known pieces into their improvisations so they can vary it and turn it into something completely different (Barrett, 1998a; Berliner, 1994; Pasmore, 1998). This provides structure to the improvisation (Azzara, 1999; Berniker, 1998; Peplowski, 1998; Sawyer, 1992, 1999) and can also have a positive impact on the audience. While it moves away from the idea of free improvisation, introducing related or known material provides the audience with more structure which is often received in a more positive fashion (Dobbins, 1980). Too much novel material and the audience can become confused. It is thought that the combination of variations of familiar material along with completely novel material provides a higher quality of improvisation (Johnson-Laird, 2002).

It is clear to see that the definition of music improvisation involves the use of new material (Berliner, 1994), whether it be completely made up or derived from an existing phrase (Berliner, 1994). However, the use of the meaning of novelty varies largely. It is often not possible to be novel at all times in the product of the improvisation and definitions therefore cater for this. Musicians cannot produce free improvisation, no matter how hard they try (Johnson-Laird, 2002). Despite any problems that may occur, including repetition, an improvising musician will never have two performances that are the same (Nettl, 1974) and will often embrace the problems that they face and work it to be part of the improvisation.

1.4.2 Elements of Music Improvisation

As discussed above, known material is often incorporated into music improvisation. This is affected by the musician's knowledge and expertise. Barrett (1998b) suggests that the more material someone knows, the easier it is to create something new when the demand arises. Pressing (1987) however, suggests the more someone knows, the less they need to be spontaneous. Technical ability is also seen as essential here, as the higher the standard, the more options that are available when trying to improvise (Berliner, 1994; Hinz, 1995). The more experience and technical ability, the higher the quality of improvisation as every aspect of the music can be changed, from the rhythm through to the dynamics (Gould & Keaton, 2000; Hargreaves, Cork, & Setton, 1991; Hinz, 1995). The more knowledge one has, the more automatic the process becomes, meaning one can let the improvisation occur naturally and less consciously (Barrett, 1998a, 1998b). However, it has been suggested that the opposite can also occur here, especially within classical musicians, such that so much technique is installed into their learning, they do not know how to use their technical ability to produce improvisations (Berliner, 1994). Music improvisation therefore takes practice and needs to be experimented with (Eisenberg & Thompson, 2003) – being constrained by aspects such as rhythm and tone take some getting used to (Johnson-Laird, 2002). Musicians therefore become "prepared to be spontaneous" (Barrett, 1998b, p. 283).

"There's no such thing as a bad note, it's where you take the note." Dizzy Gellepsie (1917 – 1993, cited in Barrett, 1998b).

There is general agreement with this quote in music improvisation. Unless strong constraints are applied, mistakes cannot happen – if an unintentional note is played, it can seem an exciting or unusual aspect of the piece (Pressing, 1984; Reimann, 2003) – the improvisers work with what is being played. With practice and confidence, the audience often do not realize anything different (Barrett, 1998a). Furthermore, musicians often use the mistake again and emphasize it to make the improvisation novel (Barrett, 1998b).

Music improvisation can be performed alone or, more commonly, in a group setting. It is therefore important to have a high level of communication (Barrett, 1998b; Bryan-Kinns, 2004; Monson, 1996; Montuori, 2003; Pasmore, 1998; Sawyer, 1992, 2008) and awareness in listening, both to what they and others are playing (Campbell, 1990; Dobbins, 1980; Gordon, 1989; Hinz, 1995; Kenny & Gellrich, 2002). As with verbal improvisation, music improvisations with more than one person are often referred to as having a conversation (Azzara, 1993).

Other elements of music improvisation include the ability to be flexible (Barrett, 1998a; Johnson-Laird, 2002; Pasmore, 1998). Within this, there is the ability to vary how one improvises within a performance (Hinz, 1995; Nettl, 1974; Pressing, 1998a, 1998b; Reimann, 2003). The higher the degree of flexibility and variation, the better the improviser (Velleman, 1978).

A variety of techniques are needed in order to be able to improvise successfully in music (Pasmore, 1998). However, the issue of whether it is an innate ability or whether it can be learnt (Konowitz, 1980) is a debate that continues (Kratus, 1991).

One controversial topic surrounding the definition of music improvisation concerns the use of notation (Nettl, 1974). Some researchers and musicians (Mainz, 1967; as cited in Nettl, 1974) suggest that some notation can be used when improvising and that this is simply a way of applying constraints to an improvisation or providing a guide (Gould & Keaton, 2000; Reimann, 2003). Others believe that for something to be improvised, no notation should be present (Berliner, 1994; Gridley, 1985; Nettl, 1974; Nooshin, 2003). It has even been argued that notation can hinder improvisation as it does not encourage people to be spontaneous (Dobbins, 1980). By using notation, it encourages people to play what is in front of them. The more notation, the more music is treated in a 'recipe-style' format.

1.4.3 The Difference Between Composition and Improvisation

One of the main difficulties in music improvisation is determining where composition ends and improvisation begins (Nettl, 1974). Some researchers state that improvisation is a type of composition which lies on one end of a continuum (Burnard, 2000; Gould & Keaton, 2000; Koutsoupidou & Hargreaves, 2009; Nettl, 1974) and that the two aspects should not be seen as separate. However, an attempt at the distinction between the two is also attempted. Some researchers suggest that composition is one element that is involved in improvisation (Campbell, 1990). Nettl (1974) believes improvisation involves a higher creative and cognitive effort.

Dobbins (1980) suggests that improvisation is "instant composition" (p.37) such that something is created and finalized all in one go. This is supported by Gridley (2000) and Kernfeld (1988). In relation to this, Prevost (1995) suggests one of the key differences is in the product, such that compositions result in a 'perfect' piece where as many changes as possible can be made, over as much time that is desired, while the product of the improvisation is simply the result of the one performance, or the process and product as a whole (Caesar, 1999; Eisenberg & Thompson, 2003; Gridley, 1985; Nooshin, 2003). While both involve the element of creativity (Campbell, 1990; Lehmann & Kopiez, 2002), the fact that you can stop and start with composition is a key difference (Sarath, 1996). However, this does not mean that improvisation cannot be used while composing. Many artists use an element of improvisation when writing music, including Elton John and David Bowie. Improvisation, with or without known phrases, therefore involves the element of spontaneity (Barrett, 1998a, 1998b; Baum, et al., 1996; Berliner, 1994; Campbell, 1990; Dobbins, 1980; Eisenhardt, 1997; Hinz, 1995; Kiehn, 2003; Konowitz, 1980; Montuori, 2003; Nooshin, 2003; Prevost, 1995; Reimer, 1997; Sarath, 1996; Sawyer, 1998; Smith, 2007; Weick, 1998), although this again is not agreed upon with Gould and Keaton (2000) suggesting that you do not need to be spontaneous to form a musical improvisation. Music making is instant (Dobbins, 1980) and this is one of the most commonly used defining factors for music improvisation, with many seeing it as key to improvisation (Alperson, 1984; Baum, et al., 1996; Caesar, 1999; Hinz, 1995; Koutsoupidou & Hargreaves, 2009; Limb & Braun, 2008; Monson, 1996; Reimann, 2003; Sarath, 1996). Although this is true, it is not the only essential element that defines music improvisation (Berliner, 1994) and controversy over the meaning of spontaneity itself produces issues for the definition of music improvisation.

1.4.4. Conclusion: Music Improvisation

There is a lot of ambiguity surrounding the definition of music improvisation, particularly with the use of the term novelty. While novelty is seen to be a defining element of music improvisation, the meaning of novelty differs within this context. While some researchers describe an improvisation to be making up something completely new all the time, resulting in free improvisation, this is seen as something that is almost impossible to achieve. Therefore, others regard it to be rearranging already known phrases in order to create a new piece.

It is generally agreed upon that the elements of novelty and spontaneity are involved in the definition of music improvisation, as well as the idea that expertise and knowledge will have an impact on the quality of improvisation that is produced.

One of the key reasons for the ambiguity in music improvisation is due to the disagreement upon where composition ends and improvisation starts. For the purposes of this research, improvisation is seen to be composition in real time. Musicians are creating music on the spot.

1.5 THE SIMILARITIES AND DIFFERENCES BETWEEN VERBAL, DANCE AND MUSIC IMPROVISATION

By looking at the domains of verbal, dance and music improvisation, it is possible to see similarities as well as some key underlying differences among the definitions. All three methods of improvisation emphasize that improvising is a process that occurs in real-time and involves elements of originality and spontaneity. All three areas of improvisation also agree that constraints can be applied and that improvisation is at its best when thought processes are unconscious. It is also suggested that improvisation should be unplanned in all three domains, such that no script is said to be necessary for verbal improvisation, no set routine present for dance improvisation and no notation used in music improvisation.

Emphasis towards other defining elements of improvisation often occur in two of the three domains. Verbal and music improvisation suggest that improvisation can involve some form of structure and both emphasize the need for novelty and flexibility and although unplanned, unique dance is mentioned in dance improvisation, this is not seen as one of the biggest factors. The idea that knowledge and expertise affects improvisation is also not prevalent in dance improvisation, suggesting a key difference in the quality of improvisation. However, music improvisation concentrates less on the social element of improvisation – something that verbal and dance improvisation state is important, even if it is in different ways from one another.

It is clear to see that key differences occur across the various domains of improvisation. For example, the idea of improvisation being novel is different among the three domains of improvisation discussed. Verbal improvisation sees novelty as making up everything on the spot, while dance and music improvisation see novelty as the finished product. Therefore, pre-learned sequences and phrases can be re-arranged in order to produce something that is new at the end.

There are a number of factors that differentiate the definitions across the three domains of improvisation. Verbal improvisation focuses on the idea of a playful attitude and the importance of audience suggestion. One key difference with music improvisation that is insinuated here focuses on the idea of mistakes. Music improvisation suggests that there is no such thing as a mistake while verbal improvisation appears to suggest that mistakes are possible which is why there is such a big risk in improvising.

Where improvisation begins appears to be more clear cut in dance improvisation. The question of whether speech is improvisation and when composition stops and improvisation begins in music are debates that continue to cause a large amount of disagreement. Dance improvisation does not focus on this but instead on the definitions of creating unplanned material with extemporaneous qualities. However, it is important to note that less research on dance improvisation exists, which may be why there are fewer definitions and therefore differences identified in comparison to other domains of improvisation.

On the other hand, music improvisation is one of the most explained domains of improvisation and often uses many aspects specifically associated with music in its definitions. These include aspects such as technical ability, using chord sequences and various techniques such as reintroducing known phrases. In this sense, the idea of novelty is not as heavily emphasized as with other forms of improvisation. Too much novelty here is seen to affect how well the audience relate to an improvisation. Finally, music improvisation introduces the idea of free improvisation, the purest form of improvisation that improvisers often aim to achieve (Hinz, 1995; Prevost, 1995; Sawyer, 2008).

1.6 DEFINING CREATIVITY

As discussed above, it is commonly agreed that improvisation is both the process and the product of creativity. Across the three domains of improvisation discussed, there is evidence to suggest that elements of creativity are involved, in particular the element of novelty and originality. It is therefore important to define creativity and identify the key differences that exist between the terms improvisation and creativity.

Thompson (1996), in the Oxford Dictionary, suggests there are two possible definitions of creativity; firstly as something that is "inventive and imaginative" and secondly as "creating or being able to create." While this is indeed likely to be a general definition of creativity, it provides no additional information as to what it actually means to create. If creativity is indeed what the Oxford dictionary describes it to be, do we need to be inventive in order to be able to be creative or is this the result of a creative product? These definitions are simply too vague to explain what creativity is.

Academically, there is no agreed upon definition of creativity (Chamorro-Premuzic & Furnham, 2005; Finke, Ward, & Smith, 1992; Marakas & Elam, 1997; Priest, 2001; Sternberg & Lubart, 1999; Thrash & Elliot, 2004). This is generally thought to be due to creativity being a multi-dimensional as opposed to uni-dimensional trait (Furnham & Bachtiar, 2008). However, in more recent literature, the terms **originality** and **usefulness** are generally agreed to be key aspects of creativity (Furnham & Bachtiar, 2008; Runco & Jaeger, 2012; Sternberg, 2005). These terms along with other various definitions of creativity are explained below.

1.6.1 The Defining Elements of Creativity

There are many elements that have been used to define creativity. Two of the most popular elements involve **Novelty** and **Flexibility.** These criteria are perhaps the most widely used elements to define creativity, although some people combine these definitions with that of divergent thinking (see Chapter 1.6). Harvey, Hoffmeister, Coates and White (1970) suggest that **novelty**, **originality** and **flexibility** are the "three basic dimensions of creativity." As discussed earlier the terms novelty and originality are often used in definitions interchangeably. However, while conducting this literature review, no definitions suggested that only one of these elements, including the idea of novelty and originality being the same element, could provide an adequate definition for creativity.

Novelty is often seen as an essential aspect of creativity and therefore a creative person (Alencar & Fleith, 2003; Almeida, Prieto, Ferrando, Oliveira, & Ferrandiz, 2008; Amabile, 1983; Barron & Harrington, 1981; Butler & Kline, 1998; Dijksterhuis & Meurs, 2006; Eysenck, 1993; Feist, 1998; Fox & Hopkins, 1936; Gardner, 1999; Getzels & Csikszentmihalyi, 1976; Guilford, 1950; Mendonca & Wallace, 2004; Reber, 1985; Runco, 2004; Sternberg, 1999, 2005; Torrance, 1998; Unsworth, 2001; Weisberg, 1993, 2003). The term has been included in definitions from 1936 through to the present day and it is therefore likely that novelty is a widely accepted dimension of creativity.

Something that is completely novel is likely to be seen as more creative. However, Gilhooly, Fioratou, Anthony and Wynn (2007) stated if a response is new to the person creating it, this counts as being novel. While this may be novel to the person coming up with the novel item, this poses potential difficulties in scoring novel responses. Scoring systems are not based on individual creativity but on the population as a whole (see Chapter 8). It is important to note that to be novel, ideas do not have to be formed from nothing. Combinations of already existing ideas can also be formed to create a novel idea (Martindale, 2007; Smith, Osherson, Rips, & Keane, 1988; Weisberg, et al., 2004; Wisniewski, 1996, 1997). Torrance (1969) reinforced this notion, saying that people need to be able to find gaps in ideas in order to be able to produce something new. These ideas can then be used again to create an entirely new and different product. Sternberg (2005) proposed that being novel in this way is a skill necessary to be creative. **Originality** is also used as a defining element and as discussed above, is sometimes combined with novelty as there appears to be disagreement upon whether the two constructs mean the same thing.

Flexibility is regarded as a separate element to that of novelty (Guilford, 1950), although definitions often incorporate the need for both novelty and flexibility. The mathematician Poincare (1854 - 1912; cited in Farah, Haimm, Sankoorikal, & Chatterjee, 2009) suggested that higher levels of creativity require thinking in many different ways and it is likely that the cognitive processes underlying creativity could be a defining element (Kerne, Smith, Koh, Choi, & Graeber, 2008). This is discussed further in Chapter Two.

These elements can also be seen as the building blocks of creativity. For example, Guilford (1959) along with Shaw (1994) and Walton (2003) have suggested that people needed to be motivated in order to increase their levels of originality and flexibility. Alencar and Frith (2003) suggested that along with novelty and originality, elaboration and an improvement in already existing ideas are also elements of creativity. Novelty, originality and flexibility however are among the most common and basic elements used to define creativity. Furthermore, building on preexisting ideas could also be a different way of creating something novel.

The concept of usefulness within a definition of creativity suggests that for an idea to be creative, it should be appropriate and "to some extent adaptive to reality" (Barron, 1955; p. 479). In this sense, creative ideas should not be completely random to the extent that the idea could not be adapted to the real world. Usefulness can also be referred to as valuable (Fink, Grabner et al., 2009; Gilhooly, 1996; Sternberg, 1999) and effective (Runco & Jaeger, 2012).

Torrance (1967) also suggested that communication is key to creativity, although this element will depend on whether it is a group activity. In relation to this, creativity is often seen as a social process (Csikszentmihalyi, 1988, 1997; Gardner, 1993; Sternberg & Lubart, 1996). Technical goodness (Priest, 2001) and the use of intuition (Pressing, 1987) have also been considered to be elements of creativity. Finally, it has also been suggested that the process of creativity occurs in a hierarchical manner (Krug, Stamm, Pietrowsky, Fehm, & Born, 1994; Weisberg, et al., 2004) such that various elements of creativity come under a number of higher-order categories (for example, cognitive aspects, personality, influences of emotion, external factors; Runco, 2009; Simonton, 2009). Creativity could therefore more structured than it first appears.

1.6.2 Creativity as Divergent and Convergent Thinking

For those papers that defined creativity (N=89), one of the most common ways to define creativity was through the use of divergent and convergent thinking (Baer, 1993; Guilford, 1950). The process of thinking is fundamental to creativity as one needs to be thinking in a different frame of mind in order to be able to elicit inventive/novel ideas. Convergent and Divergent thinking divide problem solving into two main methods of thought. Convergent thinking involves solving a problem, resulting in one definitive, correct solution. Divergent thinking, on the other hand, does not have one correct answer but a whole host of possible solutions. Webster (1990) said that this type of thinking involves coming up with as many possible solutions to a given task until the individual believes they have exhausted all ideas. Divergent thinking therefore encourages different types of thinking and due to having to find multiple solutions to one particular task, it is thought that creativity is reflected in tasks of divergent thinking (Almeida, et al., 2008; Campbell, 1960). While some researchers (Campbell, 1960; Hocevar, 1981) believe that divergent thinking is the defining element of creativity, it simply indicates what style of thinking is required to be creative, as opposed to defining what being creative actually means. Hocevar (1981) suggested that divergent thinking was the most widely used method of defining creativity. Divergent thinking tasks are still commonly used to assess the product of creativity today with Guilford's divergent thinking tasks (Guilford, 1957a) and the Torrance Test of Creative Thinking (TTCT; Torrance, 1974) being the most widely used tests of creativity (Kim, 1998; Mayer, 1999). According to Walton (2003), the majority of people think in a convergent manner while people who tend to be more creative spend the majority of their time thinking divergently. It is suggested (Walton, 2003) that convergent thinking is the more dominant style of thinking, however and this could explain why particularly creative individuals are few and far between (McFadzean, 2000).

1.6.3 Divergent Thinking and the Elements of Creativity

Gibson, Folley and Park (2009) believe that the fundamental elements of divergent thinking "involve generating novel associations" (p.162) as well as a degree of flexibility when constructing ideas or solutions in relation to a divergent thinking task. Divergent thinking enables people to think of new ideas, a fundamental element of creativity, and this is where the link between creativity and divergent thinking is made.

Guilford (1957a) used the idea that creativity involved divergent thought in constructing his scale of creativity, designed to measure what he described as the fundamental aspects of creativity. Originality, flexibility, elaboration and fluency are the four main elements that he believes define creativity. Elaboration refers to the amount of detail given in answers while fluency is the number of acceptable responses that are created in response to a given task. According to Guilford, each of these aspects is also an example of divergent thinking and the more creative one is, the higher the score of these four elements. This has become one of the mostly widely used ways of assessing creativity (Cropley, 2000; Goff & Torrance, 2002; Hocevar, 1981; Runco & Mraz, 1992), although issues such as fluency and originality scores correlating highly have arisen (see Chapter 8.1 for discussion). Webster (1990) supports this in his theory of divergent thinking as a means of defining creativity within music. He believes that originality and flexibility are key aspects of creativity along with musical complexity. This refers to how simple or difficult the creative product is. This involves many aspects such as how technically complex a product is, along with how much variation and repetition is used. It is likely that this is the musical equivalent of what Guilford termed elaboration, as scoring guidelines for both elaboration and musical complexity focus on the level of detail involved in the creative product. These researchers, among others (Hocevar, 1981; Torrance, 1969; Weisberg, 1995) believe that as elements of creativity are present in divergent thinking, then open-ended tasks of divergent thinking are therefore measuring creativity. It may be that the various elements of scoring creativity, as defined by Guilford (1957b)are scoring different aspects of the cognitive architecture. For example, flexibility may reflect the underlying process of creativity, while novelty may be a measure of the outcome.

1.6.4 Creativity and Consciousness

Dijksterhuis and Meurs (2006) suggest that unconscious thought reflects creativity and that it is another element of divergent thinking. Convergent thinking, on the other hand generally involves conscious thought processes. In other words, the more focused the thought, the more convergent it is. Wilson, Lisle, Schooler, Hodges, Klaaren and LaFleur (1993) suggest that high levels of this focused thinking may in fact inhibit divergent thinking and in turn creativity. Runco (2004) supports this view, indicating that people are more likely to find a better solution if they are distracted from the task at hand. In this way, unconscious thoughts can take over and good solutions can be obtained. Furthermore, it may allow for concurrent thinking where people are able to think about more than one thing at a time. This is what Runco primarily defines creativity to be. In both a musical (Eisenberg & Thompson, 2003) and non-musical context (Martindale, Glover, & Ronning, 1989) it is suggested that if someone is distracted, that person is more likely to think unconsciously and this is an important aspect of being creative. It may be for these reasons that Hmieleski and Corbett (2006) noted that creativity is like magic and appears to "spring from nowhere". It may also explain why some particularly creative people describe the process as not needing to require any effort (Weisberg, 1995).

1.6.5 Towards a Single Definition of Creativity

Disagreement has and continues to occur in the discussion of a single definition of creativity. Feist (1998) reports in his meta-analysis that researchers have agreed on the definition for a number of years. Feist argues that there is a general consensus that creativity is original and novel, while being useful and adaptive and this is supported by Finke et al. (1992), and Webster (1990). Furnham and Bachtiar (2008) however, suggest that definitions of creativity are not agreed upon. They suggest that although novelty is an element of creativity that is widely agreed upon, this is not the only aspect of creativity and that there is no one definition that everyone can use in their research.

Definitions also tend to vary according to creativity as a process and as a product. The above definitions involving novelty are looking at creativity as a process while divergent thinking tries to look at both the process and product of creativity. However, it is only possible to measure the product of creativity. In other words, only the result of creativity can be observed. The process of creativity refers to what is needed in order for someone to generate a creative product. It is not possible to have a concrete definition of the process – instead only theory can be put forward. However, this may indicate that separate definitions are needed for both the process and the product of creativity.

Sawyer (2000) looks at creativity in what he terms as product creativity. This refers to lots of creative work over a long period of time that mounts up to be one completed piece of creative work. This can be applied to a variety of domains including speech, music and dance. Sawyer defines this as a different type of creativity where there is no time constraint and mistakes made can be re-written if needed. However, this is supported in many general definitions of creativity, suggesting that Sawyer is simply referring to the general product of creativity. According to Stavridou and Furnham (1996), the level of creativity described by Sawyer is only achieved by particularly creative individuals.

It is likely that both divergent thinking and the elements of novelty, originality and flexibility are defining factors of creativity. Sawyer (1998) noted that most researchers tend to separate these elements when looking at creativity. Furthermore, differences in whether researchers are looking at the process or the resulting product of creativity will result in differing definitions. Being creative can occur through both conscious and unconscious thought, although there is some evidence to suggest that creativity is at a higher quality when thought of unconsciously. Other elements likely to contribute towards how creative a piece is include technical goodness, communication and intuition. It may be that these elements imply what is needed for the process of creativity. How creative a product is may involve the product.

In conclusion, creativity is a more general trait that involves creating novel, useful ideas, over any period of time. Divergent thinking is one way to measure the outcome of creativity. In relation to the quality of a creative product, the more imaginative, and therefore original the product, the more creative it is deemed to be. Being creative involves an element of flexibility, in order to be able to produce products that are novel and original.

1.7 THE DIFFERENCE BETWEEN IMPROVISATION AND CREATIVITY

Improvisation is sometimes referred to as 'creating while performing' (Blom & Chaplin, 1988; Caesar, 1999; Dobbins, 1981; Greenhoe, 1972; Kaeppler, 1987; Martindale, et al., 1989; Sarath, 1996; Smith, 2007). This directly relates to the key difference between improvisation and creativity. Improvisation involves making up something new, on the spot, with no time for conscious preparation of material. Improvisation, therefore, is the process and product of creativity occurring simultaneously.

While other fundamental differences between improvisation and creativity exist, it is important to note the similarities behind the process of these two constructs. If improvisation is creating while performing, unconscious thought processes are likely to be linked to the quality of the improvisation (Johnson-Laird, 2002). Furthermore, it is thought that improvisation can have an impact on the way that we think and as a result the process of improvisation may have an impact on cognitive abilities known to be linked to creativity, such as divergent thinking (see Chapter Two).

Researchers in the area of creativity and improvisation have reached consensus on one thing; that the definition of creativity and improvisation is not agreed upon. Creativity and improvisation are all too often defined as essentially being the same thing, particularly regarding specific domains, such as music (Greenhoe, 1972; Limb & Braun, 2008; Pressing, 1987). Many questions still remain. For example, are all individuals creative in some way (Guilford, 1950) or does it only occur in particularly gifted individuals (McFadzean, 2000)? At what level is someone being creative? Many people are likely to see this cut off point in different places (Barron & Harrington, 1981). With the discrepancy of definitions, it is likely to have an impact on the way that the product of creativity is measured.

It may be that separate definitions are needed for the process and product of improvisation. It is suggested that improvisation should lie on a continuum, indicating the varying degrees of improvisation (Sawyer, 2000) that exist. This would cover aspects of improvisation, such as extemporization (Weick, 1998), when one takes something that already exists and changes it to form an entirely new creation. However, if improvisation and creativity lie on a continuum, this does not mean that they are not multi-dimensional trait, as discussed in Chapter 1.6. It is likely that all the elements of creativity, including improvisation, lie on one continuum. Each of these elements may then have a continuum of their own.

There is no clear line showing where improvisation begins in relation to creativity. Furthermore, the different domains of verbal, dance and music improvisation reveal a different emphasis placed among the various defining elements of improvisation. In order to try and establish a definitive set of elements for both creativity and improvisation, a literature review was undertaken and various definitions of both creativity and improvisation compiled.

It has been suggested that creativity is seen as more general trait than improvisation (Miner, et al., 1996; Montuori, 2003; Sawyer, 2000). The topics of flow and flexibility, the idea that creativity should be useful, should involve variation as well as terming it creative performance suggests that the definition of creativity focuses on the general terms that are needed to create. This leads to the conclusion that improvisation is a more specific trait of creativity.

Across the various definitions of improvisation, the following definition of improvisation as a general trait was created for the purpose of this thesis. This was based on the main themes that arose as a process of the literature review and the differences in relation to creativity outlined above.

Improvisation is the process of creating in real time. Improvisation, therefore, is exploring in a spontaneous manner to form something that is new, unique and imaginative.

Chapter 2: The Influence of Improvisation on our Cognitive Processes

The following chapter sets out to identify the links between improvisation and cognition. Research is explored investigating the role that improvisation and creativity has on areas such as memory and divergent thinking. Furthermore, brain-imaging studies are introduced to discuss the neural activity associated with creativity and improvisation. A background to working memory and schemas is then presented before a theory of schemas in relation to improvisation is proposed for this program of research.

2.1 THE LINK BETWEEN IMPROVISATION AND COGNITION

2.1.1 Improvisation in relation to the way we think

It has been suggested that both improvisation and creativity involve an element of problem solving (Getzels & Csikszentmihalyi, 1976). Getzels and Csikszentmihalyi suggested that the element of novelty helps with solving divergent thinking tasks in particular.

As discussed in Chapter One, creativity is thought to be at its best when it occurs without any conscious effort. Furthermore, it is thought that creativity is linked to divergent thinking. Therefore, it may be that improvisation may influence levels of divergent thinking and problem solving.

Schmidt, Goforth and Drew (1975) were the first to indicate a difference in thinking processes following improvisation. Seventy-eight children, approximately six years of age took part in an experiment that aimed to identify a link between dramatic play and scores on a creativity test, as measured by an adapted version of Wallach and Kogan's (1965) tests of creative thinking (Rotter, Langland, & Berger, 1971). These consisted of both figural and verbal tests such as describing what a picture looks like or thinking of alternative uses for objects. Thirty-nine children took part in normal classroom activities while the remaining participants were divided into two experimental groups. These children took part in twice weekly, half hour sessions of dramatic play for a period of eight weeks. Tasks here ranged from simple, pantomime based tasks through to improvisation tasks as the weeks went on. Schmidt et al. found that the children who had taken part in the improvisation tasks scored significantly higher on a creativity test than the control condition.

However, this study had many limitations and the study has not been repeated since. Firstly, time of completion for the creativity tests was not taken into account, such that children were simply told to complete the creativity tests, without timing or imposing a time limit within which the tasks should be completed. As well as this, the method of scoring was vague. No scoring in relation to originality was carried out. Instead, simply the number of responses that were made was taken to be the creativity score (see Chapter 8 for the arguments against this). In order to be able to draw more conclusive findings, an equivalent control condition would also need to be established. Schmidt et al. used a control group that simply did not take part in any improvisation classes. This provides a lack of control in the study such that it is not possible to see whether it really was the creative process that influenced creativity scores or whether it was simply taking part in a social activity. Finally, if results were compared separately according to the two experimental groups, they only remained statistically significant for one of the groups. Schmidt et al. attributed this to observers being present in the first group, suggesting that creativity output scores may have been due to demand characteristics of the observers, such that those in the observed group displayed no differences in creativity scores. However, it is difficult to draw conclusions without replicating the results.

More recently, Karakelle (2009) conducted an experiment with a similar methodology to Schmidt et al. on adults and with a larger focus of improvisation in their classes of “creative drama”. This involved acting through the use of things such as poems, particular words, music and props. No written text was used in any sessions. However heavily improvisation based, they were still encouraged to think about past experiences while taking part. This was based on research by Hui and Lau (2006) who found these types of classes to increase school students’ creativity scores after 16 weeks of drama classes in comparison to other extra curricular classes. Karakelle (2009) asked fifteen participants to take part in a course of creative drama for a period of ten weeks with an emphasis on the use of improvisation. They, along with fifteen other people in the control condition completed two tasks of divergent thinking pre and post drama classes. Those in the control condition took the tests at the same time points but with no intervention. Two tests of divergent thinking; the Alternative Uses Task (AUT) and a ‘circle drawing’ task were administered. The AUT consisted of giving as many alternative uses as possible for five different objects in one go. However, neither the time frame to do this nor the objects that were used were given in the paper. The circle drawing task, appeared to be based on the circles task administered in the Abbreviated Torrance Test for Adults (Goff & Torrance, 2002) and required participants to draw objects using a circle. Results found that those in the improvisation conditions had significantly higher fluency and flexibility scores overall than the control condition following the intervention. The way these scores were measured however was not mentioned.

However, as with Schmidt et al., (1975) the control group had no intervention to take the place of the drama classes. It can therefore not be concluded that it was the drama that led to improved results as these differences could be due to a number of factors such as simply taking part in a social class once a week. Furthermore, it would be interesting to determine whether the results remained when looking at the tasks used individually. While the AUT assesses verbal divergent thinking abilities, the circle drawing task assesses visuo-spatial skills. If results were due simply to taking part in social classes such as the drama classes, one would expect to see verbal tasks increase but not necessarily visuo-spatial based tasks.

A link between creativity and intelligence has long been suggested (Greenhoe, 1972) where Taylor and Holland (1962) suggested that the majority of studies (Getzels & Jackson, 1962; Hudson, 1966; Torrance, 1962) indicated small but positive correlations between creativity and IQ. However, this link was only apparent in the general population. When applied to experts, no correlation was observed. Webster (1979) observed a link between improvisation and intelligence scores, such that there was a positive correlation between IQ and music improvisation scores in children. However, recent research has suggested that the link between general intelligence and creativity is not sufficient. Russo (2004) concluded that children with high creativity often exhibit a high IQ but that the opposite relationship, such that a high IQ indicated high creativity, did not exist. Preckel, Holling and Wiese (2006) tested the idea that creativity is linked to the threshold theory (Taylor & Barron, 1963) such that it is only related to an IQ below 120. Preckel et al. (2006) looked at verbal, figural and numerical intelligence using the Culture Fair Intelligence Test (CFT; Cattell & Cattell, 1959) and the Berlin Structure of Intelligence Test (BIS-HB; Jager, et al., 2005). They found that verbal creativity had the strongest correlations with intelligence. However, overall they could not find any evidence towards the threshold theory, suggesting that although early research indicated that this is an adequate theory (Barron, 1963, 1969; Christensen, 1979), the threshold theory does not actually exist (Preckel, et al., 2006; Runco & Albert, 1986).

Chamurro-Premuzic (2006) found that creativity, as measured by the AUT could predict academic performance in undergraduate students final dissertations, four years after the initial creativity test. Silvia (2008) concluded that a small effect did exist between creativity, as measured by divergent thinking, and intelligence. However, openness to experience was found to explain some of the effect such that the effect size became smaller, suggesting other factors could predict or explain the relationship found between creativity and intelligence.

Weick (1998) suggested the idea that the better people become at improvising within a musical domain, the better their memory will become. This in turn will give them access to a wider number of resources of which they can draw their improvisations from. Although this has not been tested, memory is one of the few areas of cognition to have been explored in relation to improvisation. One study that focused on memory in relation to improvisation was carried out by Scott, Harris and Rothe (2001). Scott et al. (2001) asked 99 female participants to read a monologue and to remember as much detail as they could about the character involved, instead of trying to memorize the material. They then participated in a 30-minute task based around the monologue they had just read and assigned to one of five conditions; reading, writing, group discussion, independent discussion or improvisation. Participants were then asked to recall the monologue and scored according to how well they performed. This was done by calculating a total score of word-for-word recall combined with recalling phrases that were similar to the original monologue but not exactly the same. These were termed as 'gist' phrases.

Improvisation was found to be superior to all other conditions, such that those in the improvisation condition recalled a larger proportion of the monologue correctly. Participants in the improvisation condition remembered significantly more 'gist' phrases, suggesting that improvising around the character that the monologue was based on allowed a form of rehearsal and enabled people to encode the information more effectively than the other conditions. Furthermore, it suggested that the improvement was directly related to the improvisation, due to other conversation based activities not leading to the same improvements in memory recall. This lead the authors to conclude that improvisation involves a deeper level of cognitive processing. However, no theoretical account was suggested in relation to the deeper level of processing that improvisation may provide. This study provides a small link between the act of improvisation and an increase in cognitive processing, such that the process of improvisation enables people to process information to both a deeper and unconscious level. This in turn leads to a higher level of cognitive performance, in this case an improvement in memory recall.

2.1.2 *Brain-imaging Studies: What do they tell us about the underlying cognitive processes in improvisation?*

More recently, brain-imaging studies have been used to look at the underlying processes of both improvisation and creativity. The most common methods of studying creativity and brain-imaging involve the use of EEG and fMRI. EEG or Electroencephalography show the electrical activity in the brain by finding out when and where clusters of neurons are firing. This is shown by producing an output of alpha activity. Functional Magnetic Resonance Imaging (fMRI) studies provide a more accurate picture by taking multiple images of activity in the brain, measured by blood flow.

Through the use of EEG, Martindale and Hines (1975) suggested that people with high levels of creativity exhibit higher levels of alpha activity. This was replicated by Fink, Benedek, Grabner, Staudt and Neubauer (2007). Martindale and Hasenfus (1978) also went on to replicate Martindale and Hines (1975) but found these results only occurred when people were specifically told to be original. This difference in originality is confirmed by Shamay-Tsoory, Adler, Aharon-Peretz, Perry and Mayseless (2011) who found that people with right hemisphere lesions showed decreased levels of originality while those with left hemisphere lesions actually exhibited increased levels of originality. As well as this, the greater the lesion in the left hemisphere, the higher the originality score. Shamay-Tsoory et al. have attributed these findings to the idea that the left hemisphere is associated with more systematic ways of thinking, such as language.

In relation to types of thinking Molle, Marshall, Wolf, Fehm and Born (1999) found that EEG results involved a wider distribution of EEG alpha activity when looking at divergent thinking in comparison to convergent thinking. Fink, Grabner et al., (2009) associated creativity, as measured by the AUT with both higher and lower levels of alpha activity. They suggested that to think creatively involved a combination of various cognitive processes, including the idea of cognitive flexibility. Furthermore, being original and combining all these processes and information means bringing ideas into working memory (see Chapter 2.2.2 and 2.2.3). This idea is supported by Bengtsson, Csikszentmihalyi and Ullen (2007), who through the use of fMRI, found that the right dorsal premotor cortex (DLPFC) was activated when musicians (N=11) improvised. This was replicated by Berkowitz and Ansari (2008). Bengtsson et al. also noted that the use of "free selection in cognitive tasks" (pg. 837) is also related to the DLPFC, as shown through various brain imaging studies of cognition (Nathaniel-James & Frith, 2002) including random number generation (Jahanshahi, Dirnberger, Fuller, & Frith, 2000). This not only indicates a relationship between improvisation and cognition but also suggests the importance of working memory in improvisation, with the DLPFC having been implicated in the use of action specific decisions (Bengtsson, et al., 2007).

Fink, Graif and Neubauer (2009) found differences in EEG alpha activity between novice and expert dancers. Fifteen expert dancers and 17 novice dancers were asked to complete an AUT and then imagine themselves dancing a waltz followed by carrying out a dance improvisation. Fink et al. found stronger alpha activity in expert dancers when compared to the novice dancers for the AUT and improvisation conditions, but found no difference when asked to imagine the waltz. Furthermore, they concluded that experts use a wider range of brain areas in comparison to novice dancers, where activity was mainly observed in the frontal areas of the brain.

Howard-Jones, Blakemore, Samuel, Summers and Claxton (2005) looked at the cognitive processes that occur within creativity. Eight participants underwent an fMRI (Functional Magnetic Resonance Imaging) scan while also being given a creativity test. This involved participants being asked to tell stories incorporating a set of three words. While instructing them to create a story, they were either asked to be as creative or as uncreative as possible. All stories were rated by Amabile's Consensual Assessment Technique (Amabile, 1982), a well known, yet general assessment scale of creativity, designed to be assessed by the judge's own idea of what creativity is. Although a higher level of creativity was found following the use of unrelated in comparison to related words, the most interesting results came from the fMRI scan. Using a within-subjects technique, brain activity was found to differ according to how creative participants were such that more activity in prefrontal areas of the brain was found in the more creative responses. This has since been replicated in music improvisation. Brown, Martinez and Parsons (2006) replicated these findings with sentence and melodic generation with prefrontal areas of the brain being activated in a PET scan study. Limb and Braun (2008) also found the same areas of brain activity increased following a series of improvisation tasks on a piano. However, they also found that in limbic structures, the area known for self-evaluation and motivation, shut down while improvising.

These brain-imaging studies may be linked to the idea that improvisation involves unconscious processes and may also encourage the flow for the generation of new ideas. The idea that the area for self-evaluation shuts down when improvising provides support for the idea that improvisation is at its best when it is unconscious and that there is no such thing as making a mistake (see Chapter 1). Furthermore, the link between improvisation and cognition implies the use of working memory in regards to control and decision-making. This is discussed further in Chapter 2.2.3. However, it should also be noted that the results from brain imaging studies have a huge amount of variation. Arden, Chavez, Grazioplene and Jung (2010) reviewed 45 brain imaging studies looking at creativity and cognition. They concluded that the range of tests used to measure creativity was too diverse, meaning very little overlap between studies and making it almost impossible to draw valid conclusions.

2.1.3 Improvisation and the Influence on Cognitive Abilities

These imaging studies suggest that different areas of the brain are activated when creativity and improvisation are involved, and that the processes of working memory may be involved with the processes. Several researchers have suggested that creativity involves using a number of "cognitive abilities" (Russo, 2004, p. 182) such as intelligence, problem solving skills, verbal fluency and divergent thinking (Guilford, 1950).

Ayers, Beaton and Hunt (1999) suggest that creative ideas are related to the level of consciousness. Transliminality is a term that refers to information crossing "into or out of consciousness" (Thalbourne & Houran, 2000, p. 853). It is thought that higher levels of transliminality is linked to syncretic cognition (Werner, 1948), which involves two separate aspects blending into one, a prime example being synaesthesia (Glicksohn, Alon, Perlmutter, & Purisman, 2001). According to Werner, there are many different styles of cognition. Highly creative people may be able to access levels such as syncretic cognition that not all people can. This in turn may be due to these particularly creative individuals breaking away from their set patterns of thinking and "automatized behavior patterns" (Werner, 1957, p. 124). Glicksohn et al., (2001) found that both people with schizophrenia and artists adopted a style of syncretic thinking suggesting that this thinking style proposed by Werner may have an impact on an individual's level of creativity.

Lange, Thalbourne, Houran and Storm (2000) also suggested that high scores on the transliminality scale are linked to higher levels of abstract thought. This could in turn be linked to higher levels of originality in divergent thinking tasks.

Johnstone (1979) reported that after a series of verbal improvisation games, perception appeared to be different in that people reported colours as being brighter. Although his students had been improvising in a darkened room beforehand, other aspects were also reported in relation to perception. A sharper focus was observed as well as people, objects and spaces appearing to be different in size and distance to what they actually were. He went on to suggest that set patterns of thinking dull perception but did not specifically test this assumption.

Montuori (2003) believes that the core feature of improvisation is drawing on prior experiences. Pressing (1988) suggests that improvisation occurs by recalling previous information acquired and regrouping the information to form something new. This is supported by Berliner (1994) who states that improvisation involves using your memory to create something new.

Although little research exists exploring the link between improvisation and cognition, the current literature suggests that there may be underlying cognitive mechanisms influenced by improvisation. Lewis (2008) investigated this link with musicians and found that scores on the Alternative Uses Task (AUT; Guilford, 1950) and Controlled Oral Word Association (Benton, 1969) test increased in fluency after a series of improvisation tasks. This was in comparison to musicians who simply practiced on their principal instrument. Furthermore, jazz musicians, who tend to improvise more in their domain of music, were found to have significantly higher scores in these cognitive tasks compared to classical musicians, before any improvisation had taken place, suggesting that jazz musicians may exhibit longer-lasting cognitive benefits of improvisation.

2.2 IMPROVISATION AND THE SCHEMA THEORY

It has now been suggested that improvisation may be able to influence various cognitive abilities. Furthermore, researchers have also indicated that improvisation relies on rearranging set patterns of thinking (Pressing, 1988, 1998a) and previous experiences (Montuori, 2003). This therefore suggests that improvising relies on using semantic memory. One theory that could therefore account for the process of improvisation and why this may have an impact on cognitive abilities is the schema theory.

2.2.1 What are schemas?

Schemas (Bartlett, 1932) 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 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 (Schank & Abelson, 1977), frames (Brewer & Treyens, 1981) and slots (Schank & Abelson, 1977). Scripts are seen as a type of schema and refer to event structures, such as a restaurant script. In this scenario, a restaurant script explains how we know how to behave and what to expect in a restaurant without having to remember the precise details of when you first experienced the situation.

Frames and slots, however, are used to describe the changing bits of information that occur when accessing schemas or scripts. Frames refer to what you would expect in relation to concrete concepts, such as rooms and buildings (Brewer & Treyens, 1981). Slots, by contrast, relate to the specific situation of the schema or script. Every detail of a past event cannot be remembered and therefore slots involve filling the gaps according to aspects such as our culture (Bartlett, 1932; Sulin & Dooling, 1974).

When things do not go according to plan, the problem is realized by the current schema. This in turn activates another schema in order to be able to deal with the new situation.

2.2.2 Working Memory and the Central Executive

When experiencing a situation or event in a completely new way and environment, it is easy to know what to do and how to act. This is because all the schemas and previous knowledge that are needed are combined together and the information then actively controlled in short-term memory. This is what is referred to as working memory.

There are various models of working memory that have been proposed. The most famous and widely accepted is Baddeley's model of Working Memory (Baddeley, 2000; Baddeley & Mehrabian, 1976). Baddeley suggests that working memory is made up of four parts; the phonological loop, the visuo-spatial sketchpad; an episodic buffer and the central executive. The phonological loop is responsible for processing verbal and auditory information while the visuo-spatial sketchpad is responsible for processing information concerning visual and spatial knowledge. The episodic buffer combines the information gathered from the phonological loop and visuo-spatial sketchpad. This is done when the two are needed at the same time and if the information in each starts to interfere with each other. If needed, the episodic buffer can also add information from long-term memory. All three subsystems can only hold a limited amount of information at one point in time.

Should any of the subsystems need extra capacity due to heavy demands, the central executive (CE) has extra capacity. The CE is the "control centre for working memory" (Radvansky, 2011, p. 84). The CE is to do with how attention is distributed at different time-points, e.g. knowing what to think about. If extra capacity is needed in one subsystem it will stop the processing of another in order to allocate more space to the subsystem that requires it the most. Furthermore, the CE adjusts the information so that it contains only the bits of information that are needed. One way in which this is done is by suppressing any information that is not needed, meaning more space is available. Furthermore, any information that later becomes useless also gets removed.

It is thought that the reason random generation tasks are so difficult to keep random (Baddeley, 1966) is due to the role the CE plays, as it draws on schemas and patterns to get the task completed in real-time. As well as attention, the CE also relates to being able to switch between different methods of thinking. Dysexecutive syndrome (Baddeley & Wilson, 1988; Baddeley, 1997), a type of brain damage which affects working memory, leads people to not only have problems with attention but also problems with switching to a different method of thinking. Known as perseveration, this is most evident when trying to complete a task that involves having to switch to a different problem solving style. Often, people affected know what they should be doing but cannot switch to doing so.

In relation to working memory and the central executive, Norman and Shallice (1986) highlighted that errors occurring in working memory were not addressed and explanations for how activities are controlled were vague. Through observing everyday activities they came up with the Supervisory Activating System (SAS). Norman and Shallice (1986) said that actions and activities could be controlled in two ways. Firstly, with the use of previously learnt skills such that things become so automatic that we can do two things at once. If two things come into conflict with one another, one needs to stop. This automatically happens and is termed 'contention scheduling.' The example Norman and Shallice (1986) give involves talking and driving. The two can easily occur simultaneously but if more attention is needed when driving, such as the need to suddenly break, the talking ceases automatically, in order to focus more attention on driving.

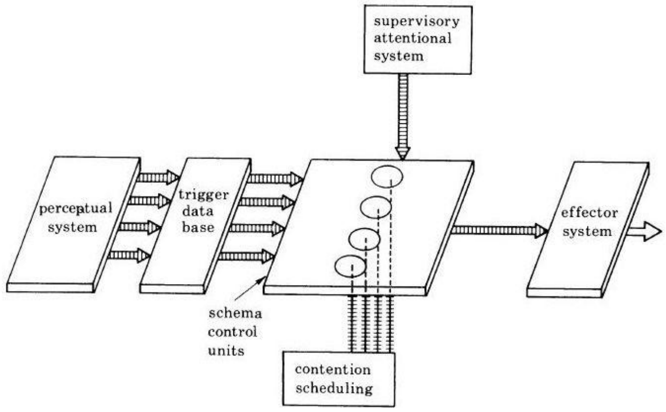

Figure 2.1 - Norman and Shallice (1986) Supervisory Activating System (SAS)

Norman and Shallice's (1986) Supervisory Activating System (SAS; figure 2.1) suggests that schemas control these automatic processes. The SAS can get in the way of these actions. When faced with a choice, the SAS is used by giving a bias towards which decision should be made. This indicates a more conscious process occurring within the control of the CE, as opposed to contention scheduling which is largely unconscious.

Further support for the SAS lies in its explanations for errors that occur, as well as how the SAS fits in with the central executive (Baddeley, 1997). The SAS allows for errors to occur by suggesting that if it is preoccupied with something, then the wrong sequence can occur. Once a schema is activated, the SAS deals with the processes associated with this schema. However, if preoccupied, another schema can be activated but is not picked up on. An example of this could be going to work but putting on your clothes for the weekend. The schema may have been activated because of other demands on the CE when the clothes for the weekend were seen, although you knew that you were going to work.

The SAS also fits into Baddeley's model of working memory and more specifically, the CE. The SAS explains why it is so hard to be random. Random generation tasks are hard and become increasingly harder as the task goes on. Within the SAS, the letters or number sequences that are often created are an example of the ongoing schemas that have been activated. The need to think differently puts constant pressure on the SAS and with a limited capacity, the faster this has to be done, the harder it becomes.

2.2.3 Improvisation in Relation to Working Memory and the Schema Theory

Fink, Grabner et al. (2009) suggested that to be original, ideas need to be brought into working memory. Bengtsson et al. (2007) found evidence to indicate that a specific area of the brain, the DLPFC, was associated with improvisation, working memory and some cognitive tasks. More specifically, the DLPFC appears to be activated in tasks of divergent thinking. One of these tasks includes random generation. Baddeley (1986) shows that random generation tasks use the CE and more specifically, the SAS. Jahanshahi et al. (2000) found random number generation to be associated with the DLPFC and suggested that it is the schemas used in working memory that make this task so difficult. Applied to improvisation, this implies that people refer to their schemas when the pressure on the CE builds. The SAS is involved with fast decision making choices and the more unconscious the process becomes, the more people use contention scheduling. The way in which working memory is used is therefore likely to differ between expert and novice improvisers. People need to learn to suppress the schemas that originally come to mind and not necessarily make a decision based on the SAS. This provides a valid account for why the quality of improvisation is seen to be related to expertise. Furthermore, as experts become used to improvising, the cognitive demands associated with working memory and the CE may lesson, meaning there is more capacity for improving variation and quality.

As with improvisation (Johnson-Laird, 2002), schemas are largely seen as a subconscious process in which phrases that have been acquired are stored and then accessed when needed while performing an improvisation. In an unpublished manuscript, Pressing (1998a) suggested that improvisation occurs by recalling previous information, or schemas acquired and regrouping the information to form something new. He refers to these phrases as “referents”, which aid improvisation, as they provide variation to music improvisations while reducing the risks involved and referents can always be used if someone cannot think of anything completely novel at a particular moment in time. Pressing (1988) argues that schemas provide a coherent theory towards improvisation as it can explain why they 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.

This theory is supported by Montuori (2003) who suggests that improvisation can occur by simply rearranging the schemas that we have. In this way, an improvisation can still remain novel. Carr and Borkowski (1987) relate this theory to divergent thinking, saying that knowledge needs to be flexible in order to be able to alternate between different schemas according to different tasks.

However, what Pressing's theory of schemas 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. This could be likened to perseveration errors within the CE such that people become stuck using one method of thinking and although they realise they need to switch to something new, find it very difficult to do so. Therefore, while schemas provide a theoretical framework for improvisation, relying too heavily on a restricted set of schemas can create problems for improvisers, as this can stop them from thinking freely. Breaking away from these schemas would provide people with a new way of thinking, enabling them to break away from the set patterns of thinking that we are so used to using in everyday life.

2.2.4 The Definition of Improvisation in Relation to Schema Theory

In Chapter One, for the purpose of this program of research, improvisation was defined as **the process of exploring in a spontaneous manner to form something that is new, unique and imaginative.**

It has already been suggested (Montuori, 2003; Pressing, 1988) that improvisations can remain novel and spontaneous by rearranging schemas as well as using a mix of novel ideas and previously acquired information, or schemas.

The schema theory also related to the importance of expertise and knowledge that has been highlighted in the definition of improvisation and is likely to affect the quality of the improvisation.

Borko and Livingston (1989) used a theory of schemas to explain the use of improvisation in an educational setting. They compared the teaching styles of expert and novice teachers and found that expert teachers were able to "improvise" away from their lesson plans in comparison to novice teachers, who stuck to structured plans. Expert teachers were able to take students comments and use them within discussions, making links to their already developed schemata. This was particularly useful when students had questions that deviated away from the lesson plan. Borko and Livingston attributed these differences to their cognitive schemas, suggesting that novice teachers do not have access to as many schemas, as they have not had the time or experience to build up as large a database as the expert teachers. This then restricts the flexibility in novice teachers.

Livingston and Borko (1990) replicated these findings in a follow-up study, although further replications have not since been published.

2.2.5 The Challenges of Improvisation in Relation to the Schema Theory

Pressing's (Pressing, 1988, 1998a) theory of improvisation and schemas indicates the possible process of how improvisation occurs. It also accounts for the problems that improviser's face on a regular basis. An improviser's main challenge is to ensure that an improvisation is always novel. A theory of schemas still allows novelty but also explains the difficulty in constantly keeping things new. By breaking away from set patterns of thinking, improvisers could face the problems that schemas pose. Breaking away from our schemas could potentially help improvisers in two different ways.

Firstly, breaking away from schemas may enable the improviser to think of more novel ideas. Secondly, breaking away from schemas may encourage flexibility to switch between a wider range of schemas, therefore extending the options of schemas available.

The idea that schemas are involved also fits in with the common use of practice and knowledge in definitions of improvisation. It is often said that the more knowledge an improviser has about their performance area, the higher the quality and variation of improvisation (Hinz, 1995). By building up a knowledge base, a performer is developing a growing set of schemas. The more schemas available, the more choice the improviser has. Knowledge is likely to affect the ability to break away from our set patterns of thinking as it would lead to more choice between schemas (Borko & Livingston, 1989) or lead to a wider range of novel ideas. Whichever method that improvisation uses, when improvisers are able to break away from their own schemas, they also break away from what is expected in the audiences' schemas.

Finally, the idea of using schemas in improvisation also explains why free improvisation is impossible. While people will try to break away from their set patterns of thinking, it is a constant battle that cannot always be won. What is unclear is whether people try to break away from the schemas they are using, whether they become more flexible at switching between schemas or whether this is dependent on the improviser's knowledge.

2.3 Improvisation and Cognition: The Research Question

For the purpose of this research, the following working definition of improvisation was created:

Improvisation is the process of creating in real time. Improvisation, therefore, is exploring in a spontaneous manner to form something that is new, unique and imaginative.

This chapter has focused on the link between improvisation and cognition, suggesting that improvisation may influence problem solving, in particular in tasks of divergent thinking. Furthermore, improvisation has been applied to a theory of schemas (Bartlett, 1932), first suggested by Pressing (1988). It is thought that improvisers rely heavily on the use of schemas when improvising. This can be beneficial to improvisation but also explains the main problems that improvisers face, such as repetition.

By having the challenge of constantly trying to think of new material, on the spot, it is therefore thought that improvisation encourages people to break away from their set patterns of thinking. This in turn, may have an impact on cognitive abilities, such that more ideas become available in tasks of divergent thinking following improvisation.

The current research therefore aims to test the idea that improvisation can have an impact on cognitive abilities. This shall be measured by asking people to complete a set of cognitive tests pre and post a series of improvisation tasks. These results shall be compared to an equivalent control task to determine whether improvisation can improve scores on these cognitive tests. Cognitive tests shall be focused on divergent and convergent thinking due to the literature that links these types of thinking with creativity.

If improvisation is found to have a positive impact on the way that people think, this provides positive implications for creativity in education. It has long been argued that improvisation and creativity should be implemented more widely into the National Curriculum (Cheng, 2011) and this could provide evidence towards different styles of teaching eventually affecting how children learn (see Chapter 11.5).

Chapter 3: Experiment One – The Effect of Verbal Improvisation on Mood, Creativity and Cognition.

The previous chapter discussed the potential connection between improvisation and cognition. Experiment One tests whether improvisation can be a catalyst for cognitive change and explores whether mood plays a mediating role in this relationship. The results are discussed in light of the relationship between schemas and improvisation.

3.1 INTRODUCTION

3.1.1 What is Improvisation?

Improvisation involves an element of creativity, where people generate novel and original ideas. However the defining element, for the purpose of this thesis, between improvisation and creativity is that improvisation involves actively creating these novel ideas on the spur of the moment.

This study looks at one particular aspect of improvisation – verbal improvisation. This type of improvisation involves making up things while talking in the present moment. Verbal improvisation is not a scripted performance and could go in any direction (Sawyer, 2008). Guided improvisation shall be used for the purpose of this research, where people shall be asked to improvise with constraints applied to the improvisation. Lockford and Pelias (2004) believe verbal improvisation is at its best when good communication and playfulness are present along with a sense of not knowing why people make particular choices about their improvisations.

The current study aims to investigate the potential relationship between the act of improvisation and changes in cognitive processing. The current literature suggests a link between improvisation and cognition (See Chapter 2.1 for review). Lewis (2008) found an increase in scores on an Alternative Uses Task (AUT; Guilford, 1950) following twenty minutes of music improvisation. Furthermore, these effects were larger when looking at a group of jazz musicians in comparison to a group of classical musicians. The current study extends Lewis (2008) in the verbal domain and aims to identify a link between verbal improvisation and cognition. This study used the same method as Lewis (2008), where cognition was measured by scores on simple creative and cognitive divergent thinking tasks following twenty minutes of an intervention consisting of either improvisation tasks or verbal discussion.

3.1.2 Measuring Cognition

It is possible to sub-divide creativity into categories. Walton (2003) said these categories are "dimensions of creativity" (p.147) and divided the different creative tests available into five separate categories; divergent thinking, attitudes/interests, personality traits, biographical inventories and creative accomplishments.

The area of creativity most often looked at and what the current study shall focus on comes under the term divergent thinking. Divergent thinking tests use open-ended tasks where there is more than one possible solution available and where answers can be as obscure or generic as the respondent completing the test wishes to make it. Tasks designed to assess creativity that fall into categories outside divergent thinking include problem solving tasks with a definite end and solution, lists of how many creative accomplishments have been achieved in one's lifetime, along with self report questionnaires on creativity. It is thought (Walton, 2003) that the majority of people adopt a convergent style of thinking, corresponding to set patterns of thought. While everybody can produce creative acts, some are seen to be more creative than others. It is thought these particularly creative individuals adopt a divergent thinking style.

According to Guilford, Christensen, Merrifield and Wilson (1978), **fluency**, **originality** and **flexibility** are what make a person particularly creative. These three aspects are generally agreed upon as a method for assessing creativity and in some cases improvisation (McPherson, 1995; Torrance, 1966; Webster, 1979). In general, the term **fluency** is used to define the number of responses that are created when performing a divergent thinking task; **originality** highlights how unique an answer is, and **flexibility** refers to the number of different categories into which responses fall. It is thought the more categories that are identified, the more diversely one is able to think. Some tasks also use other elements to identify creativity, such as **elaboration**, the amount of detail given in answers (Guilford, et al., 1978; Torrance, 1966) and **quality**, rated on a five point scale of how appealing the piece is to watch or listen to (McPherson, 1995).

Many creativity tests are designed to encourage the generation of original ideas. Divergent tests set out to do just this, where there is often an almost infinite number of responses available and where answers can be as obscure or generic as the respondent completing the test wishes to make it. The current study adopted two standard tests of divergent thinking, the first being the Alternative Uses Test (AUT; Guilford, 1950). The AUT requires people to list as many different uses as possible for a common object within a limited period of time. Common items given to participants include a brick, a paperclip and a shoe, although the object can be whatever the experimenter decides. Scoring of the AUT is often calculated for just fluency or for fluency, originality, elaboration and flexibility, as suggested by Guilford (1957a). However, no norms regarding the AUT have been found to date.

The second test used in this study, which is also a commonly used test of divergent thinking, is taken from the Abbreviated Torrance Test for Adults (ATTA; Goff & Torrance, 2002). The ATTA originated from the Torrance Test of Creative Thinking (TTCT; Torrance, 1966), originally created as a battery of tests to assess the level of creativity that children possess. The ATTA is a revised and shorter version of this suitable to administer to adults. It is made up of three activities, one of which is to be used for the current study. The task being used for the current study involves participants drawing pictures that incorporate nine triangles on a sheet of paper (see figure 3.1).

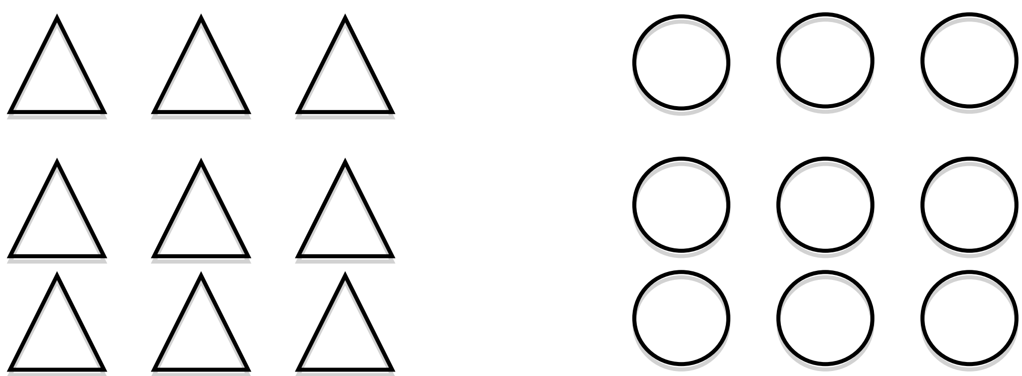

Figure 3.1: ATTA Triangles and Circles tests

Scoring is based on the same four criteria as the AUT; Fluency, Originality, Elaboration and Flexibility. Goff and Torrance (2002) suggest that as well as these scores, it is possible to obtain a 'creativity index'. Creativity is scored via 15 finer aspects of creativity, including richness, visualization, abstract titles, context, emotions, fantasy and visual perspective. This is then combined with the original method of scoring to achieve an overall index score if required. The TTCT is most widely used in education (Almeida, et al., 2008; Kim, 2006) while the ATTA has been studied in respect of a variety of backgrounds, including in relation to mood (Akinola & Mendes, 2008; Verhaeghen, Joormann, & Khan, 2005). This, as well as the vast amount of research that has been carried out using either this version or the

TTCT itself and for the levels of face validity and test re-test reliability it produces (Goff & Torrance, 2002) is why it was chosen for the present study.

Finally, cognitive ability is measured through the use of a verbal fluency task. This study employed a written version of the Controlled Oral Word Association Test (COWA; Benton, 1969), requiring participants to write down as many words beginning with a letter of the alphabet as possible. Developed as a neurological tool, the majority of research involving the COWA on this topic area includes dementia (Davis, Massman, & Doody, 2001), depression (Bogner, Richie, de Vries, & Morales, 2009) and the elderly (Sumerall, Timmons, James, Ewing, & Oehlert, 1997). Therefore, any norms available are presented on this sample as opposed to the general population (Ruff, Light, & Parker, 1996). COWA is usually scored by fluency, although other scoring methods have been suggested, with particular relation to brain lesions (Abwender, Swan, Bowerman, & Connolly, 2001). It has been chosen for the current study due to its rapid assessment and reliability to measure verbal fluency.

3.1.3 Improvisation and Mood Levels

The last aspect that this study shall focus on will be mood. No studies to date regarding improvisation and cognition could be found that measured the link between improvisation, cognition and mood. However, there is a literature on creativity and mood (Adaman & Blaney, 1995; Baas, De Dreu, & Nijstad, 2008; Grawitch, Munz, Elliott, & Mathis, 2003; Hirt, Devers, & McCrea, 2008), which suggests that a positive mood can lead to higher scores of creativity (Pannells & Claxton, 2008). However, other researchers have also shown a link between negative moods and an increase in creativity (Akinola & Mendes, 2008; Anderson & Pratarelli, 1999; Gasper, 2003).

Isen, Johnson, Mertz and Robinson (1985) reported that participants elicited higher originality on a word association test when they were in positive moods. Isen, Daubman and Nowicki (1987) found people to be more creative when problem solving if they were in a better mood. This has been replicated by Grawitch et al. (2003) who found positive mood increased the originality, but not the fluency scores of problem solving tasks. More specifically Phillips, Bull, Adams and Fraser (2002) replicated these results in the number of alternative uses that people could produce in the AUT. Isen, Niedenthal and Cantor (1992) replicated the effects of originality, along with positive mood involving a greater level of flexibility (Dreisbach & Goschke, 2004). Baumann and Kuhl (2005) suggested that these higher levels of flexibility would lead to an increase in the number of people using local processing, as opposed to global processing, the dominant form of processing (Navon, 1977). People with higher flexibility tend to look for things within the bigger picture (local processing) as opposed to simply seeing what the bigger picture says (global processing).

Fredrickson's (Fredrickson, 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. This theory is in line with that of the schema theory in the sense that to create novel ideas, one must expand on one's normal patterns of thinking. The added element in this theory is the assumption that a positive mood is what influences this increase in creative thinking.

However, George and Zhou (2002) as well as Akinola and Mendes (2008) found the opposite effect, such that negative moods led to an enhanced level of creativity, as measured by the ATTA (Goff & Torrance, 2002). Although studies on creativity have found significant effects in both mood states, Baas et al. (2008) carried out a meta analysis on all the current work involving mood and creativity and concluded that a positive mood did indeed lead to an enhanced level of creativity. The evidence that negative moods also lead to this effect was not found to be significant. However, this does not mean the results found by George and Zhou (2002), as well as Akinola and Mendes (2008) are wrong. Instead, Baas et al. (2008) noted that a greater use of correlational analyses was used in these studies and that furthermore, positive mood was not found to increase creativity significantly more than negative moods.

It is therefore plausible that should an effect in the cognitive tasks be found after improvisation, that mood could be a possible confounding variable, as it is feasible that improvisation can be a social, positive, mood enhancing experience. It may simply be that improvisation increases mood levels which is why performance in either creativity or cognitive tasks increase. In relation to Lockford and Pelias (2004), if verbal improvisation is better with an increased level of playfulness, it is likely that this element of playfulness will boost mood levels.

It was therefore deemed necessary to measure mood levels throughout the current experiment to ensure any effects found were as a result of improvisation and not mood. The Profile of Mood States (POMS; McNair & Heuchert, 2003) was chosen to measure levels of mood for a variety of reasons. It 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). Furthermore, in a study assessing construct validity, Meek et al. (2000) supported full construct validity for POMS but could not produce this for the PANAS. Finally, POMS was chosen due to the type of positive affect that is produced. McChargue, Cohen and Cook (2004) noted that the POMS positive affect result, also referred to as Vigor, assessed positive affect as being active, lively and "full of pep". The PANAS however analyzed positive mood on what McChargue et al. (2004) refer to as "low activation positive mood states" (p.289). 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 researcher is interested in determining an increase in active words, which are more likely to change in a short time frame. Furthermore, POMS is a widely used mood questionnaire and is particularly good for the current study as it is able to measure mood 'Right Now'. Originally developed in a clinical setting, this questionnaire has since been developed with healthy adults as well as students (McNair & Heuchert, 2003).

POMS is appropriate for the current study as it is able to measure mood 'right now' and not just in the past seven days, as many other mood questionnaires are designed to do, for example the Depression-Happiness Scale (DHS; McGreal & Joseph, 1993).

3.1.4 The Research Question: The impact of improvisation in relation to cognition

The present study aimed to identify if there was a change in scores of the cognitive tasks; AUT, ATTA and COWA following a series of improvisation or control exercises. While testing for this, mood scores before and after improvising were measured to determine if any differences found in cognitive task performance are attributable to changes in mood levels. The experimental hypothesis is that scores in the cognitive tasks will increase after twenty minutes of improvisation but that scores will remain the same following a control activity and that these differences will be independent of any changes in mood.

3.2 METHOD

3.2.1 Participants

Forty-one Psychology undergraduate students from the University of Hertfordshire took part in the experiment through convenience sampling, via the SONA online participation sign-up system. The total sample consisted of 33 females and eight males with a mean age of 22 years (SD=7). The experiment was carried out in groups of between three and eight people. Groups were randomly divided by condition, resulting in 21 (female = 17, male = 4) participating in the improvisation condition and 20 (female = 16, male = 4) in the control condition.

3.2.2 Design

A 2x2 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 minutes of improvisation or 20 minutes of a verbal discussion. The Independent Variable was the treatment condition. The Dependent Variables were scores and sub-scores on the AUT, ATTA, COWA and the POMS mood questionnaire pre and post treatment. The experimental hypothesis is that for the cognitive tests there will be a significant interaction between Condition and Time of testing, such that there will be a larger increase in AUT, ATTA and VFT scores after the improvisation condition than the control condition.

From, an a priori perspective, it is predicted that there will be no difference in changes in mood as a function of treatment condition.

This study has received ethical approval, protocol number: PSY/03/09/CL.

3.2.3 Materials and Apparatus

POMS

The Profile of Mood States (McNair & Heuchert, 2003), a 65 item questionnaire was chosen, asking people to fill in how they feel in the present moment. The POMS is measured on six subscales along with a Total Mood Disturbance score (TMD). 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)” (see Appendix A).

AUT

The AUT requires participants to write down as many different uses for a common object within three minutes. Instructions for the AUT are:
“ 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. For example, if I were to give you the common object of a chair, I would not want you to say to sit on it. You could, however say to stand on it to reach something taller than yourself. You will have three minutes to complete this task. Are there any questions?” Two versions of the same test with different target objects were used and counterbalanced. The two target objects given to participants were a ‘remote control’ and a ‘paperclip’.

The AUT is scored for Response, Fluency, Originality, Elaboration and Flexibility. Response refers to the number of responses elicited, regardless of whether they count as a valid alternative use or not. Response was deemed necessary as this would indicate whether participants generated more uses post treatment in the same time frame. Any differences between groups would indicate that participants were becoming faster at the task due to treatment, a difference that could be masked by fluency scores. 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 either in comparison to responses given by other people participating or compared to an initial battery of tests where common uses have been identified. For example, fewer people used the response ‘to tidy up nail polish’ than ‘as a hairclip’. The first response would therefore be scored as more original. Elaboration refers to the amount of detail that is given in each answer. For example, someone who said ‘to unbend and straighten out a paperclip to pick a lock’ would score more points for someone who simply said ‘pick a lock’. Finally, Flexibility refers to the number of different categories responses fall into. For example, ‘hairclip’ is seen as a different category to ‘piercing ears’.

ATTA

The figural ATTA asks participants to draw pictures or objects incorporating the shapes printed on some paper. Participants are asked to give each drawing a title, indicating what it represents. Two versions of the same test were used and counterbalanced. The two sets of shapes given were triangles and circles (see figure 3.1). Instructions given to participants were:

"In front of you, you will see a set of triangles/circles. I would like you to draw objects or pictures from those triangles/circles. They can be anything you like but the circle/triangle must be incorporated into the actual picture you draw. Try to make them as unusual as you can and please create titles for your pictures. Are there any questions?" (Guilford, 1957b).

The ATTA is scored for Response, Fluency, Originality, Elaboration and Flexibility via the manual by Goff and Torrance (2002). Response refers to the number of responses elicited. Fluency refers to the number of legal responses that are created. Originality was scored according to the numbers of circles and triangles used as well as according to a predefined list of common responses. Elaboration was scored by assigning points for extra detail in diagrams and Flexibility was scored according to a set of predefined categories.

COWA

The COWA requires participants to list as many words beginning with a letter from the alphabet in one minute. These letters were chosen by Benton (1969) as they have a similar number of words in the English dictionary and are of equal difficulty. Instructions given to participants were:

" I am going to give you a letter from the alphabet. I would like you to think of as many words as you can think of which begin with that letter in the space of one minute. The words can be anything you like other than proper names, such as names of people or places; or a word you have already used but with a different ending. For example, if I were to give you the letter 'S', you could write 'slow' but you would not get another point for writing 'slower'. Do you have any questions?"

Two versions of the same test were used and counterbalanced. The two letters given to participants were C and P.

The COWA is scored for Response and Fluency according to the same criteria as the AUT and ATTA.

Improvisation

The improvisation condition lasted for twenty minutes and consisted of a set of standard verbal improvisation exercises derived from Johnstone (1979). These were designed to encourage people to spontaneously produce speech that, as far as possible, could not be planned in advance. For example, people were asked to make up a story including three random words. (See Appendix B for full instructions).

The verbal control condition consisted of a set of verbal interactions that were similar in structure to the improvisation exercises. However, these 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. For example, participants would be asked what they did last weekend. (See Appendix C for tasks).

3.2.4 Procedure

Participants were recruited through the University of Hertfordshire's research study participation system. Following consent, participants were asked to complete the POMS for how they felt 'Right Now'. This takes between five and ten minutes to complete. Demographics of gender and age were also taken at this point. Once this had been completed, the AUT, figural ATTA and COWA were administered. Participants then took part in a group activity engaging in twenty minutes of either group improvisation exercises or the control condition exercises. After twenty minutes, participants were then asked to complete the POMS questionnaire again and another version of the AUT, COWA and ATTA was administered. All participants were then de-briefed and thanked for their time (see figure 3.2 for a procedural diagram).

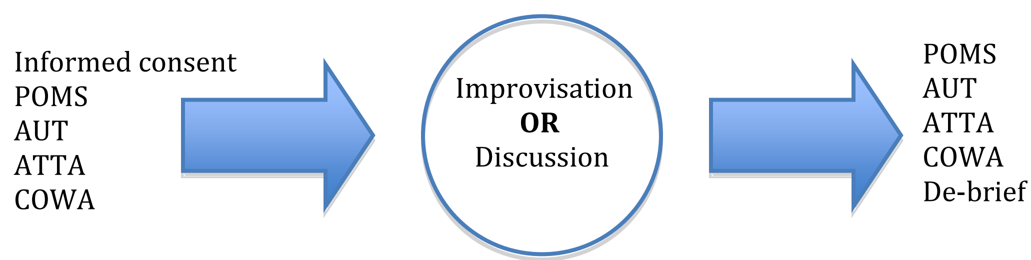

Figure 3.2 – Procedural diagram of Experiment One

The AUT, ATTA and COWA were scored for Response and Fluency. The AUT and ATTA were also scored for Originality, Elaboration and Flexibility. The ATTA was scored via the manual by Goff and Torrance (2002).

3.3 RESULTS

All tests (AUT, COWA, ATTA and POMS) administered before and after treatment were analysed to determine if there were any changes in scores after the verbal interventions had taken place and to determine whether any changes observed differed between conditions.

Alternative Uses Task (AUT)

Inter-judge reliability

A test of inter-judge reliability involved three independent raters scoring the AUT fluency and flexibility scores. Originality scores were calculated by the first judge only, as originality is a concrete score relative to the frequency of responses. Interjudge reliability was calculated using Intraclass Correlation (ICC). ICC provides a correlation for all judges in relation to their absolute agreement. A strong, positive correlation was found for fluency r = .89, n = 82, $p < .001$. The ICC for flexibility scores also revealed a positive correlation, r = .71, n = 82, $p < .001$, suggesting that this a reliable method of scoring the AUT.

AUT Mixed ANOVA Analyses

All analyses were subjected to an Analysis of Covariance (ANCOVA) and mixed ANOVA. DVs were looked at separately, as opposed to within a MANOVA or MANCOVA model due to the high correlations that have previously been associated with the different scores elicited from divergent thinking tasks (see Silvia et al., 2008). Highly correlated DVs can considerably weaken the power of analysis. Mixed ANOVAs are therefore presented in order to clearly show pre and post differences, and display the interaction predicted between control and improvisation conditions. In any cases where an ANCOVA produced conflicting results, the results of the ANCOVA are produced.

The mean scores and standard deviations for response, fluency, originality elaboration and flexibility are presented in table 3.1.

Table 3.1 – Experiment One Mean (SD) AUT scores before and after treatment

		Response	Fluency	Originality	Elaboration	Flexibility
Improvisation (N=21)	**Before**	6.57 (2.42)	5.33 (2.16)	1.33 (1.24)	2.14 (1.24)	3.71 (1.38)
	After	8.90 (2.76)	7.46 (2.42)	3.43 (1.66)	2.57 (1.94)	5.90 (1.57)
Control (N=20)	**Before**	7.15 (3.33)	5.12 (2.72)	1.95 (1.54)	2.00 (1.89)	3.75 (1.71)
	After	7.45 (2.80)	5.63 (2.41)	2.30 (2.20)	1.95 (1.47)	4.40 (2.06)

Mixed ANOVAs were carried out to determine if there were any changes in scores pre and post treatment, as well if there were any differences between the two treatment conditions. There were two factors; factor 1: Condition and factor 2: Time. Condition was the between groups factor, consisting of two levels – improvisation and control. Time was the within groups factor, again consisting of two levels – before and after the treatment.

AUT Response

For the AUT Response scores there was no significant main effect of condition, $F(1, 39) = 2.09$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 8.67$, $p = .005$, partial $\eta^2 = .182$. There was a significant interaction between time and condition, $F(1, 39) = 5.38$, $p = .026$, partial $\eta^2 = .121$.

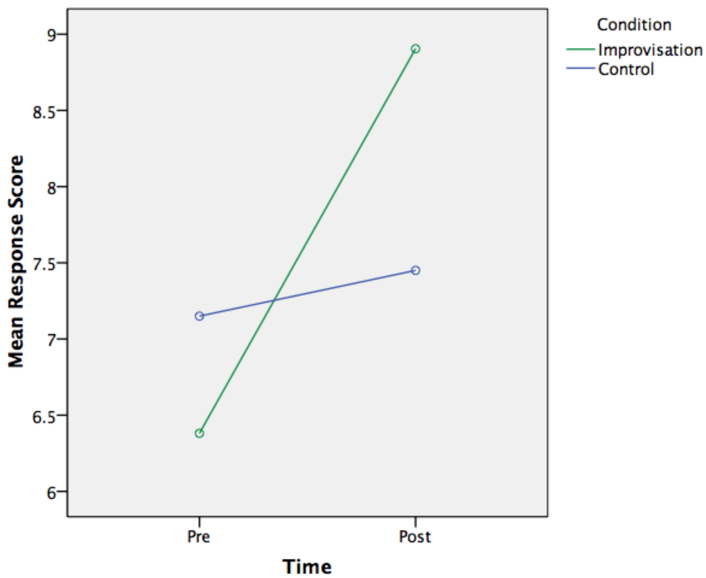

Figure 3.3: Experiment One AUT Response scores pre and post treatment.

The interaction between time and condition can be seen in Figure 3.3. Paired sample t-tests showed there is a significant difference for the improvisation group before and after treatment, $t(20) = -4.55$, $p < .001$, $r = 0.71$ but no significant difference for the control group, $t(19) = .379$, $p > .05$. Independent samples t-tests showed there was no significant difference between the improvisation and control groups pre-scores, $t(39) = -.84$, $p > .05$ and no significant difference between the improvisation and control groups post-scores, $t(39) = 1.67$, $p > .05$.

These results show that the improvisation group's AUT Response scores increased post treatment but the control group's scores remained the same.

AUT - Fluency

For the AUT Fluency scores there was no main effect of condition, $F(1, 39) = 2.38$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 12.60$, $p = .001$, partial $\eta^2 = .244$. There was a significant interaction between time and condition, $F(1, 39) = 4.68$, $p = .037$, partial $\eta^2 = .107$.

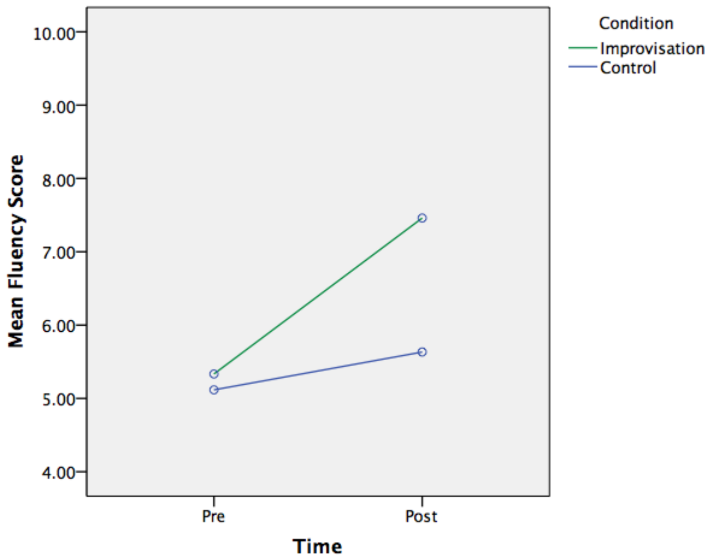

Figure 3.4: Experiment One AUT Fluency scores pre and post condition.

The interaction between time and condition can be seen in Figure 3.4. Paired sample t-tests showed there is a significant difference for the improvisation group before and after treatment, $t(20) = -3.69$, $p = .001$, $r = .64$ but no significant difference for the control group, $t(19) = .379$, $p > .05$. Independent samples t-tests also confirmed this effect, showing there was no significant difference between the improvisation and control groups pre-scores, $t(39) = .28$, $p > .05$ but that there was a significant difference between the improvisation and control groups post-scores, $t(39) = 2.42$, $p = .020$, $r = .36$.

These results show that there the improvisation group's AUT Fluency scores increased post treatment but the control group's scores remained the same.

AUT – Originality

Originality was determined by constructing a list of all responses and scoring anything with two responses or below as original. Each original response was allocated one point.

For the AUT Originality scores there was no main effect of condition, $F(1, 39) = .30$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 24.79$, $p < .001$, partial $\eta^2 = .389$. There was a significant interaction between time and condition, $F(1, 39) = 12.63$, $p = .001$, partial $\eta^2 = .245$.

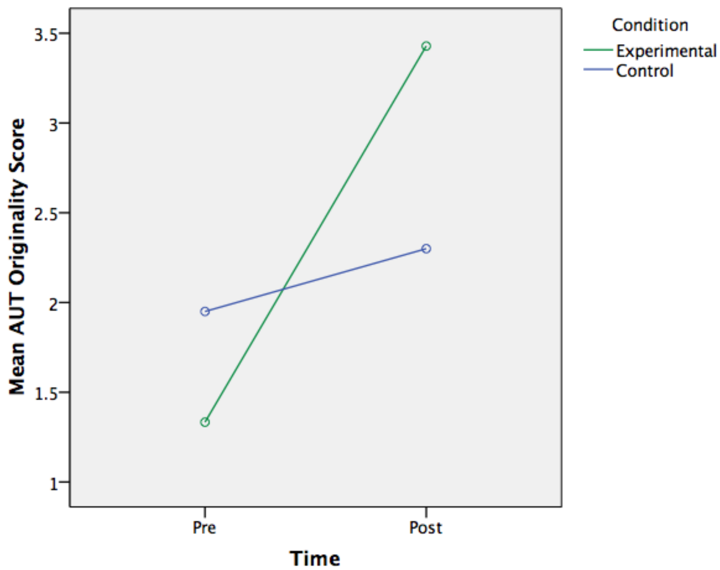

Figure 3.5: Experiment One AUT Originality scores pre and post treatment.

The interaction between time and condition can be seen in Figure 3.5, which shows the improvisation group to increase in AUT originality scores, when compared to the control group. This difference is confirmed by paired samples t-tests, which revealed a significant effect for the improvisation group before and after treatment, $t(20) = 7.18$, $p < .001$, $r = .85$ but no significant effect for the control group, $t(19) = .877$, $p > .05$. Independent samples t-tests showed there was no significant difference between the improvisation and control groups pre-scores, $t(39) = -1.42$, $p > .05$ and no significant difference between the improvisation and control groups post-scores, $t(39) = 1.86$, $p > .05$.

These results show that the improvisation group's AUT Originality scores increased post treatment but the control group's scores remained the same.

AUT – Flexibility

For the AUT Flexibility scores there was no main effect of condition, $F(1, 39) = 2.59$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 27.84$, $p < .001$, partial $\eta^2 = .295$. There was a significant interaction between time and condition, $F(1, 39) = 8.19$, $p = .007$, partial $\eta^2 = .098$.

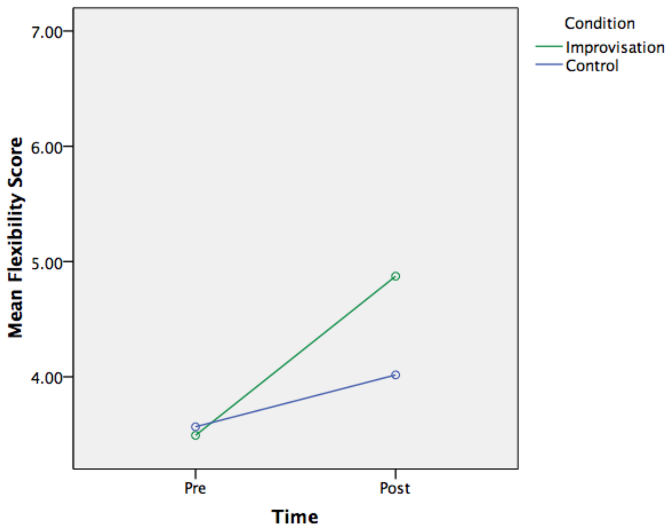

Figure 3.6: Experiment One AUT Flexibility scores pre and post treatment

The interaction between time and condition can be seen in Figure 3.6, which shows the improvisation group to increase in AUT Flexibility scores, when compared to the control group. This difference is confirmed by paired samples t-tests, which revealed a significant effect for the improvisation group before and after treatment, $t(20) = -3.68$, $p = .001$, $r = .64$ but no significant effect for the control group, $t(19) = -1.84$, $p > .05$. Independent samples t-tests also confirmed this effect, showing there was no significant difference between the improvisation and control groups pre-scores, $t(39) = -.07$, $p > .05$ but that there was a significant difference between the improvisation and control groups post-scores, $t(39) = 2.63$, $p = .012$, $r = 0.39$.

These results show that there the improvisation group's AUT Flexibility scores increased post treatment but the control group's scores remained the same.

AUT – Elaboration

For AUT Elaboration scores there was no main effect of condition, $F(1, 39) = .87$, $p > .05$. There was no main effect of time, $F(1, 39) = .36$, $p > .05$. There was no significant interaction between time and condition, $F(1, 39) = .57$, $p > .05$. These results indicate that there were no differences in elaboration scores pre and post treatment, or between condition.

Overall, the AUT results demonstrate that response, fluency, originality and flexibility all increase after improvisation but not after participating in the control group. When looking at the interaction size effect of ANOVAs, partial eta squared values revealed that originality was found to have the biggest effect size (.245), with flexibility (.175), fluency (.145) and response (.121) also having a large strength of association, according to Cohen (1988). This is confirmed with the largest effect size in t-tests also occurring in originality ($r = .85$).

Post hoc using Bonferroni adjusted alpha levels tests revealed Originality to remain significant. Response, Fluency and Flexibility, however no longer had any significant differences, indicating originality had the most prevalent effect.

Abbreviated Torrance Task for Adults (ATTA)

The triangles and circles task taken from the ATTA was scored according to the criteria outlined by Goff and Torrance (2002). These were Fluency, Originality, Elaboration and Flexibility. As with the AUT, the number of responses was also recorded. Finally, a total score of fluency, originality, elaboration and flexibility was also provided to assess if there was an overall effect.

Inter – Judge Reliability

Inter coder reliability was analysed by the means of a correlational analysis for both the triangles and circles versions of the ATTA, which had both been scored by an additional judge. Preliminary analyses were performed on all correlational analyses, to ensure no violations of the assumptions of normality.

Triangles

The relationship between the two judges' ratings for fluency was investigated using Pearson product-moment correlation coefficient. There was an extremely strong, positive correlation between the two judges' ratings, $r = .993$, n=39, $p < .001$. This is a very high correlation, with the majority of valid responses being seen the same with both ratings.

Originality revealed a strong, positive relationship between the two ratings made on the triangles response $r = .738$, n=39, $p < .001$ showing a strong correlation between the two judges ratings of originality.

A Pearson product-moment correlation coefficient on Elaboration scores revealed a very strong, positive correlation between the two ratings $r = .969$, n=39, $p < .001$.

Finally, the correlation between the two scores of flexibility were found to have a strong, positive correlation, r =.9, n=39, p < .001. It can therefore be concluded that all scores for the triangles version of the ATTA between the two judges correlate strongly, with the lowest correlation occurring in originality.

Circles

The circles version of the ATTA were assessed in the same manner as for the ratings of triangles, with one difference. As no norms were available, a list of common items which had to be created for the scoring of originality. The list was compiled by the first judge, based on the current samples responses and used by the second rater.

The relationship between the two judges' ratings for fluency was investigated using Pearson product-moment correlation coefficient. A perfect correlation was found between the two judges ratings of fluency, r =1.00, n=41, p < .001, meaning the two judges agreed on all valid responses. In comparison to the AUT, this highlights the importance of using scoring guidelines, discussed further in Chapter 8.

Originality revealed a strong, positive correlation between the two ratings, r =.792, n=41, p < .001. Elaboration was found to be highly correlated, r =.887, n=41, p < .001 as was flexibility, r =.897, n=41, p < .001.

It can therefore be concluded that all correlations between the two judges ratings were found to be strong and positive, with similar inter-rater reliability reported on both versions of the tasks.

ATTA Mixed ANOVA Analyses

Due to the high levels of inter rater reliability, the original ratings by the first judge of the ATTA were chosen, as these were deemed reliable enough for analyses.
The mean scores and standard deviations for Response, Fluency, Originality Elaboration and Flexibility are presented in table 3.2.

Table 3.2 – Experiment One Mean (SD) ATTA scores before and after treatment

		Response	Fluency	Originality	Elaboration	Flexibility	Total
Improvisation (N=21)	**Before**	4.19 (2.44)	3.43 (2.46)	2.71 (2.55)	5.19 (4.21)	2.24 (1.34)	13.57 (7.75)
	After	5.62 (3.04)	5.10 (3.39)	4.00 (2.78)	6.29 (3.91)	2.95 (1.83)	18.33 (8.34)
Control (N=20)	**Before**	5.05 (2.04)	4.40 (5.10)	2.50 (2.09)	6.50 (4.40)	2.55 (1.10)	15.95 (6.97)
	After	5.40 (1.73)	5.10 (1.59)	2.35 (2.11)	6.90 (3.81)	2.90 (1.02)	17.25 (5.66)

Mixed ANOVAs were carried out with two factors, factor 1; condition and factor 2; time.

ATTA – Response

For the ATTA Response scores there was no main effect of condition, $F(1, 39) = .21$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 15.47$, $p < .001$, partial $\eta^2 = .284$. There was a significant interaction between time and condition, $F(1, 39) = 5.96$, $p = .022$, partial $\eta^2 = .127$.

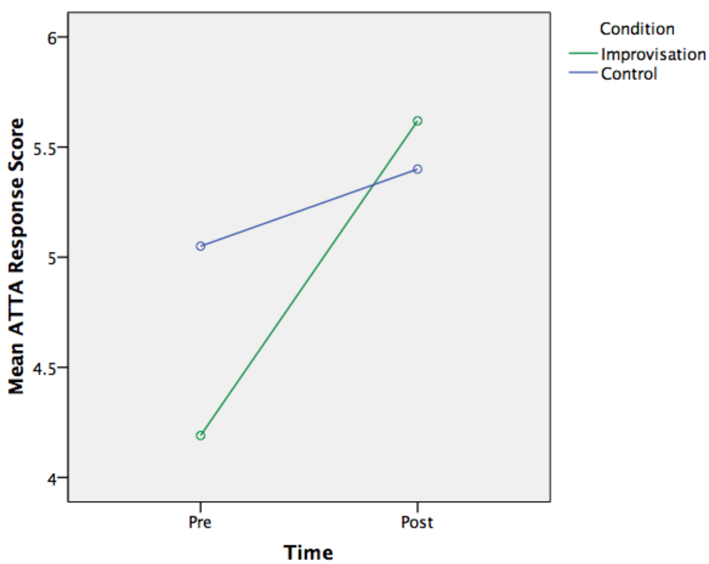

Figure 3.7: Experiment One ATTA response scores pre and post treatment

The interaction between time and condition can be seen in Figure 3.7, which shows there is no difference in ATTA Response scores control condition but that there is an increase in response scores for the improvisation condition. This difference is confirmed by paired samples t-tests which revealed a significant difference for the improvisation group before and after treatment, $t(20) = -4.80$, $p < .001$, $r = .73$, but no significant effect in the control condition, $t(19) = -1.022$, $p > .05$. However, it is worth noting that figure 3.7 shows the number of responses post treatment to be similar between groups. The graph therefore suggests that participants started off with a different baseline score. Independent samples t-tests showed there was no significant difference between the improvisation and control groups pre-scores, $t(39)=-1.22$, $p > .05$ and no significant difference between the improvisation and control groups post-scores, $t(39) = .282$, $p > .05$.

These results show that the improvisation group's ATTA Response scores increased post treatment but the control group's scores remained the same.

ATTA – Fluency

For the ATTA Fluency scores there was no main effect of condition, $F(1, 39) = .45$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 20.94$, $p < .001$, partial $\eta^2 = .388$. There was no significant interaction between time and condition, $F(1, 39) = 3.49$, $p > .05$. However, it is worth noting that the significance level here was .069.

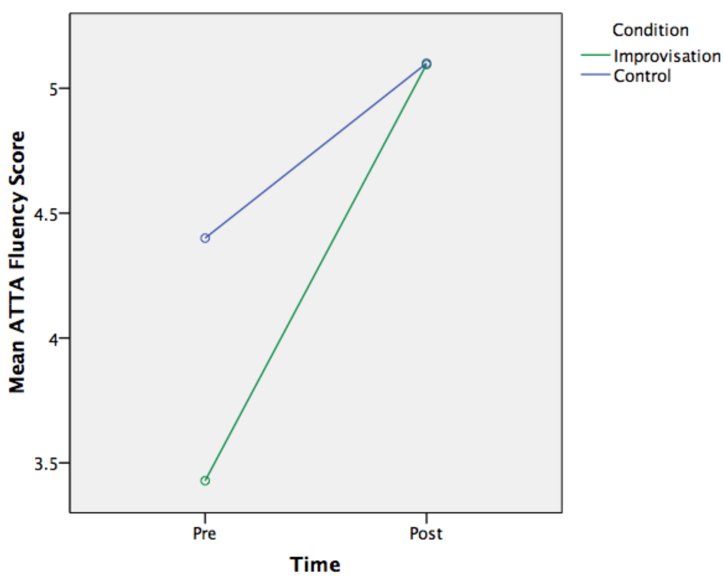

Figure 3.8: Experiment One ATTA Fluency scores pre and post treatment

As figure 3.8 shows, post fluency scores are exactly the same, suggesting that the baseline scores differ before any treatment was implemented. An independent samples t-test showed no significant baseline differences, $t(39) = -1.39$, $p > .05$. However, paired sample t-tests revealed a significant difference before and after improvisation, $t(20)=-4.62$, $p < .001$, $r = .72$ but not in the control condition $t(19)=-1.82$, $p = .074$.

ATTA – Originality

For the ATTA Originality scores there was no main effect of condition, $F(1, 39) = 2.04$, $p > .05$. There was no significant main effect of time, $F(1, 39) = 2.31$, $p > .05$. There was no significant interaction between time and condition, $F(1, 39) = 3.70$, $p > .05$. However, it is worth noting that the significance level here was .062.

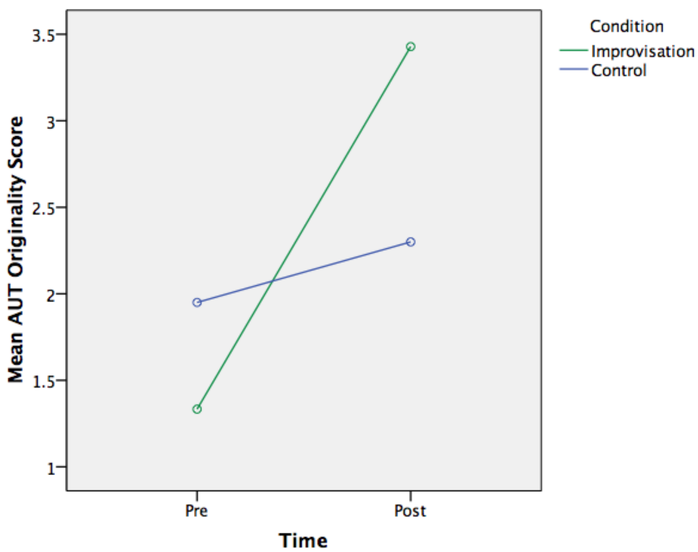

Figure 3.9: Experiment One ATTA Originality scores pre and post Treatment

The relationship between time and condition is shown in figure 3.9. Independent samples t-test confirmed that there was no significant difference between the two conditions pre treatment, $t(39)=.359$, $p > .05$. However, a significant difference was found post treatment, $t(39)=2.17$, $p = .037$, r =.33, suggesting small differences in ATTA Originality scores that are not large enough to be significant. Paired sample t-tests, however revealed no significant differences before and after improvisation, $t(20)=-1.97$, $p > .05$, and in the control condition $t(19)=.34$, $p > .05$.

Furthermore, a one-way ANCOVA on ATTA Originality scores showed that when pre-intervention scores were covaried out, the main effect on post-intervention scores was significant, F (1, 38) = 4.89, p = .033, partial η^2 = .114. The adjusted means indicate that post scores are significantly higher post improvisation (M = 4.05) in comparison to the post-intervention scores of the control condition (M = 2.35).

ATTA – Elaboration

For AUT Elaboration scores there was no main effect of condition, $F(1, 39) = .74$, p > .05. There was no main effect of time, $F(1, 39) = 1.45$, p > .05. There was no significant interaction between time and condition, $F(1, 39) = .31$, p > .05. These results indicate that there were no differences in elaboration scores pre and post treatment, or between condition.

ATTA – Flexibility

For AUT Flexibility scores there was no main effect of condition, $F(1, 39) = .11$, p > .05. There was a significant main effect of time, $F(1, 39) = 11.65$, p = .002. There was no significant interaction between time and condition, $F(1, 39) = 1.37$, p > .05. This indicates an increase in scores post treatment for both conditions.

ATTA – Total scores

For the ATTA Total score there was no main effect of condition, $F(1, 39) = 1.00$, p > .05. There was a significant main effect of time, $F(1, 39) = 10.10$, p = .003, partial η^2 = .240. There was no significant interaction between time and condition, $F(1, 39) = 3.29$, p > .05. These results suggest that both the improvisation and control condition increased in ATTA total scores post treatment.

Overall, the ATTA results indicate some differences between the improvisation and control conditions. However, Response was the only factor that produced a significant difference between treatment conditions.

Controlled Oral Word Association (COWA) test

The COWA was scored according to Response and Fluency. The mean scores and standard deviations for these scores are displayed in table 3.3.

Table 3.3 – Experiment One Mean (SD) COWA scores before and after treatment

		Response	Fluency
Improvisation (N=21)	**Before**	12.52 (3.72)	11.33 (3.18)
	After	13.71 (4.19)	12.43 (3.83)
Control (N=20)	**Before**	10.20 (3.29)	9.85 (3.25)
	After	11.40 (3.41)	10.75 (3.19)

Mixed ANOVAs were carried out, with the two factors of condition (factor 1) and time (factor 2) to determine if there were any changes in scores pre and post treatment, as well if there were any differences between the two treatment conditions.

COWA Response

For the COWA Response scores there was a significant effect of condition, $F(1, 39) = 4.82$, $p = .034$, partial $\eta^2 = .110$. There was a significant main effect of time, $F(1, 39) = 7.08$, $p = .011$, partial $\eta^2 = .154$. There was no significant interaction between time and condition, $F(1, 39) = .00$, $p > .05$. An independent samples t-test revealed that the difference between conditions lied in a siginificant difference in baseline scores, $t(39) = 2.12$, $p = .041$, $r = .32$. A independent samples t-test showed that post scores were not significant, $t(39) = 1.94$, $p > .05$. However, it is worth noting that a significance level of .06 was reached.

COWA – Fluency

For the COWA Fluency scores there was no significant effect of condition, $F(1, 39) = 2.81$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 4.42$, $p = .042$, partial $\eta^2 = .102$. There was no significant interaction between time and condition, $F(1, 39) = .04$, $p > .05$.

Overall, the COWA displayed little difference between conditions, suggesting that any difference may be a result of verbal activities, as opposed to improvisation. It is concluded that improvisation has no significant impact on verbal frequency.

Profile of Mood States (POMS)

POMS data was analysed by looking at the difference in scores before and after the treatment condition. One extreme outlier was found and therefore excluded from all POMS analyses.

Table 3.4 displays the means and standard deviations for participant's mood scores before and after the treatment condition.

Table 3.4 – Mean (SD) scores for POMS scores before and after treatment

		T	D	A	V	F	C	TMD
Improvisation (N=21)	**Before**	6.00 (4.57)	3.52 (4.42)	2.52 (3.06)	13.29 (6.69)	3.90 (2.81)	6.43 (2.87)	36.38 (16.42)
	After	2.15 (2.37)	.81 (1.50)	1.24 (2.19)	18.71 (6.23)	2.14 (3.12)	4.29 (2.78)	19.43 (10.91)
Control (N=18)	**Before**	4.83 (3.54)	3.00 (5.38)	3.94 (5.19)	14.15 (4.64)	5.44 (3.93)	6.39 (3.27)	35.28 (18.07)
	After	2.50 (2.31)	.72 (1.74)	1.44 (2.38)	17.98 (5.86)	2.06 (1.98)	4.56 (1.89)	20.61 (10.80)

POMS means were assessed in comparison to college student norms (McNair and Heuchert, 2003). These were slightly lower than the norms specified. However, this is in line with findings by Pillard, Atkinson and Fisher (1967) who found that POMS right now scores tend to be lower for college students. (POMS norms can be found in McNair and Heuchert, 2003).

Table 3.4 shows the mean scores for all POMS measures to be similar for both conditions, suggesting that both groups show a significant difference in their mood scores, after participating in either condition, in the sense that mood appears to get better after a series of verbal tasks.

A 2x2 mixed design ANOVA was carried out on each of the six aspects that the POMS measures as well as the overall TMD score. TMD scores were re-coded into positive items, in order to carry out before and after analyses. Each ANOVA consisted of two factors, factor 1 was the effect of condition and factor 2 was the effect of time.

Table 3.5 – Mixed ANOVA results for POMS

		df	df error	***F***	***P* value**
Tension	**Condition**	1	36	.199	.658
	Time	1	36	27.95	**.000****
	Interaction	1	36	1.68	.203
Depression	**Condition**	1	37	.101	.753
	Time	1	37	14.23	**.001***
	Interaction	1	37	1.09	.743
Anger	**Condition**	1	37	.787	.381
	Time	1	37	11.01	**.002***
	Interaction	1	37	1.13	.294
Vigor	**Condition**	1	39	.042	.838
	Time	1	39	19.54	**.000****
	Interaction	1	39	1.54	.222
Fatigue	**Condition**	1	37	.800	.377
	Time	1	37	22.76	**.000****
	Interaction	1	37	2.271	.140
Confusion	**Condition**	1	37	.021	.885
	Time	1	37	25.19	**.000****
	Interaction	1	37	.153	.698
TMD	**Condition**	1	37	.000	.992
	Time	1	37	45.84	**.000****
	Interaction	1	37	.240	.627

* = Significant at the $p < .05$ level, ** = Significant at the $p < .001$ level

As shown in table 3.5, the same pattern of results followed for each factor of the POMS scale. In all cases, there was no significant main effect of condition ($F < 1$ in all cases). There was a significant main effect of time ($p < .01$ in all cases) and there was no significant interaction between condition and time (*p* > .05 in all cases). These results therefore show that there were no differences in scores between the two treatment groups, suggesting that all participants mood increased, irrespective of what condition they were in.

Finally, previous research (Adaman & Blaney, 1995; Grawitch, et al., 2003) has suggested that mood could be linked to higher scores in creativity. To test this theory, baseline mood and AUT fluency scores were analysed by the means of Pearson product-moment correlation. The correlation between AUT fluency scores and the POMS TMD score were weak, r =-.20, n=41, $p > .05$, suggesting creativity is not related to participants current mood state. A weak, positive correlation was found for POMS Tension, r = .07, n=41, $p > .05$. Weak, negative correlations were found for all remaining individual measures of the POMS; Depression, r =-.09, n=41, $p > .05$; Anger, r =-.22, n=41, $p > .05$; Vigor, r =-.16, n=41, $p > .05$; Fatigue, r =-.04, n=41, $p > .05$ and Confusion, r =-.08, n=41, $p > .05$.

3.4 DISCUSSION

The present study found that verbal creativity scores based on Response, Fluency, Originality and Flexibility as measured by the AUT increase after verbal improvisation as compared with control conditions. Scores on a figural creativity test, as measured by the ATTA increase in Response and Originality after verbal improvisation as compared with control conditions. However, no differences emerged in a test of verbal cognition, as measured by COWA.

Inter-judge reliability was found to have a strong, positive correlation in all cases. Mood, as measured by POMS, was found to change significantly in a positive direction in both conditions. Furthermore, baseline scores of cognition were not found to correlate strongly to mood. The observed differences cannot therefore be attributed to differences in mood between groups.

One explanation for why improvisation improves scores in creativity tasks could be due to breaking away from set patterns of thinking. The increase in scores of fluency suggests that people are faster at finding alternative solutions after improvising, therefore suggesting that schemas are being accessed and used at a faster rate. This is likely to be related to the cognitive process involved when having to generate new items. In relation to the AUT and 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. The fluency score would therefore be the number of times that people go through this process to generate more answers. Those with a higher fluency score go through this process more, in a given period of time, while those who do not score highly on fluency get stuck when trying to produce a new schema for the next answer. This can also be applied to the ATTA in producing new ideas for their pictures.

However, people may not always be able to accurately suppress previous schemas when trying to generate new items. This is what the scoring of flexibility appears to demonstrate. Flexibility scores refer to the number of different semantic categories that are used across the tests. In relation to the schema theory, these categories could refer to the number of different schemas that are produced. It may be that some people are not always able to suppress schemas of previous answers. They may use previous schemas to create a new use or picture, for example, for a brick in the AUT, '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 answer straight away, as in the above example, resulting in proactive interference, such that the previous answer influences the next answer. As well as this, previous schemas may also be re-used when people run out of ideas. In this way, people may go through the schemas 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.

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.

Post hoc comparisons using Bonferroni adjusted alpha levels tests revealed originality to be the strongest predictor for the AUT, suggesting that an increase in originality is the most prevalent effect. This suggests that it is originality that differs after taking part in a series of improvisation games, influencing the other variables tested. In relation to the schema theory, these results suggest that being flexible across schemas is less important than coming up with new ideas. With only originality remaining significant, it suggests that people do not increase their flexibility, meaning that instead of a wider range of schemas being used, the same schemas are being used but in a more unusual manner. Although these post hoc comparisons suggest discrepancies in the current results, this may be due to a lack of power as the Bonferroni test was applied to a small sample.

The scoring of the AUT originality component itself also needs to be investigated further. With the current sample, a normative approach was used (Torrance, 1966), where items that were considered original (top 5%) were simply allocated one point. The total was then divided by the number of responses made. It has been suggested (Silvia et al., 2008) that this is not the most effective method of scoring. Originality scores are dependent on the size of the data set that the originality scores are based on. Therefore, as the dataset gets larger, the less chance there is of scoring an item as original. Due to this, it may be that the scoring of the AUT needs to allow for different levels of originality. A new scoring system should therefore be developed in future in order to assess originality in more detail. This has been done by scoring originality in respect of the top 5% and 1% (Guilford, 1957b) or, the top 5, 10 and 15% of answers (Chamorro-Premuzic, 2006). Furthermore, with a larger sample size, a larger database on which originality scores are based can be created. Each time the AUT is completed, this is added to a database of answers. This can work in two ways. With more responses, this increases the likelihood that original answers are considered as unique, as answers are consistently being compared against a larger sample. However, the larger the sample, the less likely an original answer can be found in the top 5% of answers. Furthermore, the originality of the people in the dataset will also have an impact on how likely an answer is going to be classed as original.

The scoring of the ATTA also raises some questions. As well as the criteria used to score the ATTA in the current experiment, Goff and Torrance give another method of scoring in their manual designed to give a further idea of levels of creativity. This scoring is based on ten further aspects such as the abstractness of titles, contextual scoring, richness of imagery. The current study did not score the ATTA on these further ten items as the original scoring was seen as the most common measure of creativity. Creativity indicators, as they are referred to by Goff and Torrance, could however be employed in future experiments using the ATTA. Furthermore, the current study only looked at one of three tests used in the ATTA. The current results of the ATTA may suffer from reduced validity due to only one of three tests being carried out as well as only one method of scoring. In future experiments, it may be beneficial to utilize the entire battery of tests, obtain creativity indicators and compare creativity scores to the current scores found for the one test used in the current study.

Originality scoring of the ATTA was also problematic. Common responses are indicated for the ATTA Triangles but norms were not available for the circles version of the test. An originality score for the Circles version of the ATTA was therefore obtained by conducting the same method as the AUT, such that a list containing the frequency of responses was calculated. Any score that had a frequency of two or below was scored as original. This resulted in a self-constructed form of common responses. For example, a common response drawn was a face, while an original response could be combining more than one circle and drawing an ant. It would be useful to employ this method of scoring for the triangles version and compare the common responses to the normative common response list. Some common items, such as a Jack-o-lantern, were never mentioned by the present sample and the manual does not indicate the sample size that this list of common responses is based on. In addition to this, although agreement of scores between raters was high for both the circles and triangles version of the ATTA, it is worth noting that the reliability was lowest for originality in both versions (.74 for triangles and .79 for circles). Although this is still an acceptable correlation, it provides further reasoning to look at this originality scoring, in the hope of bringing these correlations up to the other ATTA items (all .9 and above).

No significant results were found in the COWA, suggesting that improvisation does not relate to the type of cognitive processes that the COWA uses. The COWA is a test of verbal fluency and can be used to give a measure of fluid intelligence, as opposed to assessing divergent thinking in general. This may be why no improvement in cognition was observed following an intervention of improvisation tasks, as the need to produce novel and different ideas is not necessary. This task involves accessing as many words as possible as opposed to having to access a range of different schemas. Therefore, this task concentrates on fluidity as opposed to different styles of thinking. While it is possible that this may simply be due to no differences between conditions occurring, it is important to note that a shortened version of the test was used. This involved giving participants one letter instead of three, resulting in a test that is one third of the length it should be. Therefore, in future studies that employ the COWA, the full length version should be used. Furthermore, the COWA in the present study was always the last test to be administered. As it is unknown how long the effect lasts for, it may be that cognitive processes have returned to baseline levels and the effect only exists on a very short-term basis.

The way that instructions in tasks of divergent thinking are worded also needs to be taken into consideration. Harrington (1975) carried out a study using the AUT that suggested the wording of instructions could influence the results of the AUT. This was replicated by Katz and Poag (1979) who found that only males could be influenced by the instructions administered for the AUT. Males who were specifically told to "be creative" came up with more responses than if the instructions did not include these words. It should therefore be ensured that instructions are well controlled in order that participants do not get told different things which could influence their creativity levels. The current experiment did not specifically tell people to be creative in the AUT, but more control needs to be taken to ensure that this is not said accidently. The ATTA, however, did tell people to be as unusual as possible, as told to do so in the manual (Goff and Torrance, 2002).

Furthermore, when scoring creativity tests, there is nothing to take into the account the level of creativity that they themselves possess. The raters themselves will differ in terms of creativity, as shown by Howard-Jones et al. (2005). This may in turn influence whether they think a use is a valid alternative use. Therefore, raters of high creativity should be used to assess the fluency of AUT items in future studies.

In relation to POMS scores, One way ANOVAs were conducted and found to be significantly lower than the norms stated by McNair, Lorr and Droppleman (1971) who found POMS right now norms to be no different than other versions of the mood questionnaire. However, there are mixed findings regarding the norms of the right now condition, of which this experiment utilised. Pillard, Atkinson and Fisher (1967) found scores to be lower on all aspects of POMS when using the right now condition, coinciding with the current findings. Although more recent studies have not replicated Pillard et al's (1967) findings (Terry & Lane, 2000), due to the similarity in results between the current study and Pillard et al's findings, as well as the fact that the manual mentions norms may be lower, this sample is considered as being reliable for the 'right now' condition.

There are a number of questions that arise from the current experiment of which all need to be investigated further. Firstly, it is important to develop the idea that improvisation can lead to cognitive change by using more cognitive tests which are both more sophisticated and measure different aspects of cognition (e.g. memory in relation to improvisation, Weick, 1998; Scott et al., 2001). One particular difference to compare would be the benefits of improvisation in relation to divergent and convergent thinking tasks (see Chapter 1.6 about convergent/divergent thinking). The current experiment in improvisation has shown changes in scores of divergent thinking tasks. 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 but not convergent thinking.

Furthermore, it would also be useful to investigate the domain of the cognitive or creative tasks. The AUT, a verbally based divergent thinking task elicited different results to the ATTA which was a figural based test. It may be that improvisation may help divergent thinking in some domains but not in others. The fact that some significant results were found with the ATTA, a figural based task, in the current experiment suggests that effects can be transferred across different domains of cognition. Building on this, the domain of improvisation may therefore influence the results regarding the type of thinking that improvisation helps. It would therefore be useful to carry out studies using different domains of improvisation, such as dance improvisation, and to extend the findings in music improvisation. In relation to Lewis (2008), the results that fluency increased in the AUT are replicated in the current study. This also suggests that this effect occurs across domains and that the effects are not simply due to priming.

Another area to explore further would be the duration of improvisation as well as whether there are any long-term benefits with expert improvisers. While the current study carried out improvisation tasks for a period of twenty minutes, 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. It is possible that those used to improvising elicit greater scores from the outset, resulting in a smaller difference pre and post treatment, due to lasting benefits of improvisation. Therefore, the order of which the cognitive tests are presented should be varied in future to determine whether results are influenced by how long the effect lasts for and how strong the effect is at different time points.

Finally, it would be useful to determine if there are any differences in regards to demographic data, individual differences and previous experience of the domain of improvisation pre and post improvisation. It has been suggested that sex and handedness are linked to creativity (Baer & Kaufman, 2008; Coren, 1995; Kogan, 1974; Matud, Rodriguez, & Grande, 2007) where left-handed males performed better in divergent thinking tasks (Coren, 1995). No difference however, was found in tasks assessing convergent thinking. Shobe, Ross and Fleck (2009) however, found that on tasks of divergent thinking, such as the AUT, people who showed signs of being ambidextrous exhibited higher levels of creativity. Katz and Poag (1979) showed that males scores on the AUT also differed when they were specifically told to be creative such that they produced more responses. However, more recent research has not supported these initial links. While Matud et al., (2007) found that women had significantly higher scores in the figural TTCT and in verbal fluency they concluded that these sex differences in creativity were a function of education level. Baer and Kaufman (2008) carried out a review looking at sex differences in creativity literature. They concluded that the majority of research showed no sex differences. Furthermore, those studies that did show differences between males and females creativity scores had very small effect sizes. Hong and Milgram (2010) suggest that, although it would be useful to look at handedness and sex within studies, the differences are small and should therefore not be looked at as a main hypothesis for a study.

In conclusion, this study provides interesting results to support the idea that improvisation affects cognitive processes. 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 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. This program of research therefore needs to address the use of different cognitive tests, firstly, in terms of divergent and convergent thinking, and secondly, in relation to the type of task that is being assessed. For example, it may be that mathematical abilities shows different effects to those of a verbal divergent thinking task, such as the AUT. Furthermore, results in relation to the duration of improvisation, as well as how long the cognitive benefits last should also be looked at in future.

Chapter 4: The Development of a Battery of Cognitive Tests

Experiment One demonstrated that improvisation can have an impact on our cognitive processes. In order to extend these findings, a variety of cognitive tasks were needed to ascertain whether the beneficial effects of improvisation on cognition could be extended across domains. Verbal, visuo-spatial and numerical tasks were chosen to cover a wide spectrum of cognitive functioning. To further explore different types of cognition, a convergent and divergent version of each task were chosen.

4.1 INTRODUCTION

Experiment One found that after twenty minutes of verbal improvisation, scores on the AUT increased in terms of Fluency, Originality and Flexibility. Furthermore, scores on the ATTA were also found to increase post improvisation when compared to a control equivalent, showing that improvements in both a verbal and visuo-spatial task were observed. Following from Pilot Study Three, conducted by Lewis (2008) the idea that cognitive tasks could extend across to different domains of improvisation was also raised. Therefore, one key idea in the present research is to look at the type of cognitive task that is being used in relation to various domains of improvisation.

A battery of cognitive tasks was therefore developed in order to be able to accurately test different cognitive abilities across a range of improvisation domains.

Divergent thinking, as discussed in Chapter 1.6 is thought to be closely linked to creativity and potentially with cognitive abilities. Therefore, if improvisation is linked to creativity, the influence that it has on problem solving may differ according to whether the task involves divergent or convergent thinking processes. Experiment One showed that improvisation could influence divergent thinking processes. However, the effects of improvisation have not yet been investigated in convergent thinking. Improvisation could have an impact on convergent thinking in two ways. Firstly, the act of improvisation may improve the flow of cognitive thinking and the use of Working Memory, meaning that people become faster in these tasks. Secondly, it has been suggested that creative thinking can lead to improvements in tasks of convergent thinking, such that it enables people to be able to approach problem solving tasks from a different perspective in order to find the solution (Cristante, 1982; Cropley, 2006; Guilford, 1967; Langer, 1989). In this sense, people who improvise have more schemas available and they can switch between them. However, it may be that improvisation has no impact on tasks of convergent thinking such that improvisation increases levels of originality and helps in tasks that involve more than one answer but is not useful for tasks that require one answer. People may be less likely to improve on tasks that involve one solution, particularly if they can find the answer with the first style of thinking that they adopt. This battery of cognitive tasks was therefore divided according to convergent and divergent thinking tests.

A battery of tests was therefore designed to establish whether any cross-modal effects within cognition occur post improvisation. The battery of tests were developed to assess divergent and convergent thinking abilities. This consisted of six individual tests, three of which were convergent tasks and three divergent tasks. Three areas of cognition were looked at within this. Therefore, each cognitive task had a divergent and a convergent thinking test. The three different areas of cognition used in this battery of tests were chosen according to previous relationships that have been identified between the area of cognition and either verbal, dance or music performance. These tests were therefore designed to be used in pre and post tests looking at improvisation, irrespective of what the domain of improvisation was.

4.2 MUSIC AND COGNITION

4.2.1 Music and spatial ability

There is some evidence for an improved level of spatial ability in musicians (Allman, 1889; Hassler, Birbaumer, & Feil, 1985; Hetland, 2000). Rauscher, Shaw, Levine, Wright, Dennis and Newcomb (1997) found higher scores on a visuo-spatial reasoning task in pre-school children after training in music. Children were asked to complete an Object Assembly task (taken from Wechsler, 2001) which involved arranging puzzle pieces to form meaningful shapes. Rauscher et al. (1997) found that not only did musicians get higher scores on this task but as their scores increased, they correlated with the level of musical expertise. Aleman, Nieuwenstein, Bocker and de Haan (2000) found adult musicians had higher scores in a task of mental imagery. Furthermore, Brochard, Dufour and Despres (2004) discovered that adult musicians had faster reaction times when compared to non-musicians in a visuo-spatial task assessing mental imagery. Brochard et al. (2004) conclude that these effects are likely to be due to the constant use of reading music because of the spatial abilities musicians use to detect different patterns. It has already been shown that expert musicians read music in a different way to novice musicians, as shown by eye movement patterns (Rayner & Pollatsek, 1997; Waters, Underwood, & Findlay, 1997).

The idea that music is linked to spatial abilities has been suggested due to the notation skills that the majority of musicians possess (Hetland, 2000). Aleman et al. (2000) suggest that visual imagery is also heavily involved in the use of composing music as well as trying to remember music from memory. Although the most common theory as to why an enhanced score on spatial ability tasks is associated to musicians reading music, other theories suggest that the link between notation and determining the rhythm associated involves spatial processing. Parsons and Fox (1997) suggest that this task is related to mental rotation and because of this, there may be a neurological connection.

This may be because musicians become so fast at reading music that they become faster at other tasks, such as those that require mental imagery. The findings of Brochard et al. (2004) support those of Hassler (1992) who as well as finding a significant difference in musicians, such that musicians scored higher in a visuo-spatial tasks, conducted a longitudinal study and found that the effects observed increased over time, suggesting the more experience a musician has of playing, the higher their visuo-spatial test score.

Also of interest is the idea that spatial ability task performance can be improved by simply listening to music. Schellenberg, Nakata, Hunter and Tamoto (2007) claim that listening to familiar music enhances spatial ability. However, it would be interesting to determine whether it is an effect of music or simply whether familiar music is able to enhance levels of concentration. We would therefore expect to see better performance across a number of tasks requiring a certain amount of concentration.

In a meta analysis conducted by Hetland (2000), it was concluded that playing music for at least two years did enhance scores of spatial ability including a mental imagery task, but that this did not depend on an ability to be able to read music.

It may be that the effect depends on the type of spatial ability task that is being tested. Yilmaz (2009) divided tests of spatial ability into four main sub-categories, the reason for this being that there are many different definitions and tests of spatial ability, all of which do not measure the same aspect. Each of these tests looks at cognition from a different perspective. The four subcategories were spatial visualization (e.g. does this flat shape fold into this picture of a cube?), spatial orientation (e.g. do these two lines match up with each other?), spatial relations (e.g. mental rotation) and spatiotemporal abilities (e.g computer-based task – when is a falling ball behind a screen?).

However, spatial ability is not the only cognitive skill that has been linked to music. Nering (2002) tested ten sets of twins, where one underwent musical training but the other did not. Those who did the musical training obtained significantly higher scores in not only spatial tasks but also verbal, IQ and numeracy tasks. Furthermore, Vaughn (2000) suggested that reasoning may also be linked to both music and higher spatial ability scores.

4.2.2 Music in relation to Mathematical and Verbal ability

The idea that music can enhance numeracy skills (Bilhartz, Bruhn, & Olson, 2000) links not only to the rhythm involved in music but even to the method of tuning instruments, which is based on the use of maths ratios. The majority of research that focuses on the link between music and numeracy skills concentrates on children. Geoghegan and Mitchelmore (1996) found children who played an instrument got better maths results in comparison to the rest of their year group. This was replicated in older students of approximately 16 years of age (Catterall, Chapleau, & Iwanaga, 1999; Haley, 2001). In addition to this, Southgate and Roscigno (2009) found that the amount of musical training and achievement that children and adolescents received correlated with their scores on convergent maths tasks. Vaughn (2000) concluded via a meta analysis that a positive correlation was present between musicians and mathematical ability. Those who studied music performed higher in mathematical tests. This was linked to the use of rhythm in music including patterns and the use of ratios in tempos. However, this was not carried out in relation to how good the musicians were perceived to be or whether experienced musicians are better at mathematics in comparison to novice musicians.

As previously mentioned, a higher score in verbal memory tasks has also been observed in musicians (Nering, 2002). Higher levels of verbal memory in young musicians in comparison to non-musicians, have been reported by Brandler and Rammsayer (2003). This has been replicated in adults by Ho, Cheung and Chan (2003) where adults who can play an instrument, on average, remember 17% more verbal information than those who cannot play an instrument. Butzlaff (2000), in a meta-analysis of 24 studies concluded that musicians have a greater reading ability in comparison to non-musicians. This has since been extended where Long (2007) found that short musical exercises, which consisted of chanting and clapping to music helped children who were struggling with their reading skills.

Across this range of literature, some studies have focused on both numeracy and verbal improvements in musicians compared to non-musicians. Johnson and Memmott (2006) found, in a sample of 4739 people, that musicians in primary and middle school achieved higher scores in tests of both maths and English. These results were replicated by Fitzpatrick (2006).

Schellenberg (2001) conducted a review on the different ways that music can influence cognitive abilities and concluded that there were long-term influences for verbal, mathematical and visuo-spatial abilities in children who had music lessons.

The idea that cross-modal effects may occur following music improvisation is therefore feasible. We learn well if we are not consciously aware of doing so (Blakemore & Frith, 2000). If cross-modal effects can be observed in relation to musicians and non-musicians, it may be that cross modal benefits can also be observed following music improvisation.

4.3 DANCE AND COGNITION

4.3.1 Dance and Spatial Ability

The link between dance and spatial ability has been suggested in numerous writings on dance, particularly those concerning possible links between dance and cognition (Armelagos & Sirridge, 1978; Hanna, 1983; Klein, 1997) but little experimental evidence exists. However, a link between dance and scores on spatial ability tests has been found in a small meta-analysis of only four studies (Keinanen, Hetland, & Winner, 2000). These included Kim (1998) who found that children who took part in a creative dance class scored higher on the Raven's standard progressive matrices. These results were also observed by (von Rossberg-Gempton, Dickinson, & Poole, 1999) using the Weschler Intelligence Scale for Children Revised (WISC - R) although, according to Keinanen et al. (2000), it has not always been possible to replicate this. It should therefore be noted that none of the studies that were included in the meta-analysis dealt with the same sample as the current experiments.

4.4 DEVELOPING A BATTERY OF DIVERGENT AND CONVERGENT THINKING TESTS

The three different areas of interest for the cognitive tests were chosen as verbal, spatial and mathematical tasks. Each of the tasks were to have two test versions consisting of one divergent and one convergent thinking task. These areas were chosen because relationships had been observed in all three areas for musicians, as well as the idea that enhanced spatial abilities are related to dance due to the spatial awareness often needed in all dance forms, including choreography and dance improvisation. Verbal cognitive tasks were chosen to extend the findings of Experiment One.

4.4.1 Criteria of the Battery of Tests

A range of cognitive tests were examined for each area relating to convergent and divergent thinking styles. Various criteria for the tests were also present. As the battery of tests was being designed to test the difference in cognitive scores before and after improvisation or a controlled equivalent, two versions of each test were required, or alternatively, a test that could be divided into two equal versions for use before and after treatment.

Tests of convergent thinking also needed to include a measure of reaction time. This is because people may become quicker at doing the tasks without improving their overall accuracy score. Computerized versions of tests were therefore needed in order to be able to measure reaction time. Finally, the idea of using a similar method of scoring tasks was taken into account separately for divergent and convergent thinking tasks in order to make accurate comparisons across the battery of tests.

4.5 THE FINAL BATTERY OF COGNITIVE TESTS

As previously mentioned, tests looking at both convergent and divergent thinking were required for each of the three areas being assessed: verbal, spatial and numerical cognition. These areas were chosen in regards of the relationships that had previously been identified with verbal dramatics, music and dance. The final battery of tests is displayed in table 4.1.

The final battery of tests that was developed consisted of two verbal tasks; the Alternative Uses Task (AUT) and the Lexical Decision Task (LDT), two spatial tasks; the Matchstick task and the Mental Rotations Task (MRT), and two numerical tasks; Alternate Additions and the numerical General Aptitude Test Battery (GATB; converted into new metric quantities). The AUT, Matchstick task and Alternate Additions all measure divergent thinking while the LDT, MRT and GATB measure convergent thinking abilities. These tests were chosen due to meeting the various criteria mentioned above.

Table 4.1 - Final Battery of Cognitive Tests

	Divergent Thinking	Convergent Thinking
Verbal	Alternative Uses Task (AUT)	Lexical Decision Task (LDT)
Visuo-spatial	Alternate Additions	Mental Rotations Task (MRT)
Numerical	Matchsticks Task	Convergent Maths Tasks (CMT; based on GATB)

4.5.2 Verbal tests

The majority of verbal style divergent thinking tests were found were by Guilford (1950). As an influential researcher in the area of divergent thinking, many established tests are based on Guilford's original tests of divergent thinking. It was decided that the Alternative Uses Task (AUT) would be used as the verbal divergent thinking test in order to be able to replicate and extend the findings of Experiment One. Other possibilities involved the Benton Controlled Oral Associations (COWA) task. This is a verbal fluency based task where participants are asked to come up with as many words as they can think of beginning with a particular given letter. This is designed to measure fluid intelligence and the AUT was therefore chosen as it was considered to specifically assess divergent thinking and had yielded positive results in Experiment One. Having found effects previously thus makes it a good test to investigate cross-modal effects within other areas of improvisation. It is worth noting that the AUT is sometimes presented with alternative titles such as the different uses task in Kuse's (1977) Hawaii Battery. The AUT has also been used in other forms such as the Unusual Uses task in the Torrance Test of Creative Thinking (TTCT; Torrance, 1966).

The verbal convergent thinking task that was chosen was the Lexical Decision Task (LDT). Other possible convergent thinking tasks included the verbal reasoning tasks from the Differential Aptitude Test (DAT) as well as using anagrams (Benedek, Bergner, Konen, Fink, & Neubauer, 2011). The LDT asks people to simply indicate on a computer whether a word is a real word or not. This was chosen due to its uses in relation to multiple testing and had the added benefit that differences in reaction time could be measured. While it may be that scores do not improve post treatment according to condition, reaction times may decrease post treatment.

4.5.3 Visuo-spatial tests

Guilford's Matchsticks Task was used to assess divergent thinking while Shephard and Metzler's MRT was chosen to look at convergent thinking. These tasks were chosen as they both involve problem solving methods and the use of mental imagery.

Divergent tests for spatial ability again appeared to be dominated by Guilford's (1950/1971) set of divergent thinking tasks. They consisted of tasks such as 'making objects', where participants are asked to make a new object from a minimum of two out of four shapes presented; or 'figural implications' where participants are asked to add lines to a shape to make a simple figure. Goff and Torrance (2002) also use a similar task in their Abbreviated Torrance Test for Adults (ATTA) where people are required to draw pictures using the triangles provided. Park (2004) also created some divergent thinking tasks to assess spatial ability, such as to draw as many shapes as possible from nine dot square grids. However, no set of norms could be found for these tests and could not be found in the use of other experiments. Guilford's match problems task was finally chosen as a divergent thinking task for assessing spatial ability. This was due to more than one version being available, enabling pre and post tests. The match problems task presents a grid of 'matchsticks' where people are then asked to either leave a designated number of squares as many times as possible, using as many matchsticks as needed, or alternatively, to use a set number of matchsticks, ensuring that just squares are left – the number of squares this time does not matter.

A number of convergent spatial tasks were also available, many of which are well established. One type of task that was looked at included a matrix reasoning task, where the correct tile needs to be chosen in relation to a set of other tiles presented. These will be correct due to patterns on the tiles that follow specific rules. The original version of this task is referred to as Raven's matrices, although a recent adaptation is included in the WAIS. However, the WAIS was not chosen due to no significant findings found in dancers (von-Rossberg-Gempton et al., 1999). The Raven's matrices was also decided against for the current battery of tests. Evidence against the Raven's matrices has been shown by Hetland (2000) who found no difference in musicians performance on the Raven's matrices. As well as this, Hetland argues that the Raven's Matrices should not be classed as a task of spatial ability. He argues that instead the task should be seen as a test of "logical intelligence" (p. 183). As well as this, the task is paper-based and would not be suitable to transfer onto a computer. Should this be done, it could also potentially change the results such that they no longer coincide with the norms.

Another type of convergent thinking task involves assessing spatiotemporal ability. Smith and McPhee (1987) use moving targets in their tests where people have to decide when a moving object will reach its destination. These tests are good for measuring reaction time and were strongly considered for the current battery of tests as they are designed for use on a computer. However, they were not chosen for the current battery due to the lack of research that could be found using one type of spatiotemporal task as well as stronger evidence in relation to music and dance for other tests such as mental rotation (Brochard, et al., 2004).

The final set of spatial ability tasks that were looked at in relation to convergent thinking were mental rotation tasks. Many cognitive test batteries incorporate tasks of mental rotation. Hakstian and Cattell (1984) use a 2D mental rotation task in their Comprehensive Ability Battery (CAB), as well as Kuse (1977) Hawaii Battery. Mental rotation tasks involve looking at two shapes and deciding whether the shapes are the same or not. In order to figure this out, one shape needs to be mentally rotated to see if it will fit with the other. Shepherd and Metzler (1971) introduced the 3D mental rotation task and, as the name suggests, is a version where 3D shapes are used as opposed to 2D shapes. These have also been used by Vandernberg and Kuse (1978) as well as in Thurstone's (1948) Primary Mental Abilities (PMA). Furthermore, Guilford and Lacey (1947) were one of the first people to suggest that mental rotation was a part of 'spatial visualizaton'. French (1951) went on to suggest that this should include 3 dimensional as well as 2 dimensional objects. The final decision concerning which spatial task to use concerns the suggestion of a potential link between music and mental imagery (Brochard, et al., 2004; Hetland, 2000).

It was therefore decided that Shephard and Metzler's MRT would be used for the current battery of tests. Shephard released a set of images along with instructions in which the MRT could be used for in a computer task. Due to this, it was therefore possible to create two versions of the task for a computer based version of the task, while making them as similar to the paper version of the test as possible.

4.5.4 Numeracy tests

Guilford's Alternate Additions Task was used to assess divergent thinking while an adapted version of the GATB, a numerical reasoning task was chosen to look at convergent thinking.

These tasks were chosen as they both involve problem and the use of mathematical reasoning.

A divergent numeracy test was considered essential for the current battery of tests due to the links identified in relation to music (Catterall et al., 1999; Schellenberg, 2001; see 4.2.2). In addition to this, Haylock (1978) has previously suggested that these results differ in comparison to other divergent thinking tasks. Although Haylock (1987) suggests a number of people who have used divergent thinking tasks (Dunn, 1976; Evans, 1964; Jensen, 1973), the specific details of these tasks were not identified and could therefore not be retrieved.

Kwon, Park and Park (2006) used a set of open ended, divergent thinking maths tasks which were all used with a pre and post test method. These tests were derived from Becker and Shimada's (1997) and Burn's (1996) open-ended maths tasks. However, only examples of the tests could be found in the appendices and the full version of tasks could not be found. Divergent numeracy tests in general were difficult to come by and only two established tests could be obtained. These were Park's (2004) cross number puzzle and alternate additions (Guilford & Hoepfner, 1971; Maxwell, 1974). Park's cross number puzzle presents a four-by-four grid with numbers in. Participants are then asked to find as many different paths as possible on the grid that equal a given number. This is done by drawing lines through the grid. Guilford's alternate additions involves giving people five numbers, followed by a specified sum. People have to find as many different ways to achieve the sum using any amount of the five numbers given. Guilford's alternate additions task was chosen to be the divergent thinking task for numeracy for several reasons. Firstly, Guilford's tasks of divergent thinking have a higher level of reliability. As well as this, using Guilford's tests in all three divergent thinking tasks means that the same method of scoring can be utilized for all three versions.

A wide variety of convergent thinking tasks for numeracy are available. In order to narrow down the search, a numerical reasoning task was decided as the type of numeracy test to be used, as opposed to sequential or arithmetic based tasks. One convergent task that could have been used was Guilford's arithmetic reasoning task which simply consists of short, verbal questions involving mental arithmetic. This has been used as an Air force test within the U.S and is therefore a well established method of obtaining numerical reasoning scores. However, there were two main reasons this task was not chosen. Firstly, difficulty in obtaining the task was experienced and secondly, the task still emphasizes the arithmetic aspect of mathematics, suggesting that it may not necessarily be a direct measure of numerical reasoning.

Carter (2003) has developed a set of four numeracy tests, one of which was a numerical problem solving test. However, these tasks were again found to be inappropriate for the current battery of tests due to a number of reasons. Firstly, the length of the test was too long for what was needed. Participants were told to spend 60 minutes on the numerical reasoning test. Even with this time halved in order to perform a test before and after, this remained too lengthy. As well as this, questions appeared to be of a particularly difficult standard (when tested on people of an IQ of 120 and above). Finally, all four tests were obtained online and as such, no indication of norms could be obtained. As well as this, no evidence of the tests having been used in other research areas could be found following a literature search.

Wechsler (2001) also produced an arithmetic test which asked numerical reasoning questions as part of the Weschler Adult Intelligence Scale (WAIS-III). However, this test was too short to be able to administer two versions of the test and could therefore not be used with the current battery of tests.

Other general mathematics tests that looked at numerical reasoning include the mechanical reasoning test, the Differential Aptitude Test (DAT) and the General Aptitude Test Battery (GATB). The GATB was finally chosen to be included in the current set of tests. Although one of the older tests, it concentrates on numerical reasoning, can be used as a set of two tests for before and after treatment and increases in difficulty, making it suitable for people of varying levels of mathematical skill.

4.6 PILOT STUDY ONE

The final battery of tests were carried out in a pilot study to ensure that there were no significant differences in scores between the two versions of the tests created as well as to test the logistics and quality of the battery of tests, such as the running of the battery of tests as well as aspects such as ensuring that participants understood all test instructions. Any errors that arose could subsequently be addressed to ensure that no errors arose in future experiments utilizing the tests.

4.6.1 Method

The final battery of tests were input into superlab, being converted from a paper version of the task if necessary and a pilot test carried out on the battery of tests. Six participants were issued two versions of the task. The experimenter chatted with them for 20 minutes after participants had completed the first version of the task in order to ensure the same amount of time had elapsed as in an improvisation session or equivalent. Participants were then asked to complete the second version of the test. Half of the participants (N=3) carried out version A first, while the other half carried out version B. These were counterbalanced to determine whether one version of tests was simpler. From an a prior perspective, no difference between the two versions was expected as no particular treatment was being given participants to potentially influence results on these tasks.

4.6.2 Results and Conclusion

Table 4.2 - Means (SD) and t-values for Pilot Study One

	AUT	**Div. Maths**	**Match-sticks**	**LDT**		**MRT**		**CMT**
	Resp.	**Resp.**	**Resp.**	**Resp.**	**R.T**	**Resp.**	**R.T**	**Resp.**
Pre	6.4	3.6	1.60	91.89	959.91	56.0	3402.78	70.91
Mean (SD)	(3.98)	(2.3)	(3.05)	(4.21)	(205.39)	(5.48)	(1298.63)	(15.18)
Post	5.4	4.8	5.20	92.5	836.54	50.0	3180.24	61.87
Mean (SD)	(3.44)	(1.64)	(5.59)	(2.81)	(147.66)	(20.0)	(1378.44)	(15.98)
***t*-value**	3.16	-.79	-1.79	-.33	2.39	.69	1.29	5.61

Paired samples t-tests revealed no significant differences in five of the six battery of tests ($p > .05$ in all cases). However, a significant difference was found in the convergent numeracy thinking task (GATB, $p = .005$), suggesting that one version of the task was simpler than another.

These results are not surprising, as the pre and post test versions were compiled by splitting the one test of numerical reasoning into two (by taking every other item). In order to address this issue, all questions were rank ordered according to the number of responses that were correct. The same method of taking every other question was then adopted to make two new different versions of the test. The original scores were then compared with an independent samples t-test revealing no significant difference with the new test items ($p > .05$).

A problem of logistics were also determined in the pilot task with the MRT. Some participants did not fully read the instructions or pressed a button following the previous task (LDT) making the instructions disappear. Therefore, as with the LDT, two practice items were introduced where participants are required to get the correct answer before moving on to the next item. Participants are not told these are practice questions but should they need help from the experimenter, results, and in particular reaction time, would not be affected.

No other problems were determined via the results of the pilot study on the battery of tests. Once the changes had been made, they were carried out in real test conditions.

Chapter 5: The impact of Improvisation on Divergent and Convergent thinking tasks.

The battery of cognitive tests developed in Chapter 4 were designed to investigate the affects of various cognitive tasks across different domains of improvisation; verbal, dance and music. The following chapter presents two experiments investigating the impact of improvisation on verbal (Experiment Two) and dance (Experiment Three) improvisation. In addition to this, further analysis to investigate the idea of ceiling effects is also presented.

5.1 EXPERIMENT TWO – VERBAL IMPROVISATION

The results of Experiment One revealed an increase in AUT and ATTA scores following twenty minutes of improvisation. However, only tasks measuring divergent thinking were assessed. As mentioned throughout Chapters 1 to 4, divergent thinking can be recognized as part of creativity. Furthermore, it has been suggested that improvisation may help people to break away from set patterns of thinking, which, in turn may facilitate divergent thinking. As a result improvisation may affect convergent and divergent thinking in different ways. Therefore a battery of tests looking at different areas of cognition for both divergent and convergent thinking was developed (see Chapter 4) for the current experiment.

Convergent and divergent thinking divide problem solving into two main methods of thought. Convergent thinking is seen as finding one particular answer to a given problem, involving one definitive answer. Divergent thinking, on the other hand, does not have one correct answer but a number of different possible solutions. Divergent thinking therefore encourages different types of thinking as open problems involve the need to come up with lots of alternative solutions. The AUT is an example of a divergent thinking task as there are a number of alternative uses that can be thought of for each object.

The aim of the current study was therefore to replicate and extend the findings of Experiment One while also determining whether the effects could be observed in both divergent and convergent thinking, as well as looking at different types of cognitive task. The domains in question were verbal, visuo-spatial and mathematical abilities.
The experimental hypotheses for this experiment are:

1. There will be a significant difference in AUT scores following twenty minutes of improvisation tasks.

2. There will be a significant difference following twenty minutes of improvisation in comparison to the control condition in tasks of divergent thinking.
3. There will be a significant difference following twenty minutes of improvisation in comparison to the control condition in tasks of convergent thinking.

5.2 METHOD

5.2.1 Participants

The study consisted of a convenience sample of 46 participants from the University of Hertfordshire who each took part via the SONA online participation sign-up system in return for one hour's course credit, needed for their course. The total sample consisted of 38 females and 8 males with a mean age of 23 years (SD=6.5). The experiment was carried out in groups of between three and six people and due to the nature of the tasks, it was requested that English was the first language. Groups were randomly divided by condition, resulting in 25 (19 females, 6 males) participating in the improvisation condition and 21 (19 females, two males) in the control condition.

5.2.2 Design

A 2x2 mixed design was implemented, consisting of two factors. 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 minutes of improvisation or 20 minutes of a verbal discussion. The Independent Variable was the treatment condition. The Dependent Variables were the scores and sub-scores on the battery of cognitive tests.
This study received ethical approval, protocol number: PSY/10/09/CL.

5.2.3 Materials and Apparatus

The battery of cognitive tests consisted of six short tasks, three of which were divergent thinking tasks and three of which were convergent thinking. The three divergent thinking tasks used were the Alternative Uses Task (AUT), Divergent Maths Task and the Matchsticks task. The three convergent thinking tasks used were the Lexical Decision Task (LDT), Mental Rotations Task (MRT) and the Convergent Maths Task (CMT). All tasks were performed on a Macintosh computer where scores and reaction times were recorded. All Macintosh computers were set to a default refresh rate of 60Hz. With tasks requiring a time limit, the task would automatically time out after the designated period had elapsed.

AUT

The AUT used the same instructions as in Experiment One (see Chapter 3.2.3). However, the instructions were shown and the test carried out on a Macintosh computer.

Two versions of the same test with different target objects were used and counterbalanced. The two target objects given to participants were a 'newspaper' and a 'paperclip'.

Divergent Maths Task

The Divergent Maths task (Guilford, 1957b) can also be referred to as the Alternate Additions task. Instructions for this task were:

"The computer shall present a number (e.g.35) followed by five smaller numbers underneath (e.g. 1, 5, 7, 10 and 15). I would like to you to come up with as many different ways of achieving the larger number.

You may use as many or as few of the numbers as you want, but only once in each sum and you may use any of the common denominators (+, -, x, /).

You will have three minutes to write down as many sums that equal 35 as you can think of. Press the enter key after each response that you make.

Are there any questions?"

Two versions of the same test with different target numbers were used and counterbalanced. The two target numbers given to participants were a '45' and a '36'.

Matchsticks Task

The Matchsticks task (Guilford, 1957b) involved a diagram of separate lines, known as matches, making up a set of squares and required participants to leave a designated number of squares by indicating which matchsticks would be removed.

Instructions for this task were:

"On the screen a grid of squares will be presented where each line has a letter/number and represents a matchstick.

Removing as many matchsticks as you like, your task is to find as many different ways to leave ‘x number of’ squares in the grid.
Enter the letters and numbers of the matchsticks you would remove, followed by the enter key for each way of achieving this. You will have three minutes to complete this.
Do you have any questions?”

Two versions of the test with different targets were used and counterbalanced. The two targets given to participants were ‘five squares’ and a ‘three squares’.

LDT

The LDT was the first of the convergent thinking tasks. This task consisted of 32 strings of letters that either made up a word (e.g. Helicopter) or a non-word (e.g. blueblepip). These word lists were drawn from Hulme, Newton, Cowan, Stuart, and Brown (1999). Participants were asked to indicate if each letter string was a word or a non-word. Instructions for this task were:

“On the computer, you will be shown a string of letters. Some of the letter strings will be words (e.g. CATCH) and some will be non-words (e.g. THCAC).
Your task is to press the '/' key if the letter string is a word and 'Z' key if the letter string is not a word.
It is important that you complete this task as quickly as you can without making too many mistakes.
Do you have any questions?”

Two versions of this test with different sets of letter strings were used and counterbalanced.

MRT

The MRT (Shepard & Metzler, 1971) is a convergent thinking task designed to measure spatial awareness. Two pictures are displayed on the screen which are made up similar looking 3D blocks. Participants are asked to indicate whether the objects are the same or different. Instructions for this task were:

“Two objects shall be displayed on the screen. Look at each pair of pictures and decide whether the two objects are the same or different.
If you think the two objects are the same, press the '/' key. If you think they are different, press the 'Z' key.
Work as fast as you can. Your reaction time will be measured for each response.

Are there any questions?"

Two versions of this test with different stimuli were used and counterbalanced. There were ten pairs of objects for each version of the MRT.

CMT

The CMT is derived from the General Aptitude Test Battery (GATB) and consists of multiple choice mathematical reasoning questions. Instructions for this task were:

"You are about to be shown some problems in arithmetic.

Look at the example below.

It takes half an hour to do one piece of work.

How many pieces of work can be finished in 8 hours?

1. 8 pieces
2. 10 pieces
3. 16 pieces
4. 24 pieces
5. None of these

In the above example, the answer is option 3 - 16 pieces.

This test will consist of similar questions. You may do any working out on the sheet of paper next to you. When you have your answer, type in the appropriate number.

Please work as fast as you can. You have just over 3 minutes to complete all the questions.

You must answer the current question to be able to move onto the next.

Are there any questions?"

Two versions of this test with different stimuli were used and counterbalanced. There were eleven questions in each section of the CMT.

Verbal Intervention

Treatment conditions were the same as for Experiment One and consisted of either twenty minutes of verbal improvisation exercises or twenty minutes of a control condition consisting of verbal interaction exercises.

5.2.4 Procedure

Participants were recruited through the University of Hertfordshire's research study participation system. Six slots were given for each study time advertised and an hour was awarded to each participant who took part. Following consent, participants were told they would take part in six short, cognitive tests on the computer, where instructions would be provided for each task. They were also informed that should they need reminding of these instructions, they could consult an overview of instructions sheet next to them. Finally, they were told that should they need to make notes or do any working out, some paper was provided for them. Participants were then told to start when they were ready by pressing the enter key on the computer. All participants worked their way through the battery of cognitive tests, lasting approximately twenty minutes. Once completed, they were asked to leave their workstations and enter a separate room where they then participated in either the verbal improvisation or control condition. After twenty minutes, participants were asked to return to their cubicles and complete the second battery of cognitive tests. Participants informed the experimenter once they had finished these tests, where they were then debriefed and thanked for their time.

5.3 RESULTS

All tests administered before and after treatment were analysed to determine if there were any changes in scores after the verbal interventions had taken place and to determine whether any changes observed differed between conditions. Outliers, as determined by descriptive analysis in the software program SPSS, and participants who did not engage in tasks were omitted from the data analysis. This resulted in five participants being excluded from the AUT and six participants excluded from the Divergent Maths task and the Matchsticks task. All participants were used in the analysis of convergent thinking tasks.

5.3.1 Divergent Thinking Tasks

All divergent thinking tasks were scored for Response, Fluency, Originality and Flexibility. Elaboration was not scored due to vague scoring instructions as well as many researchers (Crockenberg, 1972; Plucker & Renzulli, 1999; Sternberg & Lubart, 1996) not including it as a key element of the scoring system and therefore only scoring according to the above criteria. Furthermore, as no significant differences were observed in Experiment One, scoring of Elaboration was not carried.

As with Experiment One, ANCOVAs and mixed ANOVAs were carried out to determine if there were any changes in scores pre and post treatment, as well if there were any differences between the two treatment conditions. ANCOVAs are only reported when conflict occurs with the results of a mixed ANOVA. There were two factors; factor 1: Treatment and factor 2: Time.

Alternative Uses Task (AUT)

Table 5.1 – Experiment Two Mean (SD) AUT scores before and after treatment

		Response	Fluency	Originality	Flexibility
Improvisation (n=21)	**Pre**	8.57 (4.48)	6.65 (3.88)	3.55 (3.90)	4.78 (2.41)
	Post	10.91 (3.72)	9.35 (3.80)	5.45 (4.21)	6.61 (2.74)
Control (n=20)	**Pre**	8.80 (3.19)	4.47 (2.25)	1.60 (1.76)	3.71 (1.98)
	Post	9.70 (4.73)	5.58 (4.74)	3.60 (5.07)	3.67 (2.87)

AUT: Flexibility

For the AUT Flexibility scores, there was a significant main effect of treatment, $F(1, 42) = 9.58$, $p = .004$, partial $\eta^2 = .186$. There was a significant main effect of time, $F(1, 42) = 4.89$, $p = .033$, partial $\eta^2 = .104$ and a significant interaction between time and treatment, $F(1, 42) = 5.43$, $p = .025$, partial $\eta^2 = .114$, such that the improvisation group improved post intervention in comparison to the control condition who displayed no change in scores post intervention.

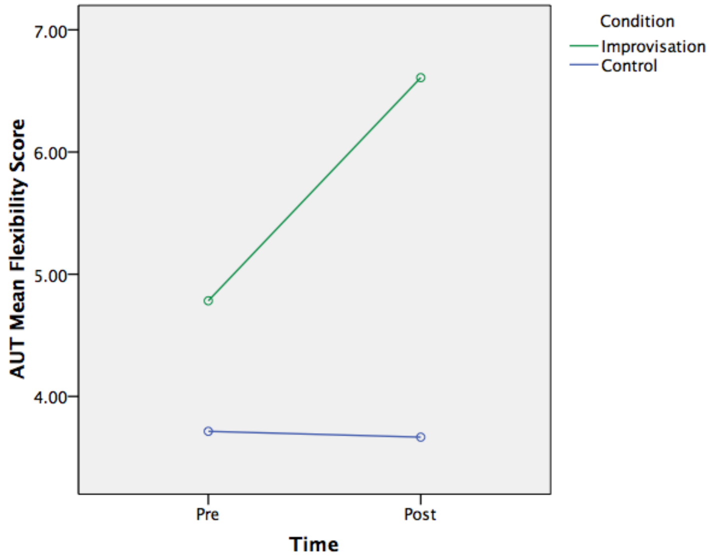

Figure 5.1: Experiment Two AUT Flexibility Scores Pre and Post Treatment

The interaction between time and condition can be seen in Figure 5.1. To determine whether differences between conditions may be due to differences in pre scores, this was investigated further using independent samples t-tests where no significant effect was found for pre scores $t(42) = 1.60$, $p > .05$. However, a significant effect was found for post treatment scores $t(42) = 3.48$, $p = .001$, $r = .47$. Paired samples t-tests also revealed a significant effect for the improvisation group $t(22) = -2.85$, $p = .009$, $r = .52$ but no significant effect for the control group, $t(20) = .10$, $p > .05$ pre and post improvisation.

Furthermore, an analysis of covariance (ANCOVA) showed that when pre-test AUT flexibility scores were covaried out, the main effect of treatment on post-test scores remained significant, $F(1, 39) = 10.78$, $p = .002$, partial $\eta^2 = .208$. The unadjusted means indicate that post scores are significantly higher post improvisation ($M = 6.95$) in comparison to the post scores of the control condition ($M = 3.95$).

AUT: Fluency

For the AUT Fluency scores, there was a significant main effect of treatment, $F(1, 40) = 10.88$, $p < .002$, partial $\eta^2 = .214$. There was a significant main effect of time, $F(1, 40) = 6.43$, $p = .015$, partial $\eta^2 = .139$. There was no significant interaction between time and treatment, $F(1, 40) = 1.13$, $p > .05$.

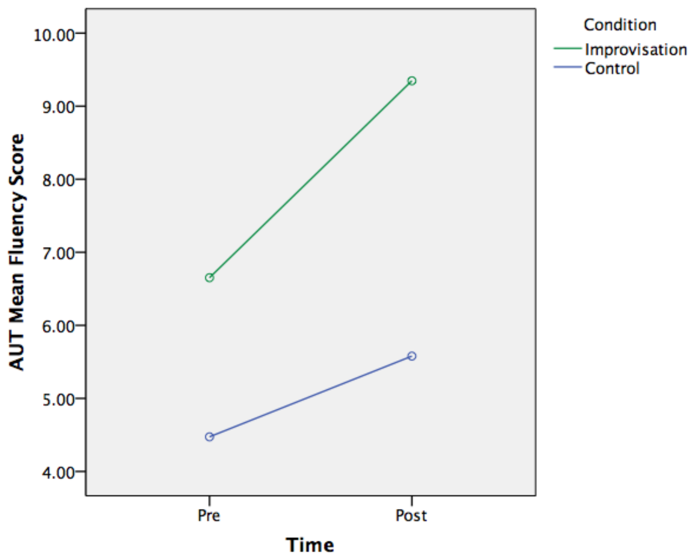

Figure 5.2: Experiment Two AUT Fluency scores pre and post treatment

The interaction between time and condition can be seen in figure 5.2. To investigate this further, independent samples t-tests were carried out. A significant effect was found for both pre treatment $t(42) = 2.18$, $p = .035$, $r = .32$ and post treatment $t(42) = 3.31$, $p = .002$, $r = .45$ scores between condition. Paired samples t-tests also revealed a significant effect for the improvisation group pre and post intervention $t(22) = -2.67$, $p = .014$, $r = .50$ but no significant effect for the control group, $t(19) = -.98$, $p > .05$ pre and post intervention.

To determine whether differences between conditions may be due to differences in pre scores of the AUT fluency, an analysis of covariance (ANCOVA) showed that when pre-test AUT fluency scores were covaried out, the main effect of treatment on post-test scores was significant, $F(1, 39) = 8.78$, $p = .005$, partial $\eta^2 = .184$. The unadjusted means indicate that post scores are significantly higher post improvisation ($M = 9.77$) in comparison to the post scores of the control condition ($M = 5.55$).

AUT: Response; Originality

AUT Response showed a significant effect of time, $F(1, 41) = 4.51$, $p = .040$, partial $\eta^2 = .099$ as did AUT Originality scores, $F(1, 40) = 7.35$, $p = .010$, partial $\eta^2 = .155$. However, no significant main effect of treatment and no significant interaction effect was found between time and treatment ($p > .05$ in all comparisons). These results indicate that there were no differences in AUT response or originality between conditions.

However, it is worth noting that paired samples t-tests for AUT Response were found to be significant for the improvisation condition, $t(22)=-2.12$, $p=.038$, $r=.41$ but not with controls, $t(19)=-.83$, $p=.419$. It could therefore be possible that a type II error is being experienced here such that there are differences in originality but these are not large enough to be significant.

Divergent Maths Task

Table 5.2 – Experiment Two Mean (SD) Divergent maths scores before and after treatment

		Response	Fluency	Originality	Flexibility
Improvisation (n=22)	**Pre**	4.08 (1.31)	3.35 (1.37)	.82 (1.05)	2.45 (.91)
	Post	5.65 (3.39)	3.87 (1.74)	.64 (.73)	2.59 (1.10)
Control (n=18)	**Pre**	4.53 (1.22)	3.21 (1.55)	.58 (.69)	2.39 (1.14)
	Post	5.63 (1.16)	3.79 (1.72)	1.16 (1.26)	2.56 (1.25)

Divergent Maths: Originality

For the Divergent Maths Originality scores, there was no significant main effect of treatment, $F(1, 39) = .54$, $p > .05$. There was no significant main effect of time, $F(1, 39) = 1.05$, $p > .05$. There was no significant interaction between time and treatment, $F(1, 39) = 3.84$, $p = .057$. The significance level of the interaction was .057, indicating differences in the originality scoring of the two conditions and suggesting that caution should be taken in accepting the null hypothesis.

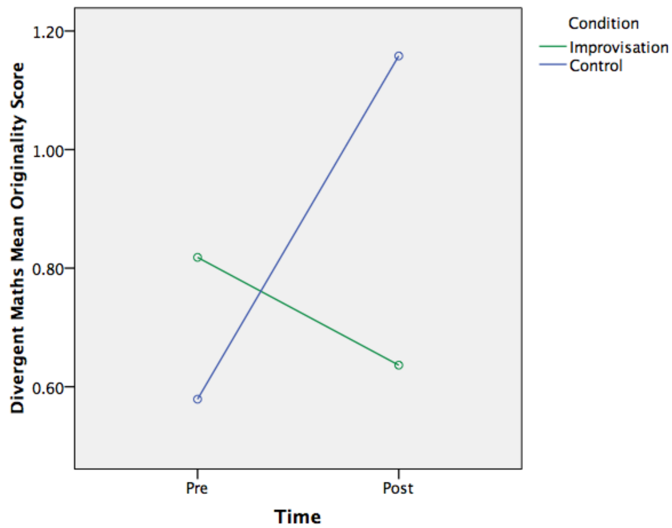

Figure 5.3: Experiment Two Divergent Maths Originality scores pre and post treatment

Figure 5.3 shows the interaction of the divergent maths originality scores. Although no effect of time was observed, it can be seen that the improvisation and control conditions show the opposite relationship, with the improvisation group becoming marginally worse and the control group improving post treatment.

To investigate this further, independent samples t-tests were carried out. No significant effects were found on pre- intervention scores $t(39) = .85$, $p > .05$ or post-intervention scores $t(40) = -1.64$, $p > .05$. Paired samples t-tests however, revealed no significant effect for the improvisation group $t(21) = -.61$, $p > .05$, but a significant effect was found for the control condition, $t(18) = -2.48$, $p = .023$, $r = .50$ pre and post treatment, suggesting the control condition became more original in comparison to the improvisation group.

Divergent Maths: Response; Fluency; Flexibility

Divergent Maths Response scores showed a significant effect of time, $F(1, 40) = 10.12$, $p = .003$, partial $\eta^2 = .202$ as did Divergent Maths Fluency scores, $F(1, 40) = 5.34$, $p < .026$, partial $\eta^2 = .118$. However, Divergent Maths Flexibility had no significant main effect of time ($p > .05$). Divergent Maths Response, Fluency and Flexibility had no significant main effect of treatment ($p > .05$ in all cases) and no significant interaction between time and treatment ($p > .05$ in all cases) were found. These results indicate that Divergent Maths Response and Fluency scores improved in both conditions pre and post treatment but no differences between condition occurred. Divergent Maths Flexibility suggested no differences were present pre and post treatment.

Matchsticks Task

Table 5.3 - Experiment Two Mean (SD) Matchstick scores before and after treatment

		Response	Fluency	Originality	Flexibility
Improvisation (n=22)	**Pre**	3.67 (2.24)	2.67 (2.12)	.62 (.92)	1.71 (1.19)
	Post	5.90 (2.70)	3.71 (3.32)	.38 (.67)	1.95 (1.56)
Control (n=18)	**Pre**	4.00 (4.90)	1.32 (2.00)	.21 (.54)	.95 (1.31)
	Post	4.26 (2.90)	2.58 (2.69)	.58 (.90)	1.58 (1.43)

Matchsticks Task: Response; Fluency, Originality and Flexibility

For the Matchsticks Fluency scores, there was a significant main effect of treatment, $F(1, 38) = 4.29$, $p = .045$, partial $\eta^2 = .101$. There was a significant main effect of time, $F(1, 38) = 4.25$, $p = .046$, partial $\eta^2 = .101$. However, there was no significant interaction between time and treatment, $F(1, 38) = .04$, $p > .05$. These results indicate that scores in matchsticks fluency do differ between conditions but that the two groups follow the same pattern.

For the Matchsticks Response, Originality and Flexibility scores, there were no significant effects of treatment or time and no interaction effect between time and treatment ($p > .05$ in all cases). These results indicate that there are no differences between the two conditions for Matchsticks response, originality and flexibility scores.

5.3.2 Convergent Thinking tasks

Mixed ANOVAs were carried out to determine if there were any changes in scores pre and post treatment, as well if there were any differences between the two treatment conditions. There were two factors; factor 1: Treatment and factor 2: Time.

Lexical Decision Task (LDT)

Table 5.4: Experiment Two mean (SD) LDT scores before and after treatment

		Response (%)	LDT Reaction Time (Correct)	LDT Reaction Time (Incorrect)	LDT Reaction Time (Total)
		n = 25	n = 25	n = 15	n = 25
Improvisation	**Pre**	94.63 (4.18)	833.87 (169.23)	1379.11 (809.90)	846.56 (182.61)
	Post	95.50 (4.61)	756.68 (174.05)	842.98 (353.99)	758.98 (180.74)
		n = 21	n = 21	n = 19	n = 21
Control	**Pre**	88.99 (7.57)	903.37 (250.35)	1067.71 (704.88)	909.29 (257.82)
	Post	91.67 (6.35)	732.45 (113.38)	749.95 (212.81)	737.86 (114.23)

LDT: Response; Reaction Times

LDT Response stands for the percentage of correct responses that participants achieved. For the LDT Response scores, there was a significant main effect of treatment, $F(1, 44) = 9.24$, $p = .004$, partial $\eta^2 = .174$. There was a significant main effect of time, $F(1, 44) = 7.08$, $p = .011$, partial $\eta^2 = .139$. There was no significant interaction between time and treatment, $F(1, 44) = 1.83$, $p > .05$.

LDT Reaction time scores revealed a significant effect of time for Correct, $F(1, 44) = 20.34$, $p < .001$, partial $\eta^2 = .316$, Incorrect, $F(1, 32) = 10.92$, $p = .002$, partial $\eta^2 = .254$, and Total scores, $F(1, 44) = 20.58$, $p < .001$, partial $\eta^2 = .319$. However, there was no effect of treatment ($p > .05$ in all cases) and no significant interaction between time and treatment ($p > .05$ in all cases), suggesting that both conditions became faster post treatment.

Mental Rotations Task (MRT)

Table 5.5: Experiment Two mean (SD) MRT scores before and after treatment

		Response (%)	MRT Reaction Time (Correct)	MRT Reaction Time (Incorrect)	MRT Reaction Time (Total)
		n = 25	n = 25	n = 22	n = 25
Improvisation	**Pre**	59.60 (17.19)	4382.83 (1212.53)	4396.64 (1703.26)	4411.47 (1099.40)
	Post	66.00 (22.36)	4375.78 (1697.34)	4419.66 (2085.25)	4346.84 (1690.84)
		n = 21	n = 21	n = 19	n = 21
Control	**Pre**	53.33 (20.58)	4451.69 (1612.05)	4051.20 (1345.68)	4264.70 (1296.81)
	Post	61.90 (19.65)	3711.87 (1335.49)	3443.26 (1814.85)	3713.56 (1270.03)

MRT: Response; Reaction Times

For the MRT Response scores, there was a significant main effect of time $F(1, 44) = 8.14$, $p = .007$, partial $\eta^2 = .156$. However, there was no significant effect of treatment, $F(1, 44) = .95$, $p > .05$ and no significant interaction between time and treatment, $F(1, 44) = .17$, $p > .05$.

MRT Reaction time scores for Correct, Incorrect and Total answers showed that there was no effect of treatment ($p > .05$), time ($p > .05$) or an interaction between time and treatment ($p > .05$ in all cases), suggesting no significant changes in the MRT according to treatment condition.

Convergent Maths Task

Table 5.6: Experiment Two mean (SD) CMT scores before and after treatment

		Attempted (%)	Response (%)	CMT Reaction Time (Correct)	CMT Reaction Time (Incorrect)	CMT Reaction Time (Total)
Improvisation (n = 25)	**Before**	82.18 (12.98)	61.60 (15.10)	22620.84 (8790.94)	32266.49 (10641.0)	26103.34 (5166.15)
	After	82.55 (13.36)	63.55 (15.58)	21509.54 (7022.46)	31831.53 (11465.6)	25760.31 (6000.54)
Control (n = 21)	**Before**	79.19 (11.92)	63.82 (12.50)	20923.65 (5598.43)	33711.06 (11465.6)	26102.04 (4293.02)
	After	82.25 (13.32)	60.13 (14.59)	22122.65 (8473.94)	30624.74 (16481.2)	25605.55 (6212.49)

CMT: Attempted; Response; Reaction Times

CMT attempted scores stand for the number of questions that participants attempted (%) within a time limit of 3.5 minutes while CMT response stands for the number of correct responses (%) of the questions attempted.

For these scores as well as all reaction time scores there was no effect of treatment (p > .05), time (p > .05) or an interaction between time and treatment (p > .05), suggesting no significant changes in the CMT according to treatment condition.

5.3.3 Further Post-hoc Analyses

The results of the current study revealed some significant differences. As some effects were observed in different methods, the idea that ceiling effects could be present were tested. Therefore, what participants scored in their cognitive tests pre-treatment was taken into account. Unless otherwise indicated, participants were selected according to the top and bottom third of pre scores, once any outliers had been determined and excluded. Only significant effects are presented below. (Please see Appendix D for correlation matrix).

Mixed ANOVAs were carried out to determine if there were any changes in cognitive tests pre and post treatment, to determine if there were any differences between the two treatment conditions and to look at the quickest and slowest responses. There were three factors: factor 1; Condition and factor 2; Time and factor 3; Score. Condition was a between groups factor, consisting of two levels – improvisation and control. Time was a within groups factor, again consisting of two levels – before and after the treatment. Score was a between groups factor, consisting of two levels – high and low pre scores.

AUT: Fluency

An improvement of AUT scores may depend on the scores exhibited before any treatment took place. It was not possible to conduct a mixed ANOVA on the highest and lowest responses of AUT Fluency, as splitting the data in this way resulted in small sample sizes. Therefore, the top 20% AUT Fluency scores were excluded from the analyses. For the AUT Fluency scores, there was no significant main effect of treatment, $F(1, 32) = 1.25$, $p > .05$. There was a significant main effect of time, $F(1, 32) = 21.43$, $p < .001$, partial $\eta^2 = .401$. Finally, there was a significant interaction between time and treatment, $F(1, 32) = 4.00$, $p = .054$, partial $\eta^2 = .111$.

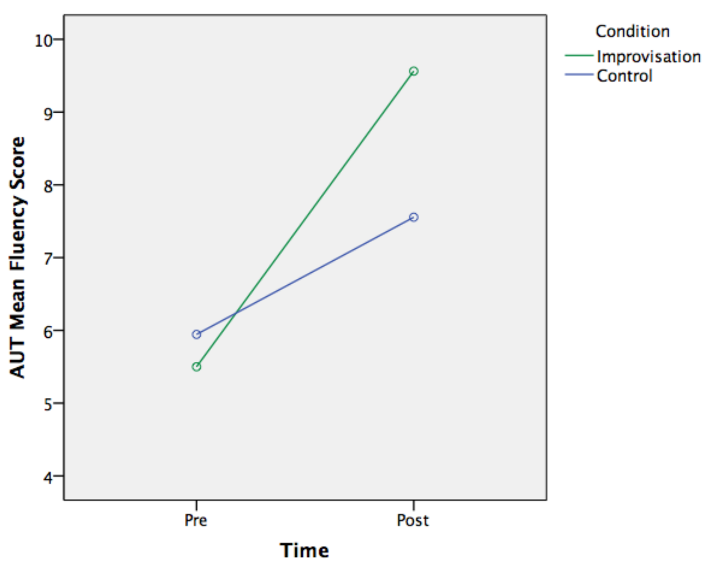

Figure 5.4: Experiment Two post hoc analysis; mean AUT Fluency scores pre and post treatment

Figure 5.4 shows the interaction between the two conditions. It can be seen that the improvisation condition show a larger improvement in AUT scores in comparison to the control condition. This is confirmed with independent samples t-tests, with a significant change observed pre and post treatment for the improvisation condition, $t(15) = -4.65$, $p < .001$, $r = .77$ and no significant change for the control condition, $t(17) = -1.88$, $p > .05$. This suggests that ceiling effects may occur in the AUT.

LDT Reaction Time: Total

For the LDT total reaction time, there was no significant main effect of treatment, $F(1, 19) = .05$, $p > .05$. There was a significant main effect of time, $F(1, 19) = 21.56$, $p < .001$, partial $\eta^2 = .532$ and a significant interaction between time and treatment, $F(1, 19) = 4.49$, $p = .047$, partial $\eta^2 = .191$. Furthermore, a significant interaction was found between time and scores, $F(1, 19) = 16.12$, $p = .001$, partial $\eta^2 = .459$ and between time, condition and score, $F(1, 19) = 8.53$, $p = .009$, partial $\eta^2 = .310$.

The interactions are displayed in figures 5.5 to 5.8 which show that overall the control group's reaction times decrease post treatment. However, this is dependent on high and low scorers. Those who had the slowest reaction times showed significantly quicker reaction times post treatment but those who scored highly to begin with got faster post improvisation.

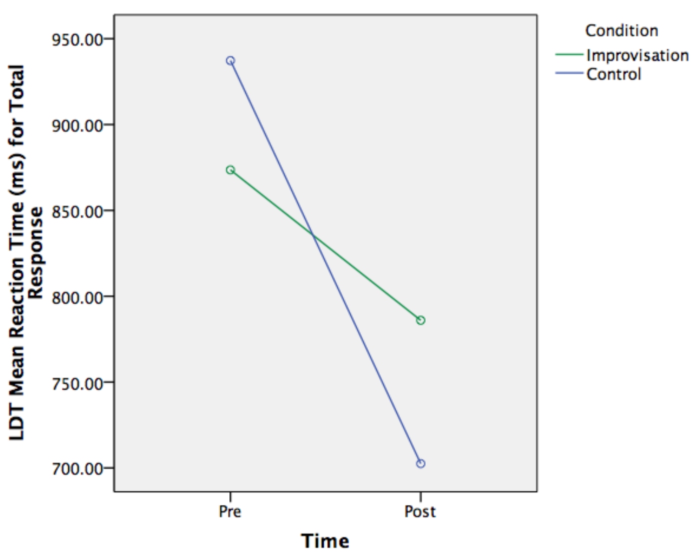

Figure 5.5: Experiment Two post hoc analysis; LDT Total Reaction time pre and post treatment according to condition.

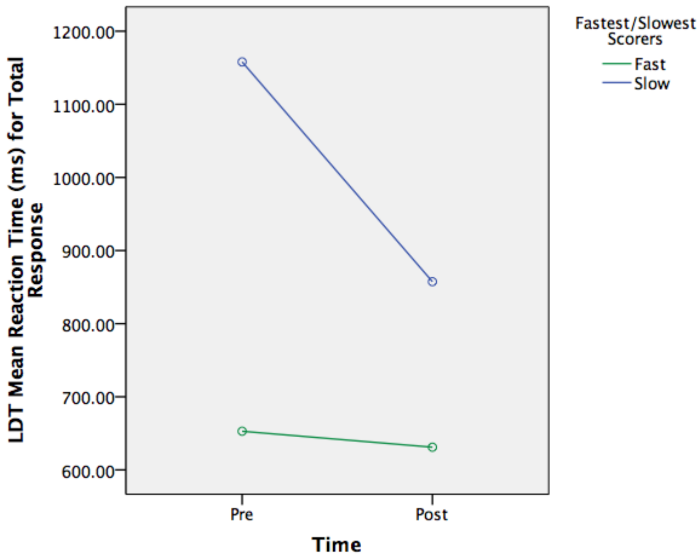

Figure 5.6: Experiment Two post hoc analysis; LDT Total Reaction Time pre and post treatment according to quickest and slowest reaction times

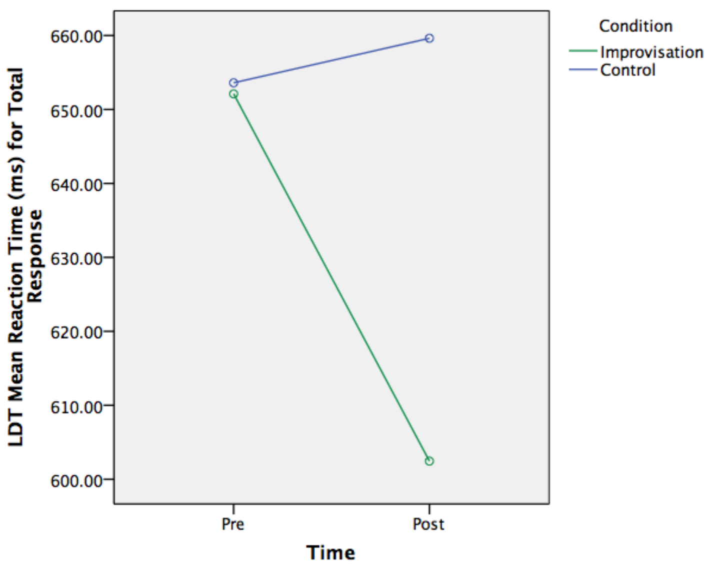

Figure 5.7: Experiment Two post hoc analysis; LDT High Total Reaction Time pre and post treatment according to condition

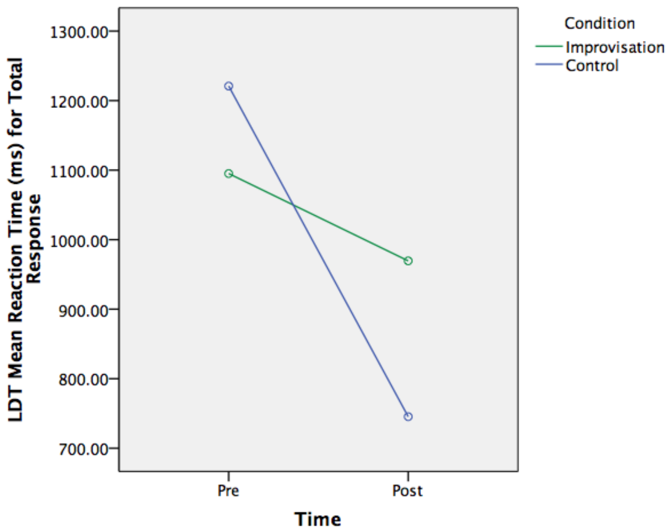

Figure 5.8: Experiment Two post hoc analysis; LDT Low Reaction Time pre and post treatment according to condition

The same results for LDT Reaction time emerged for correct responses showing no significant main effect of treatment, $F(1, 20) = .05$, $p > .05$. There was a significant main effect of time, $F(1, 20) = 23.60$, $p < .001$, partial $\eta^2 = .541$ and a significant interaction between time and treatment, $F(1, 20) = 12.92$, $p = .002$, partial $\eta^2 = .392$. Furthermore, a significant interaction was found between time and scores, $F(1, 20) = 23.96$, $p < .001$, partial $\eta^2 = .545$ and between time, condition and score, $F(1, 20) = 13.60$, $p = .001$, partial $\eta^2 = .405$.

The interactions are displayed in figures 5.9 to 5.12 which show that overall the control group's reaction times decrease post treatment. However, this is appears to only be the case in the slowest pre score reaction times (figure 5.12) which showed significantly quicker reaction times post treatment for those in the control condition.

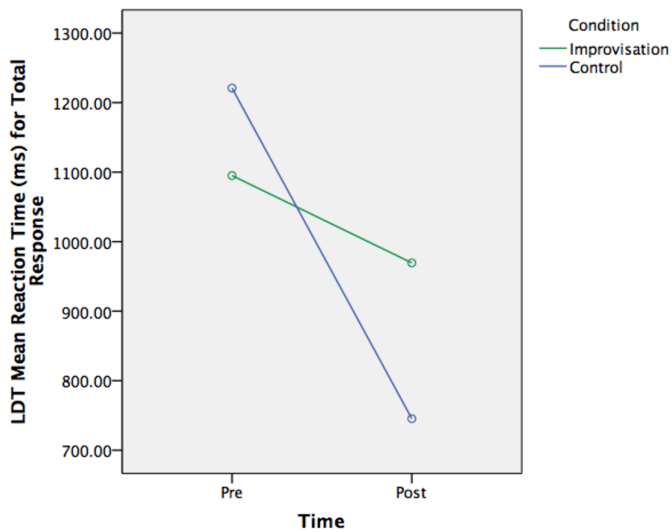

Figure 5.9: Experiment Two post hoc analysis; LDT Correct Reaction time pre and post treatment according to condition.

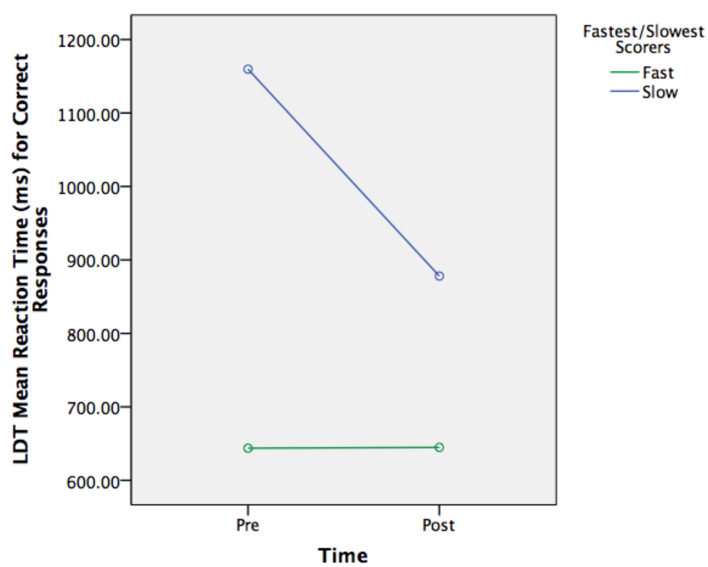

Figure 5.10: Experiment Two post hoc analysis; LDT Correct Reaction Time pre and post treatment according to quickest and slowest reaction times

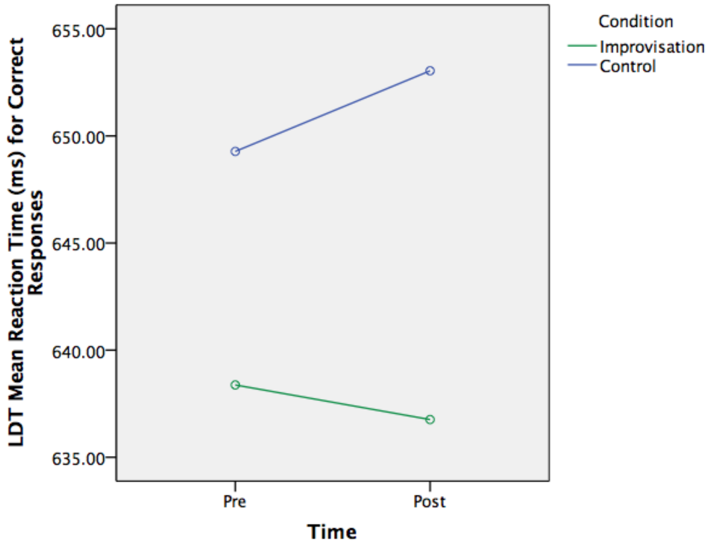

Figure 5.11: Experiment Two post hoc analysis; LDT High Correct Reaction Time pre and post treatment according to condition

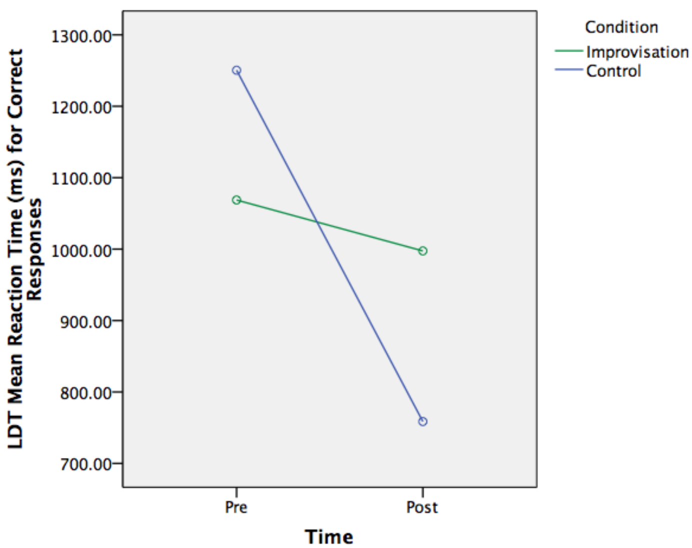

Figure 5.12: Experiment Two post hoc analysis; LDT Low Correct Reaction Time pre and post treatment according to condition

MRT Reaction time – Correct responses

For the MRT reaction time correct responses, there was a significant main effect of treatment, $F(1, 23) = 7.60$, $p = .011$, partial $\eta^2 = .248$. There was no significant main effect of time, $F(1, 23) = .38$, $p > .05$ and a significant interaction between time and treatment, $F(1, 23) = 4.27$, $p = .05$, partial $\eta^2 = .156$. Furthermore, a significant interaction was found between time and scores, $F(1, 23) = 15.91$, $p = .001$, partial $\eta^2 = .409$ and between time, condition and score, $F(1, 23) = 4.86$, $p = .038$, partial $\eta^2 = .174$.

The relationships of these interactions are displayed in figures 5.13 to 5.16 which show that overall the control group's reaction times decrease post treatment. However, this appears to only be the case in the slowest pre score reaction times (figure 5.16) which showed significantly quicker reaction times post treatment for those in the control condition.

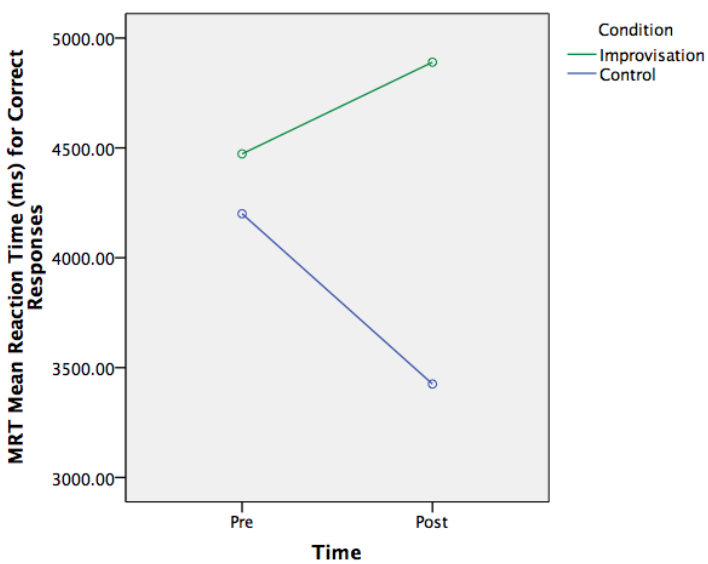

Figure 5.13: Experiment Two post hoc analysis; MRT Correct Reaction time pre and post treatment according to condition.

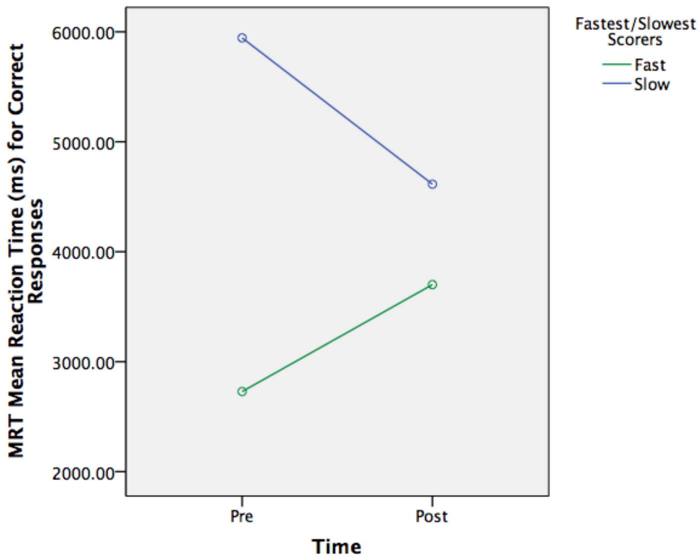

Figure 5.14: Experiment Two post hoc analysis; MRT Correct Reaction Time pre and post treatment according to fastest and slowest reaction times

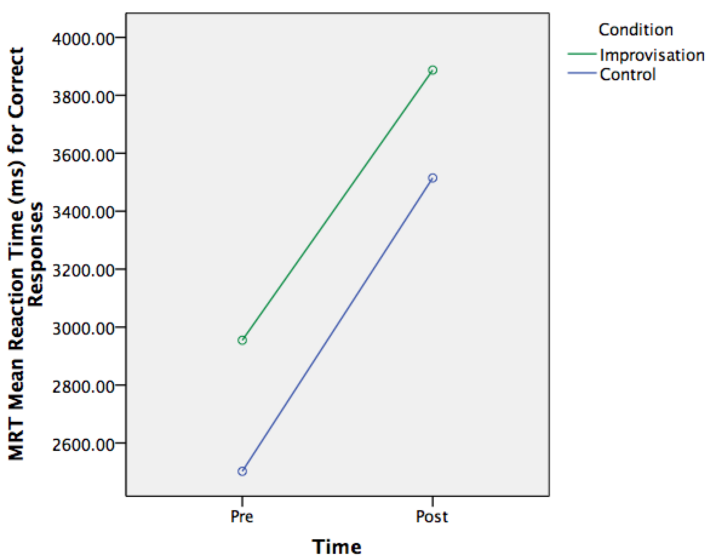

Figure 5.15: Experiment Two post hoc analysis; MRT Correct Reaction Time for high pre treatment scores according to condition.

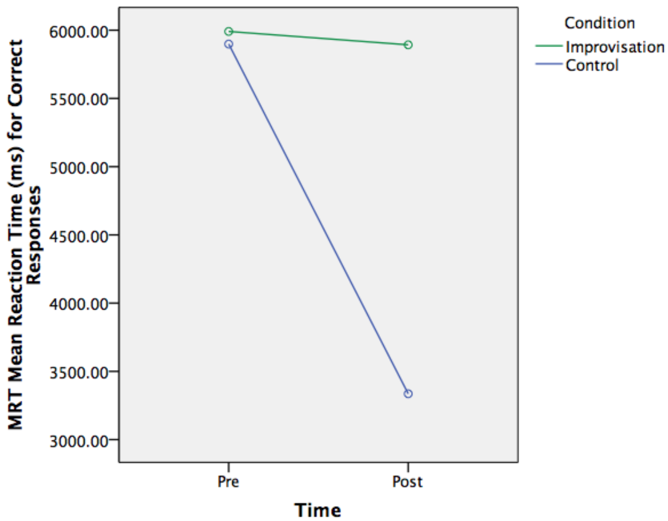

Figure 5.16: Experiment Two post hoc analysis; MRT Correct Reaction Time for low pre treatment scores according to condition

CMT Response

For CMT response, there was no significant main effect of treatment, $F(1, 19) = .45$, $p > .05$ and no significant main effect of time, $F(1, 19) = .55$, $p > .05$. Furthermore, no significant interaction was found between time and treatment, $F(1, 19) = 1.18$, $p > .05$. However, a significant interaction was found between time and scores, $F(1, 19) = 14.30$, $p = .001$, partial $\eta^2 = .429$, and between time, condition and score, $F(1, 19) = 5.10$, $p = .036$, partial $\eta^2 = .212$. The relationship of these interactions are displayed in between figures 6.17 and 6.19 which show that CMT Response scores improve post treatment when participants scored lower in the pre-test. However, participants who elicited higher pre-scores got worse post-treatment if they were in the control group but scores remained equal if in the improvisation condition.

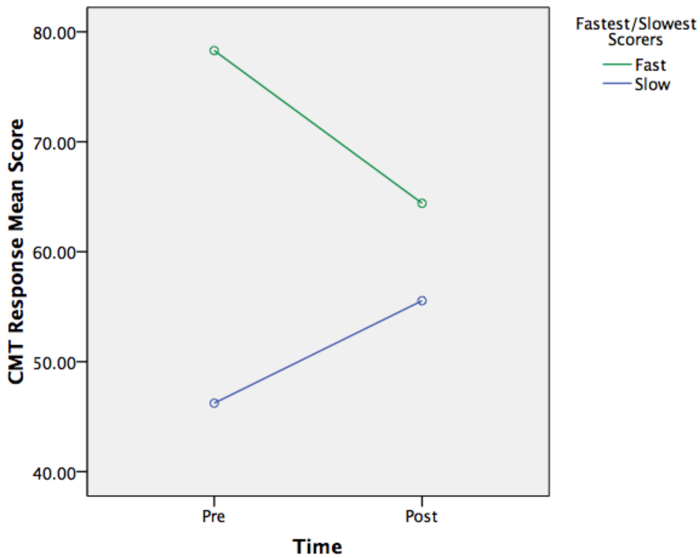

Figure 5.17: Experiment Two post hoc analysis; CMT Response Score pre and post treatment according to highest and lowest pre treatment scores

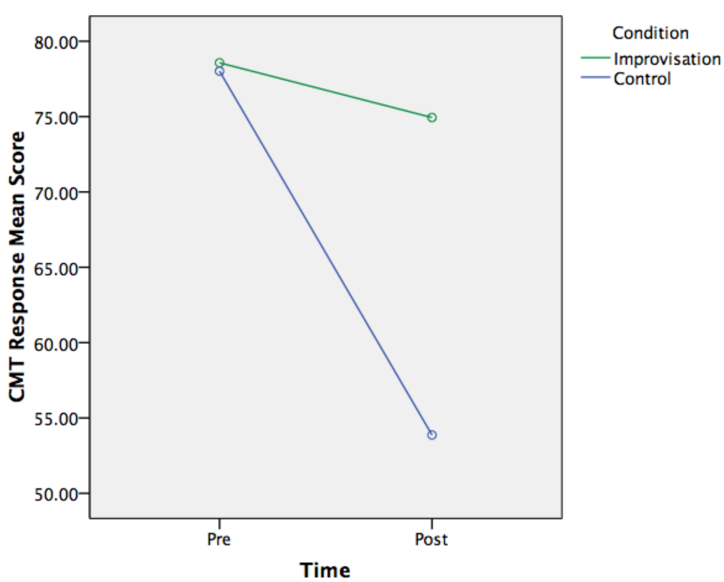

Figure 5.18: Experiment Two post hoc analysis; CMT Response scores for high pre treatment scores according to condition

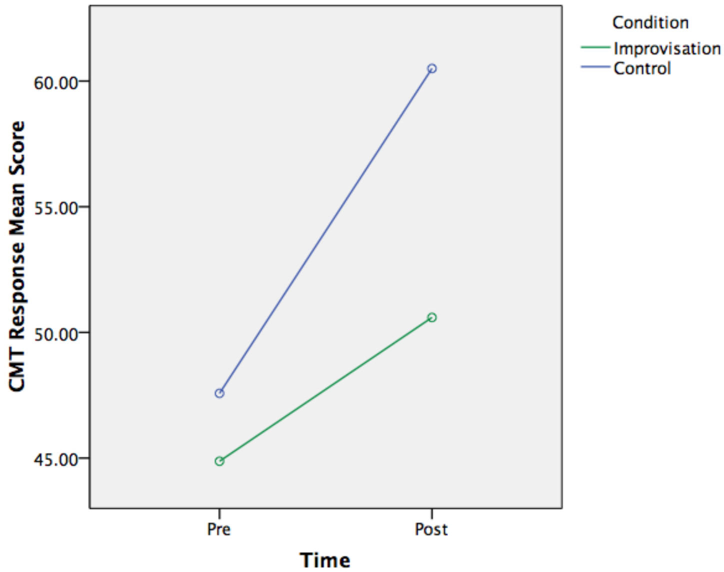

Figure 5.19: Experiment Two post hoc analysis; CMT Response scores for low pre treatment scores according to condition

5.4 DISCUSSION

The present study replicated previous findings such that following twenty minutes of improvisation, scores in the AUT increased in comparison to a control equivalent. Furthermore, this experiment extended previous findings such that verbal improvisation showed increased scores in divergent but not convergent thinking tasks.

Results found a significant increase in AUT Fluency and Flexibility scores following twenty minutes of verbal improvisation in comparison to twenty minutes of a controlled equivalent (verbal discussion). However, surprisingly originality scores in the divergent maths task were found to significantly increase following the verbal control condition and reaction times were found to be faster for the LDT and MRT when pre treatment scores were taken into account. It is therefore suggested that ceiling effects may have occurred in tests of convergent thinking.

The increase observed in the control condition for originality scores in the divergent maths condition are surprising. Although this may be the effect that occurs, it is possible that the method of originality scoring lacks validity. It should be considered that originality scores were only based on the current sample and so should be re-scored according to a larger sample. Furthermore, different methods of scoring originality should be looked at. For example, differences may occur when using the top 1% and 5% of scores, or simply using the top 5%, or by allocating a different number of points according to how original the answer is (see Chapter 3.4).

Overall, these results suggest that verbal improvisation provides benefits in tasks of verbal divergent thinking only and that these effects are not transferrable across domains. However, no other method of improvisation has been tested in relation to cognition and it is therefore feasible to replicate this study using a different domain of improvisation.

5.5 EXPERIMENT THREE – DANCE IMPROVISATION

Experiment Two looked at verbal improvisation in relation to a new battery of cognitive tests and found benefits in a verbal divergent thinking task following improvisation. Furthermore, novel results were observed in the reaction times of convergent thinking tasks, such that those in the control condition became faster at both the LDT and MRT.

However, the domain of improvisation has so far only focused on verbal improvisation. One aspect raised in the discussion of Experiment One included whether any of the effects observed could be seen in other domains of improvisation and within this, whether the same effects relating to the aspect of cognition being measured would differ according to the type of improvisation being used.

Therefore, this experiment aimed to replicate Experiment Two using dance improvisation instead of verbal improvisation.

The experimental hypotheses for this experiment are:

1. There will be a significant difference following twenty minutes of improvisation in comparison to the control condition in tasks of divergent thinking.
2. Based on an a-priori perspective, there will be no significant differences following twenty minutes of improvisation in comparison to the control condition in tasks of convergent thinking.

5.6 METHOD

5.6.1 Participants

The study used a convenience sample of 50 participants from the University of Hertfordshire who each took part via the SONA online participation sign-up system in return for one hour's course credit. The total sample consisted of 42 females and eight males with a mean age of 21 years (SD=4.61). The experiment was carried out in groups of between three and six people and due to the nature of the cognitive tasks, it was requested that English was the first language. Groups were randomly divided by condition, resulting in 24 (female = 19, male = 5) participating in the improvisation condition and 26 (female = 23, male = 3) in the control condition. No experience of dance was necessary for either condition.

5.6.2 Design

The same design as Experiment Two was utilized other than treatment condition which consisted of either a dance improvisation or dance control video to watch.

5.6.3 Materials and Apparatus

The same materials were used as in Experiment Two for the battery of cognitive tests. The improvisation tasks, did however differ.

The improvisation condition lasted for ten minutes and consisted of a video for participants to watch and dance to. A series of dance improvisation exercises were carried out, leading up to asking people to dance round the room in an improvised way. Dance improvisation exercises were designed to encourage people to spontaneously move different parts of the body in ways that they were not used to moving (see Appendix O for dance improvisation video).

The control condition also consisted of a video lasting ten minutes. However, instead of asking participants to move in different ways they were asked to copy the movements being made on the video. This eventually led to learning a simple, structured dance routine (see Appendix P for dance control video).

5.6.4 Procedure

This experiment followed the same procedure as for Experiment Two. However, instead of verbal improvisation, participants took part in dance improvisation or a control equivalent.

5.7 RESULTS

As with Experiment Two, outliers, as determined by descriptive analysis in the software program SPSS, and participants who did not engage in tasks were omitted from the data analysis. This resulted in 16 participants being excluded from the AUT and 18 participants excluded from the Divergent Maths task and the Matchsticks task. Eight participants were excluded in the LDT and CMT and six in the MRT.

5.7.1 Divergent Thinking Tasks

All divergent thinking tasks were scored and analysed according to the same method as Experiment Two (5.3).

Divergent Maths Task

Table 5.7 – Experiment Three Mean (SD) Divergent Maths scores according to treatment

		Response	Fluency	Originality	Flexibility
Improvisation (n=14)	**Pre**	4.64 (2.82)	2.42 (1.91)	.17 (.58)	1.64 (1.55)
	Post	6.57 (4.54)	3.50 (1.95)	.50 (.80)	2.29 (1.14)
Control (n=17)	**Pre**	4.41 (1.87)	2.94 (1.56)	.50 (1.00)	1.94 (.94)
	Post	4.18 (1.63)	3.00 (1.94)	.35 (.59)	1.94 (1.35)

Divergent Maths: Response

The divergent maths response score consisted of the number of responses made. For the Divergent Maths Response scores, there was no significant main effect of treatment, $F(1, 29) = 1.96$, $p > .05$. There was a significant main effect of time, $F(1, 29) = 4.09$, $p = .052$, partial $\eta^2 = .124$. There was a significant interaction between time and treatment, $F(1, 29) = 6.68$, $p = .015$, partial $\eta^2 = .187$.

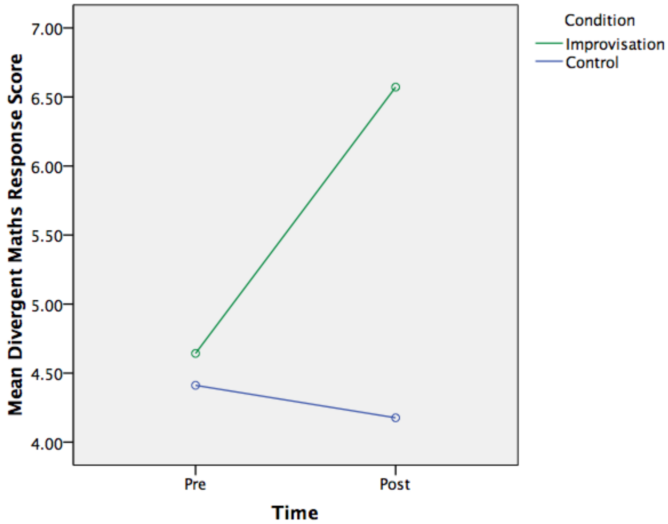

Figure 5.20: Experiment Three Divergent Maths Response scores pre and post treatment

Figure 5.20 demonstrates the relationship for this interaction such that scores in the improvisation group improved post treatment when compared to the scores of the control condition. To explore this significant interaction further, independent samples t-tests were carried out where a significant effect was found for post-treatment reaction time, $t(33) = 2.23$, p = ,033, $r = .48$ but no significant effect was found for pre treatment scores $t(30) = .51$, $p > .05$. This confirms that the control group became faster than the improvisation group with MRT scores. Furthermore, paired samples t-tests revealed a significant effect for the improvisation group $t(15) = -2.25$, $p = .03$, $r = .50$ but no significant effect for the control group, $t(19) = -.96$, $p > .05$ pre and post improvisation.

Divergent Maths Fluency, Originality and Flexibility

Divergent Maths Fluency, Originality and flexibility scores showed no significant effects for time ($p > .05$) or treatment ($p > .05$) and no significant interaction between time and treatment ($p > .05$). These results indicate that there were no differences in any Divergent maths scores other than the response.

Matchsticks Task

Table 5.8 - Experiment Three Mean (SD) Matchstick scores according to treatment

		Response	Fluency	Originality	Flexibility
Improvisation (n=13)	**Pre**	3.00 (2.65)	1.92 (2.63)	.15 (.38)	1.08 (1.04)
	Post	5.85 (4.62)	3.15 (3.44)	.69 (1.25)	1.85 (1.63)
Control (n=18)	**Pre**	4.50 (3.59)	2.00 (2.54)	.22 (.94)	1.11 (1.37)
	Post	4.00 (3.83)	2.22 (2.53)	.67 (1.24)	1.56 (1.38)

Matchsticks: Response

For the Matchsticks response scores, there was no significant main effect of treatment, $F(1, 29) = .02$, $p > .05$. There was no significant main effect of time, $F(1, 29) = 2.75$, $p > .05$, partial $\eta^2 = .124$. There was a significant interaction between time and treatment, $F(1, 29) = 5.59$, $p = .025$, partial $\eta^2 = .162$.
The interaction between time and treatment is displayed in figure 5.21.

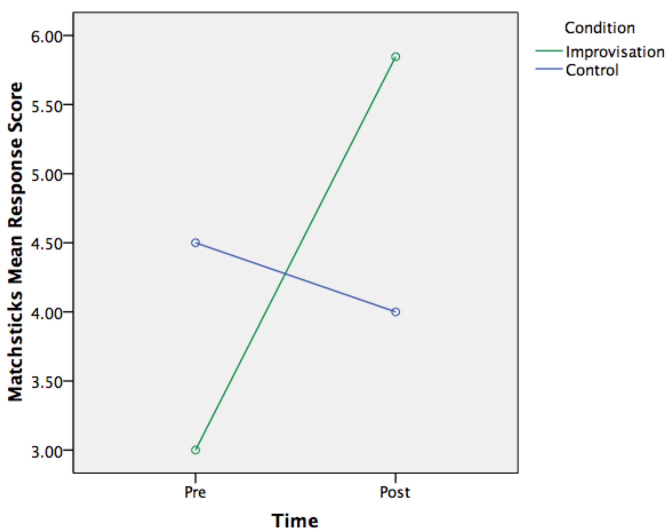

Figure 5.21: Experiment Three Matchsticks Response scores pre and post treatment

Figure 5.21 suggests that scores in the improvisation group improved post treatment when compared to the scores of the control condition. To explore this significant interaction further, independent samples t-tests were carried out which revealed no significant effect for pre treatment scores $t(41) = 1.88$, $p > .05$ or post treatment scores $t(41) = 3.50$, $p > .05$. Paired samples t-tests however, revealed a significant effect for the improvisation group $t(12) = -2.25$, $p = .052$, $r = .54$ but no significant effect for the control group, $t(17) = -.68$, $p >$ .05 pre and post improvisation.

Furthermore, an ANCOVA showed that when pre-test Matchstick response scores were covaried out, the main effect of treatment on post-test scores was significant $F(1, 28) = 3.89$, $p = .05$, partial $\eta^2 = .122$. The unadjusted means indicate that post scores are significantly different between the improvisation ($M = 5.85$) and the control condition ($M = 4.00$).

Matchsticks Fluency, Originality and Flexibility

A significant effect of time was found for Matchsticks Originality, $F(1, 29) = 5.93$, $p = .021$ and Flexibility, $F(1, 29) = 4.56$, $p = .041$. However, Matchsticks Fluency showed no significant effect of time ($p > .05$). Matchsticks Fluency, Originality and flexibility scores showed no significant main effect of treatment ($p > .05$). No significant interactions between time and treatment ($p > .05$) were found for any conditions. These results indicate that there were no differences in the remaining matchstick scores between conditions.

Alternative Uses Task (AUT)

Table 5.9 - Experiment Three Mean (SD) AUT scores before and after treatment

		Response	**Fluency**	**Originality**	**Flexibility**
Improvisation (n=14)	**Pre**	7.79 (5.31)	5.45 (4.11)	3.21 (4.23)	3.83 (2.55)
	Post	10.86 (4.47)	7.83 (4.83)	4.07 (5.00)	5.05 (3.27)
Control (n=19)	**Pre**	7.75 (5.14)	5.75 (4.09)	2.33 (2.99)	3.82 (2.66)
	Post	8.85 (3.69)	7.28 (3.37)	4.67 (3.94)	5.35 (2.54)

AUT Response, Fluency, Originality and flexibility scores showed significant effects for time ($p < .05$) but no significant main effect of treatment ($p > .05$) and no significant interaction between time and treatment ($p > .05$). These results indicate that there were no differences in any AUT scores between conditions.

5.7.2 Convergent Thinking Tasks

Mixed ANOVAs were carried out to determine if there were any changes in scores pre and post treatment, as well if there were any differences between the two treatment conditions. There were two factors; factor 1: Condition and factor 2: Time.

MRT

Table 5.10 - Experiment Three Mean (SD) MRT scores before and after treatment

		Response (%)	MRT Reaction Time (ms; Correct)	MRT Reaction Time (ms; Wrong)	MRT Reaction Time (ms; Total)
		n = 18	n = 18	n = 16	n = 18
Improvisation	**Before**	58.33 (22.82)	3683.47 (1638.40)	3003.05 (1218.86)	3690.30 (1520.50)
	After	62.22 (18.65)	3746.63 (1964.88)	3936.10 (2400.54)	3774.50 (2000.58)
		n = 25	n = 25	n = 24	n = 25
Control	**Before**	47.20 (20.52)	3468.75 (1717.70)	2830.00 (1548.41)	3162.56 (1542.82)
	After	50.40 (17.91)	2364.71 (1563.67)	2309.14 (1560.47)	2410.83 (1546.98)

MRT Reaction Time (Correct responses)

For the MRT reaction time of correct responses, there was no significant main effect of treatment, $F(1, 41) = 2.88$ $p > .05$. There was a significant main effect of time, $F(1, 41) = 4.55$, $p = .039$, partial $\eta^2 = .100$. There was a significant interaction between time and treatment, $F(1, 41) = 5.72$, $p = .021$, partial $\eta^2 = .122$.

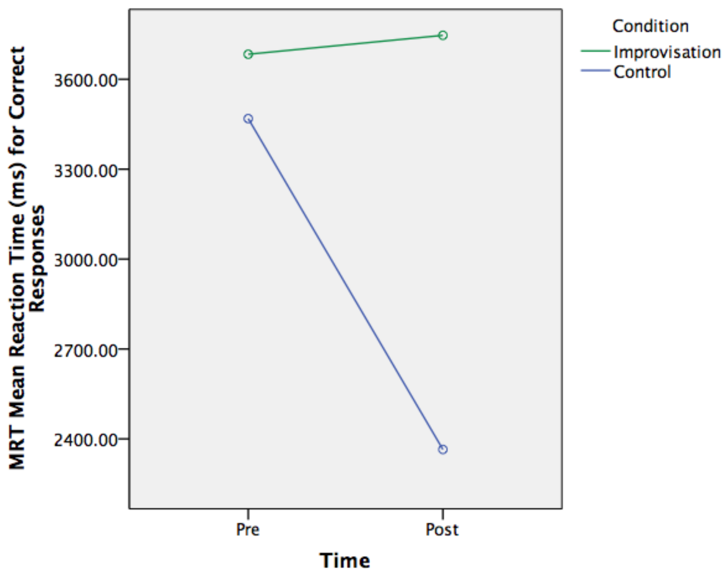

Figure 5.22 - Experiment Three MRT mean reaction time for correct responses pre and post treatment

Figure 5.22 suggests that the control group's reaction times became faster post treatment when compared to the scores of the improvisation condition. To explore this significant interaction further, independent samples t-tests were carried out where a significant difference was found for post-treatment reaction time, $t(41) = 2.57$, $p = .014$, $r = .37$ but no significant difference was found for pre treatment scores $t(41) = 1.88$, $p > .05$. This confirms that the control group became faster than the improvisation group with MRT scores.

The same results for MRT Reaction time emerged for incorrect and total responses. In both cases, there was no significant main effect of treatment ($p > .05$). There was a significant main effect of time ($p < .05$) and a significant interaction between time and treatment ($p < .05$) such that the control group became faster post treatment in comparison to the improvisation group.

LDT

Table 5.11 - Experiment Three Mean (SD) LDT scores before and after treatment

		Response (%)	LDT Reaction Time (ms; Correct)	LDT Reaction Time (ms; Wrong)	LDT Reaction Time (ms; Total)
		n = 18	n = 18	n = 12	n = 18
Improvisation	**Before**	93.41 (5.45)	775.68 (186.75)	3257.00 (5854.15)	792.11 (206.25)
	After	94.62 (4.52)	691.51 (128.85)	2992.13 (6103.69)	695.39 (134.51)
		n = 23	n = 23	n = 19	n = 23
Control	**Before**	89.99 (7.95)	857.48 (236.72)	5988.07 (10173.1)	869.57 (245.13)
	After	92.26 (5.07)	732.91 (172.42)	6363.98 (9244.51)	742.32 (186.54)

For the LDT response scores, there was no significant main effect of treatment, $F(1, 39) = 3.08$, $p > .05$. There was no significant main effect of time, $F(1, 39) = 3.26$, $p > .05$ and there was no significant interaction between time and treatment, $F(1, 39) < 1$, $p > .05$. These results suggest that there were no differences for LDT response scores according to condition pre and post treatment.

LDT Response and reaction time scores showed no significant main effect of treatment ($p > .05$). A significant effect of time was found for LDT Reaction time correct, $F(1, 39) = 17.63$, $p < .001$ and total responses, $F(1, 39) = 20.12$, $p < .001$. However, LDT response and reaction time for incorrect answers revealed no significant effect of time ($p > .05$). No significant interactions between time and treatment ($p > .05$) were found for any conditions. These results indicate that there were no differences in LDT in relation to treatment condition.

CMT

Table 5.12 - Experiment Three Mean (SD) CMT scores before and after treatment

		Attempted (%)	Response (%)	CMT Reaction Time (Correct)	CMT Reaction Time (Wrong)	CMT Reaction Time (Total)
		n = 17	n = 17	n = 17	n = 12	n = 17
Improvisation (N=17)	**Pre**	78.07 (24.07)	61.62 (24.55)	24068.64 (13618.3)	40733.29 (30962.0)	32691.44 (18927.7)
	Post	82.89 (16.97)	66.43 (15.42)	21718.59 (7232.17)	31860.90 (17790.1)	25733.35 (7919.45)
		n = 24	n = 24	n = 24	n = 19	n = 24
Control (N=24)	**Pre**	78.41 (14.88)	60.95 (18.82)	24275.25 (18572.0)	36426.90 (12410.3)	29788.05 (17102.4)
	Post	81.44 (14.80)	55.73 (14.91)	21348.11 (8884.37)	31702.77 (11511.9)	25775.37 (7853.04)

CMT Attempted, Response and reaction time scores showed no significant main effect of treatment ($p > .05$). CMT Reaction time for the total response showed a significant effect of time $F(1, 39) = 6.54$, $p = .015$. However, CMT response and reaction time scores for correct and incorrect answers revealed no significant effect of time ($p > .05$). No significant interactions between time and treatment ($p > .05$) were found for any conditions. These results indicate that there were no differences for the CMT in relation to treatment condition.

5.7.3 Further Analysis

As with the results of Experiment Two, the idea that ceiling effects could be present were tested. Again, what participants scored in their cognitive tests pre-treatment was taken into account. Only significant effects are presented below. Furthermore, further analysis was not carried out on already significant results (refer to Appendix D for matrix table).

CMT Response

CMT Response scores involved using sample sizes that were too small to carry out a repeated measures ANOVA on the highest and lowest scorers (Highest=8 and Lowest=7). Therefore, the top 20% of scores were excluded from the analyses and a 2x2 mixed ANOVA conducted. For the CMT Response scores, there was no significant main effect of treatment, $F(1, 33) = .07$, $p > .05$ and no significant main effect of time, $F(1, 33) = 2.27$, $p > .05$. However, there was a significant interaction between time and treatment, $F(1, 33) = 4.89$, $p = .034$, partial $\eta^2 = .129$.

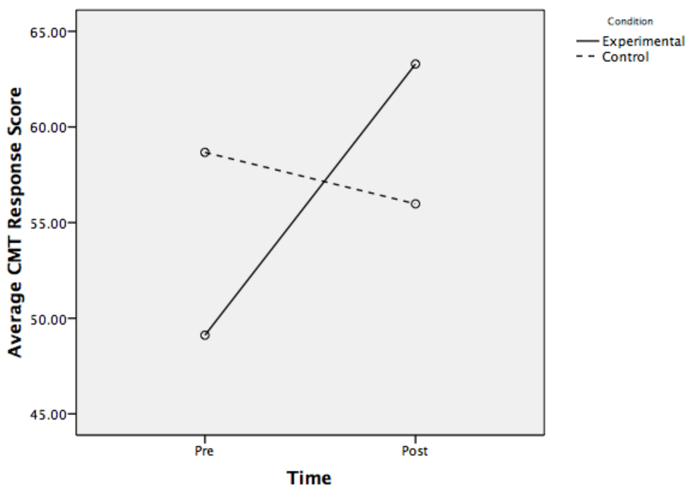

Figure 5.23: Experiment Three post hoc analysis; CMT Response Scores pre and post treatment with high pre-scores excluded

Figure 5.23 shows the relationship of this interaction and suggests an increase in the improvisation treatment condition but not in the control. This is confirmed by independent samples t-tests on the total sample which found no significant effects for pre scores $t(46) = -.37$, $p > .05$ but did find a significant effect on post scores $t(45) = -2.63$, $p = .012$.

Furthermore, an ANCOVA on the total sample found that when pre-test CMT Response scores were covaried out, the main effect of treatment on post-test scores was significant $F(1, 44) = 6.96$, $p = .016$, partial $\eta^2 = .137$. The unadjusted means indicate that post scores are significantly higher post improvisation ($M = 67.78$) in comparison to the post scores of the control condition ($M = 55.78$).

5.8 DISCUSSION

The present study found that following ten minutes of dance improvisation, scores on divergent thinking tasks increased but did not increase in tasks of convergent thinking. Results found a significant increase in divergent maths response scores and matchsticks response scores following dance improvisation but not following a convergent equivalent. Furthermore, participants in a control condition became significantly faster in MRT reaction times when compared to the improvisation condition. Furthermore, when pre treatment scores were taken into account, CMT Response scores increased following improvisation.

It is not surprising that the effects observed are in the visuo-spatial and mathematical domains. As discussed in Chapter 4, these areas tie in with dance improvisation, therefore suggesting that benefits occur but only in areas of cognition found to be linked to the domain of improvisation taking place.

5.9 SUMMARY OF EXPERIMENT TWO & THREE RESULTS

Experiments Two and Three adopted the same method but used two different forms of improvisation; verbal and dance improvisation. Results differed according to the type of improvisation and these are summarized in table 5.13.

Table 5.13 summarizes what significant effects were observed across Experiments Two and Three. Only the subscales of significant measures are mentioned and the group (improvisation or control) of where an increase in scores or a quicker reaction time was observed is indicated.

Table 5.13 – Summary of Experiments Two and Three battery of cognitive tests results

	Cognitive task	Experiment Two (Verbal)	Experiment Three (Dance)
Divergent Thinking	**AUT**	Fluency, Flexibility [Improvisation]	$p > .05$ in all cases
	Divergent Maths	Originality, $p = .057$ [Control]	Response [Improvisation]
	Matchsticks	$p > .05$ in all cases	Response [Improvisation]
Convergent Thinking	**LDT**	$p > .05$ in all cases, Further analysis: Reaction Time [Control]	$p > .05$ in all cases
	MRT	$p > .05$ in all cases, Further analysis: Reaction Time [Correct; Control]	Reaction Time [Control]
	CMT	$p > .05$ in all cases, Further analysis: Response [Improvisation]	$p > .05$ in all cases, Further analysis: Response [Improvisation]

Table 5.13 indicates improvisation to have an impact on divergent thinking tasks post treatment while in convergent thinking tasks, reaction time scores become quicker for those in the control condition. This pattern is shown across both experiments but the specific task and therefore cognitive domain differs between the two experiments.

5.10 GENERAL DISCUSSION

Experiments Two and Three were designed to look at the impact improvisation has on various cognitive tasks and, in particular, to determine whether improvisation had a different impact when looking at divergent or convergent thinking tasks. Overall, significant changes were observed following improvisation in tasks involving divergent thinking but not in tasks that involved convergent thinking. Surprisingly, participants elicited significantly faster reaction times in the convergent thinking tasks following the control condition and not improvisation. Furthermore, the two different domains of verbal and dance improvisation were found to show effects in different cognitive tasks.

The domain of improvisation appears to have an impact on different cognitive tasks such that verbal improvisation has an impact on verbal tasks while dance improvisation has an impact on tasks involving visuo-spatial and mathematical abilities. Furthermore, divergent and convergent thinking appears to be affected by different treatment conditions. Improvisation improves scores on divergent thinking tasks but not convergent thinking tasks. An improvement in the verbal improvisation group was seen in the AUT divergent thinking task. However, no other changes were observed with divergent thinking tasks following verbal improvisation, suggesting effects are limited to the verbal domain. However, positive changes following dance improvisation in a divergent maths task and a visuo-spatial divergent task were observed in Experiment Three. Convergent thinking tasks were found to show changes in reaction times, such that the control group became faster in both experiments for the MRT as well as the LDT in Experiment Two. This was an unpredicted result that found differences between thinking and treatment condition.

However, two unexpected results also occurred, where CMT response was found to significantly increase post dance improvisation and Divergent maths originality was found to increase for the control condition in Experiment One.

It is thought that ceiling effects occurred in these experimental conditions, especially when concerning verbal improvisation as some of the tasks used only revealed significant effects when the highest pre-test scores were eliminated. This suggests that the effects seen regarding improvisation may only occur when participants score a certain level or below. By scoring highly to begin with, little room for improvement is given for participants who, if scoring highly in a divergent thinking task, are likely to be of a higher creativity level. The idea of ceiling effects occurring is supported by comparing pre-treatment scores to the previous experiments in this program of research. Scores in participants who took part in the dance improvisation were generally lower than those in the verbal improvisation condition. This was also apparent when comparing scores of Experiment Two to Experiment One. In addition to the findings observed in Experiments Two and Three when looking at the differences between the highest and lowest responses, Experiment One was reanalyzed in the same way. Due to difficulties in sample size and distribution, ATTA and COWA were re-analyzed using mixed ANOVAs with the top 20% of scores omitted. As observed in 5.3, ATTA Fluency was close to significance. These results showed a significant interaction for ATTA Fluency between time and condition, $F\,(1, 36)$ =

6.74, p = .014, such that improvisers improved post improvisation in comparison to the control condition. No further effects, however were observed (see appendix E for matrix table).

These findings suggest that domain specifity does occur in cognitive tests according to the type of improvisation being used with a difference occurring in verbal improvisation but not following dance improvisation in the AUT – a verbal based divergent thinking task. However, it is important to note that the dance improvisation task was of a shorter duration and it cannot be ruled out that this is the reason verbal effects were not found in this study, such that not enough treatment is being received to show these effects. However, dance improvisation did reveal significant differences in convergent visuo-spatial and mathematical thinking tasks. Some of these visuo-spatial findings were replicated in verbal improvisation such that the control group of the MRT became faster post treatment. However, this was only when the highest and lowest pre-scores were taken into account. This suggests that the style of improvisation that is being undertaken has an influence on the type of cognitive task that an increase in scores occur in.

No significant differences were observed in either verbal or dance improvisation when looking at the matchsticks task, a visuo-spatial, divergent thinking task. This is surprising, considering the significant results observed with the ATTA in Experiment One. It is possible that the ATTA is a better task with a better scoring system than that of the matchsticks task. Participants appeared to find one version more difficult than another, and although counterbalanced, often did not read the instructions properly in post tests regarding the number of squares they needed to leave. This, as a consequence, had an impact on the results and therefore the scoring of the matchsticks task. It would be interesting to replicate results of the ATTA in verbal improvisation as well as to determine whether any significant effects are seen in dance improvisation, particularly as significant differences were found in the MRT, a convergent, visuo-spatial task.

These results provide further support towards a theory of schemas in relation to improvisation. It is thought that improvisation encourages people to break away from their set patterns of thinking. This in turn encourages people to think in many different ways and therefore produce more answers in tasks involving divergent thinking. The current experiments indeed show an increase in the production of divergent thinking following improvisation. Furthermore, significant increases in flexibility were observed in the AUT for Experiment Two, again suggesting that schema switching increases post improvisation. The difference in the results of divergent and convergent thinking tasks also supports the idea that improvisation involves breaking away from set patterns of thinking. Convergent thinking requires people to obtain a single answer, simply classed as right or wrong. Thinking outside of the box, the type of thinking that improvisation elicits, may not benefit people in achieving this answer. In particular, the current set of tasks involved very simple convergent thinking tasks which did not require a different type of thinking to achieve the answer. It has been suggested that thinking in different ways can help people with more complex tasks of convergent thinking as they are able to think and use a variety of different routes when one method does not work (Webster, 1990; Runco, 2004). This could provide an explanation as to why people in the improvisation condition elicited higher scores post treatment in the CMT, as this task involved a more complex method of thinking and problem solving. Further evidence to support this idea is shown by the control condition developing faster reaction times following a rigid set of either choreographed dance or conversations. However, what is unknown here is whether people in the control condition got faster due to taking part in a very structured and rigid treatment condition, or whether improvisation, by helping people think in a variety of different ways in fact hindered the speed at which people could perform simple convergent thinking tasks.

Further research needs to investigate the idea of ceiling effects occurring and whether creativity scores pre treatment has an impact on the results. However, as noted previously, scores on the AUT were higher in Experiment Two when compared to Experiments One and Three. More results of higher initial scores on the AUT pre-treatment are needed to determine and replicate whether this effect really does occur. Furthermore, if this were the case, it may be possible to determine who will improve following improvisation according to original creativity levels, such that if high scores of creativity are exhibited before any treatment has taken place, then improvisation will not have an effect on these people.

Scores on the AUT have been found to improve following improvisation in both Experiments One and Two. Further research now needs to establish whether these findings can be replicated in other verbal divergent thinking tasks to determine whether the results can be extended to multiple tasks of divergent thinking.

Furthermore it would be beneficial to determine whether computerized versions of the task in comparison to written tasks can elicit different scores. Some researchers (Lee & Weerakoon, 2001; Wierenga & van Bruggen, 1998) have suggested that levels of creativity can be affected by the method that they give the response, such that giving answers on a computerized version on the task, can inhibit levels of creativity.

Further research is also needed concerning the length of improvisation needed to achieve an increase in divergent thinking tasks. This would be beneficial in order to determine what the optimum level of improvisation is in order to get the effects observed. As well as this, it would be useful to determine how long the effect lasts for. Within the latter, it would be beneficial to determine whether any long-term effects of improvisation can be seen in expert improvisers in comparison to novice improvisers.

In conclusion, the findings of Experiments Two and Three show that improvisation has a benefit on cognitive tasks that involve divergent thinking. However, no benefit is seen following improvisation on a convergent thinking task. This provides further support to a theory of improvisation and schemas, such that people need to be able to break away from their set patterns of thinking to increase levels of creativity. Future research could be conducted in many different areas including the exploration of the effect of improvisation on convergent and divergent thinking tasks, whether ceiling effects occur or whether creativity levels beforehand can determine if an improvement in cognition will be seen, the optimum length of improvisation needed to achieve benefits in cognition, how long these cognitive effects last for and whether long-term effects can be seen in expert improvisers.

Chapter 6: Divergent thinking; Differences among Expert and Novice improvisers

The battery of cognitive tests developed in Chapter 5 were constructed to be used in relation to verbal, dance and music improvisation. Initially, the intention to this chapter was to look at the differences in cognition pre and post a series of music improvisation tasks. However, it became apparent early on that musicians baseline scores were higher than baseline scores of Experiments One to Three. Therefore, the idea that expert and novice improvisers may display cognitive benefits without being tested immediately after improvisation was explored.

6.1 INTRODUCTION

Experiments One to Three demonstrated a significant increase in scores of divergent thinking tests following a series of improvisation activities. One theory behind this is thought to be related to the schema theory such that improvisation helps us to break away from set patterns of thinking, thus enabling greater access to a range of schemas and the ability to think of original ideas due to thinking outside of our regular ways of thinking.

Pilot Study Three (Lewis, 2008) carried out a study on musicians using the same methodology as Experiments One to Three. Thirty-six musicians took part in twenty minutes of either music improvisation tasks or a control equivalent, where they were simply asked to practice a piece they were learning. Of the total sample, 24 musicians improvised and 12 musicians took part in the control condition. Those improvising were further divided into jazz musicians (n=12) and classical musicians (n=12). Results found that those who improvised showed an increase in AUT Fluency scores as well as in the COWA. No effects occurred in a task of convergent thinking, as measured by the LDT. Jazz musicians showed a larger increase in AUT Fluency scores post improvisation when compared to classical musicians. Furthermore, a convergent thinking task, designed for the study looking at musical abilities found that classical musicians improved post improvisation but that jazz musicians did not due to obtaining a significantly higher proportion of correct answers pre treatment.

As discussed in Chapter One, it has been suggested by a number of researchers (Alterhaug, 2004; Crossan & Sorrenti, 1997; Snowber, 2002) that knowledge and expertise are key elements that are needed in improvisation. This is particularly emphasized in definitions of music improvisation (Barrett, 1998b; Carter, 2000; Vera and Crossan, 2005). It has also been suggested that a wider use of schemas is dependent on expertise. Borko and Livingston (1989, 1990) demonstrated that expert teachers are better at improvising away from lesson plans within their teaching style. These authors attributed this to the schemas the teachers have built up through experience, suggesting that expert teachers were able to be more flexible with schemas through knowledge and experience in comparison to novice teachers. These studies suggest that experts in a particular field are able to be more flexible in their way of thinking. It is therefore feasible that people who improvise on a regular basis may therefore have a broader knowledge area. Consequently, they will be used to thinking on the spot, in a variety of different ways, which may in turn be due to a lighter level of workload being experienced in working memory.

6.2 PILOT STUDY TWO

Pilot Study Two aimed to determine whether the effects of cognitive abilities observed in earlier experiments could be found in musicians. As this had to be carried out on musicians, a pilot was conducted to determine whether this difference in experience could have an impact on cognitive abilities, pre and post improvisation. Experiments Two and Three looked at the effects of verbal and dance improvisation in relation to a battery of cognitive tests designed to look at both differences between divergent and convergent thinking, as well as three different domains of cognition; verbal, visuo-spatial and mathematical abilities. As discussed in Chapter 4.2, music has been found to link to tasks involving visuo-spatial abilities (Aleman, et al., 2000; Brochard, et al., 2004; Hetland, 2000). In addition to this, in a review in 2001, Schellenberg suggested that musicians had improved scores in verbal and mathematical tasks, as well as visuo-spatial abilities.

This study aimed to replicate and extend the findings of Experiments Two and Three by replicating the results with music improvisation. The experimental hypotheses for this experiment were:

1. There will be a significant difference following twenty minutes of improvisation in comparison to the control condition in tasks of divergent thinking.
2. Based on an a-priori perspective, there will be no significant differences following twenty minutes of improvisation in comparison to the control condition in tasks of convergent thinking.

6.2.1 Method

The same Design, Procedure and Materials as Experiments Two and Three was utilized in this study. Improvisation tasks, however did differ such that the improvisation condition consisted of jazz musicians taking part in twenty minutes of a jazz improvisation workshop.

Participants

Participants in the music improvisation condition were all Masters Jazz students at the Guildhall School of Music and Drama. Six participants (four males and two females) took part in the pilot study with a mean age of 27. Six participants from Experiments Two and Three were taken to for baseline comparisons and therefore treated as novice controls. All participants took part in an improvisation condition.

6.2.2 Results

Preliminary Analysis

Due to errors with computer equipment, only three participants from the music improvisation condition were able to take part in the matchsticks task. These were not counterbalanced and therefore excluded from the analysis. For all scores in the AUT and divergent maths task, preliminary analysis of music improvisers via a paired samples t-test revealed no significant differences pre and post treatment ($p > .05$ in all cases). Furthermore, paired samples t-tests for scores in convergent thinking tasks also revealed no significant differences ($p > .05$) pre and post improvisation. One significant difference did emerge, such that a paired samples t-test revealed a difference between pre ($M = 77.49$) and post ($M = 63.23$) Convergent Maths Response scores, such that participants scores on this task were lower post improvisation.

AUT Baseline Scores

Descriptive statistics of the AUT for jazz musicians suggested that baseline scores of the AUT may be higher than Experiments Two and Three. Independent samples t-tests were therefore carried out to determine if there was a difference between the jazz musicians pre-treatment AUT scores and a sample of six random participants from Experiments Two and Three. These two groups were labeled as expert and novice improvisers. Descriptive statistics are shown in table 6.1.

Table 6.1 – Pilot Study Two Mean (SD) AUT scores according to jazz musicians and novice improvisers

	AUT Response	AUT Fluency	AUT Originality
Expert	11.00	9.00	3.33
(n=6)	(2.83)	(2.37)	(2.50)
Novice	4.50	3.33	1.00
(n=6)	(1.87)	(1.86)	(1.26)

An independent samples t-test revealed a significant difference between expert and novice improvisers mean response scores, $t(10) = 4.70$, $p = .001$. A significant difference was also found in expert and novice improvisers mean fluency scores, $t(10) = 4.61$, $p = .001$. However, no significant difference was found between mean originality scores, $t(10) = 2.04$, $p = .069$.

Additional AUT Baseline Sample

Six jazz musicians from Pilot Study Three attending the Guildhall School of Music and Drama were added to the above data set (N=12). Furthermore, another six participants from Experiments Two and Three were randomly allocated to the data set (N=12) and results re-analyzed.

Table 6.2 – Pilot Study Two; further analysis: Mean (SD) AUT scores according to jazz musicians and novice improvisers

	AUT Response	AUT Fluency	AUT Originality
Expert	10.25	8.33	3.08
(n=12)	(3.84)	(4.08)	(2.81)
Novice	5.17	4.25	1.33
(n=12)	(2.41)	(2.67)	(1.37)

An independent samples t-test revealed a significant difference between expert and novice improvisers mean response scores, $t(22) = 3.89$, $p = .001$, $r = .64$. A significant difference was also found in expert and novice improvisers mean fluency scores, $t(22) = 2.90$, $p = .008$, $r = .53$. However, no significant difference was found between mean originality scores, $t(15.95) = 1.94$, $p > .05$.

6.2.3 Discussion

This study aimed to replicate and extend the findings of Experiments Two and Three using music improvisation. However, when testing jazz musicians at the Guildhall School of Music and Drama, a different pattern appeared to be emerging, such that postgraduate jazz musicians did not show an improvement in the battery of cognitive tests following twenty minutes of music improvisation. Upon analyzing the data it was noticed that jazz musicians had significantly higher scores on the AUT, in relation to the previous two experiments before the improvisation tasks had taken place.

Additional AUT baseline results were obtained by adding six jazz musicians to the data set from the Guildhall School of Music and Drama, who had taken part in Pilot Study Three. A further six novice participants selected at random from Experiments Two and Three were subsequently added. Data was reanalyzed with this sample (N = 24) and the same results achieved as with the original set of data.

It should be considered that expert and novice improvisers were from different domains of performing arts. Expert improvisers were musicians while novice improvisers had participated in either verbal or dance improvisation. It is therefore not possible to say that the results are due to expert improvisers as they could be indicating differences between musicians and non-musicians. Future experiments should therefore test people from the same domain of improvisation.

These preliminary findings suggest differences between expert and novice improvisers. This led to the question of whether people who improvise on a regular basis display long-term cognitive benefits from the act of improvisation.

6.3 EXPERIMENT FOUR: INVESTIGATING DIVERGENT THINKING BETWEEN EXPERT AND NOVICE IMPROVISERS

In line with the above findings, the current study aimed to find whether experts in the field of improvisation score higher in tasks of divergent thinking. Therefore, expert and novice improvisers scores on baseline divergent thinking scores were compared.
The experimental hypothesis was that expert improvisers would score significantly higher than novice improvisers on a task of divergent thinking, in this case the AUT.

6.4 METHOD

6.4.1 Participants

The sample consisted of 40 participants, 21 expert improvisers in the domains of verbal and music improvisation and 19 novice improvisers within verbal improvisation. Expert improvisers were defined as those who had improvised on a regular basis, while novice improvisers were defined as people who had rarely or never improvised before.
Participants were recruited via an opportunity sample. Expert improvisers were at the Edinburgh Fringe Festival performing in a verbal improvisation group (n=16) or were jazz musicians attending the Guildhall School of Music and Drama (n=5). Novice improvisers were all students at the University of Hertfordshire.

6.4.2 Design

A between subjects design with two levels (expert and novice) was used.
The independent variable was whether participants were expert or novice improvisers.
The dependent variable was the AUT Fluency score.
The experimental hypothesis was that expert improvisers would elicit higher scores at baseline on the AUT in comparison to novice improvisers.

6.4.3 Materials and Apparatus

The AUT, as described in Chapter 3.2.3 was used. The target object used for this experiment was a remote control.

6.4.4 Procedure

Expert improvisers performing at the Edinburgh Fringe Festival were written to prior to the festival taking place. They were asked if it would be possible to take part in a short, three minute cognitive test prior to their improvisation show. The experimenter then met the expert improvisers at the venue they were performing at a designated meeting time and following written consent asked participants to complete the AUT in groups of twos or threes, with the standardized instructions used (see Chapter 3.2.3). Once completed, participants were thanked for their time and were given the opportunity to discuss and ask questions about the current research. The remaining improvisers attended the Guildhall School of Music and Drama. They were written to and a time arranged to visit prior to a jazz improvisation session. Again, following written consent, participants were asked to complete the AUT before improvisation began.

Novice improvisers were approached at the University of Hertfordshire in a tutorial group meeting and were undergraduate psychology students. All students took part in the experiment and following written consent, were administered the AUT. Upon completion, those who considered themselves to have experience in improvisation were then asked to write this down on their answer sheet. All participants were thanked for their time and given a debrief sheet.

6.5 RESULTS

AUT was scored for Response, Fluency, Originality and Flexibility. The means are presented in table 6.3.

Table 6.3 – Experiment Four Mean (SD) AUT scores for expert and novice improvisers

	AUT Response	AUT Fluency	AUT Originality	AUT Flexibility
Expert	9.95	9.00	7.95	7.38
(n=21)	(3.79)	(3.22)	(6.89)	(3.01)
Novice	7.79	5.42	2.00	1.84
(n=19)	(3.71)	(3.17)	(1.70)	(1.86)

AUT: Fluency

An independent samples t-test revealed a significant difference between expert and novice improvisers, $t(38) = 3.54$, $p = .001$, $r = .50$ showing that expert improvisers produced significantly more valid AUT answers than novice improvisers.

AUT: Originality

Originality was scored using the same method as Experiments Two and Three, such that the responses that appeared in the top 1% and 5% in a database of responses were given points of originality. An independent samples t-test revealed a significant difference between expert and novice improvisers originality scores, $t(38) = 3.66$, $p = .001$, $r = .51$. Again, expert improvisers had significantly higher originality scores in comparison to novice improvisers.

AUT: Flexibility

An independent samples t-test for AUT flexibility scores revealed a significant difference between expert and novice improvisers, $t(38) = 7.07$, $p < .001$, $r = .75$ showing that expert improvisers use a significantly wider range of categories as opposed to novice improvisers.

AUT: Response

An independent samples t-test for AUT Response scores showed no significant difference between expert and novice improvisers, $t(38) = 1.82$, $p > .05$, showing that expert improvisers and novice improvisers come up with the same number of responses, when validity of response is not taken into account.

Post-hoc Analyses

In the current sample, five of the expert improvisers were musicians. In order to establish that results did not differ according to the domain of improvisation that expertise occurred in, independent samples t-tests were re-conducted on the expert verbal improvisers (n = 15) only.

An independent samples t-test for AUT Fluency scores revealed a significant difference between expert (M = 9.00) and novice (M = 5.42) improvisers, $t(32) = 3.09$, $p = .004$, $r = .48$ showing that expert improvisers produced significantly more valid AUT answers than novice improvisers. AUT Originality scores also revealed a significant difference between expert (M= 9.80) and novice (M = 2.00) improvisers, $t(32) = 4.54$, $p < .001$, $r = .61$ such that expert improvisers had significantly higher originality scores than novice improvisers. AUT Flexibility scores again revealed a significant difference between expert (M = 7.27) and novice (M = 1.84) improvisers, $t(20.81) = 5.65$, $p < .001$, $r = .78$ showing that expert improvisers use a significantly wider range of categories as opposed to novice improvisers. Finally, AUT Response scores showed no significant difference between expert (M = 9.53) and novice (M = 7.79), $t(32) = 1.30$, $p > .05$, showing that expert improvisers and novice improvisers come up with the same number of responses, when validity of response is not taken into account.

Results therefore did not differ according to the domain of improvisation that improvers were considered to be experts in.

6.6 DISCUSSION

The present study found that scores on an AUT were significantly higher for expert improvisers in terms of fluency, originality and flexibility when compared to novice improvisers. These preliminary results give an indication that there may be longer lasting benefits of improvisation such that those who improvise on a regular basis appear to have long-term benefits by being able to produce more answers on a divergent thinking task before taking part in improvisation tasks.

It should also be noted that the expert improvisers in the current sample consisted of verbal improvisers along with five musicians. Analyses were undertaken with music improvisers excluded from the sample and no differences in the results were observed.

These results support the suggestions made by Borko and Livingston (1989) such that expert improvisers show more use of schematic knowledge. However, it is not clear how this is done. It may be that expert improvisers have built up a large knowledge base, as suggested by Livingston and Borko (1990), meaning that they have more access to schemas or it may be that expert improvisers become used to having to think in a number of different ways and are simply more flexible at accessing and making new links with their already developed schemas. In this sense an improvement is seen in the ability to switch between schemas. The results seen in Experiments One to Three suggest that breaking away from set patterns of thinking results in an increase in schema switching as well as greater access to novel schemas. As the results were seen after a series of improvisation tasks, this suggests that it is not simply a matter of having acquired more knowledge and therefore a greater number of schemas as these experiments were carried out on novice improvisers. However, it is possible that the results seen here in Experiment Four are due to a combination of the two ideas, such that improvisers become used to breaking away from everyday thinking patterns but that they also gain a more extensive schematic knowledge base during this process.

While these results appear to show long-lasting effects of improvisation, it is unknown whether this is because expert improvisers are considered expert for a reason such that, as Webster (1990) and others (Plucker & Renzulli, 1999; Runco, 2007; Ryder, Pring, & Hermelin, 2002) suggested, particularly creative people exhibit a divergent style of thinking. In this sense, it may be that because they are particularly good at divergent thinking, they are naturally good at improvisation. These effects would have therefore been present before any long-lasting effects of improvisation could occur.

Future research should focus on replicating the current results with a larger sample size, in various domains of improvisation and across different cognitive tasks in order to determine whether lasting effects of improvisation are both domain specific and whether they extend to various areas of cognitive abilities. Furthermore, it would be interesting to determine whether expert improvisers have any differences in tasks of convergent thinking. A difference between expert and novice improvisers in these tasks may indicate whether the effects observed in Experiments Two and Three are due to improvisation inhibiting areas of convergent thinking or, if there are no differences, whether it may be due to the control conditions influencing people to think in very structured ways.

Overall, these findings indicate that by comparing AUT scores of expert and novice improvisers, there may be long-term benefits to improvising on a regular basis. This therefore encourages the question of how long the effects observed in Experiments One to Three last following improvisation in novice improvisers. However, before this can be determined the optimum length of improvisation first needs to be assessed as it may be that varying amounts of improvisation have different or more pronounced effects on cognitive tasks. In short, the evidence appears to suggest that people who take part in a large amount of improvisation (expert improvisers) have long lasting effects on certain cognitive tasks. This explains why the effects that twenty minutes of improvisation enhances problem solving observed in Experiments One to Three were not seen in expert improvisers. This leads to the question of how much improvisation is needed to lead to these enhanced effects of problem solving. However, before determining the long-lasting effects of improvisation, it is necessary to determine how much improvisation is needed to achieve the same effects observed in Experiments One to Three.

Chapter 7: Experiment Five: Length of Treatment; Cognitive effects following a shorter improvisation treatment length.

Experiments One and Two observed an increase in scores of verbal divergent thinking tasks following twenty minutes of verbal improvisation. Experiment Three replicated these findings in different cognitive tasks following ten minutes of dance improvisation. As discussed in Chapter 5.9, there are various ways in which these findings need to be extended. One of these is to look at the length of the treatment condition – how long do people have to improvise for in order to see cognitive benefits? This is addressed in the following chapter. It is concluded with a summary of all the results investigating the impact of improvisation on cognition.

7.1 INTRODUCTION

The findings of Experiments One to Three have raised further questions surrounding the benefits that improvisation can have on the way we think including how long the effect lasts for and how long people need to improvise for these effects to be observed. Scott et al. (2001) found recalling a dramatic monologue improved following thirty minutes of improvisation (see 2.1.1). Experiments One and Two found effects in verbal divergent thinking tasks following twenty minutes of verbal improvisation and Experiment Three found effects in visuo-spatial and mathematical divergent thinking tasks following ten minutes of dance improvisation, suggesting that short-term effects can be incurred in less than twenty minutes of improvisation.

It has also been suggested that ceiling effects have occurred in previous experiments such that participants who scored the highest in pre-tests did not show any cognitive increases post treatment. It would therefore be beneficial to look at pre-test levels of divergent thinking scores and see if this has an impact on the benefits that are seen following improvisation. If ceiling effects do occur, the cut-off score for when cognitive benefits stop occurring post treatment needs to be determined.

The results from Experiment Two suggest that these effects may be particularly prevalent in tasks involving verbal divergent thinking. In addition to this, Experiment Three indicated that effects of improvisation could be seen from as little as ten minutes of dance improvisation. Only the AUT has been used in previous experiments to assess verbal divergent thinking. Therefore, the idea that effects of improvisation on divergent thinking could occur after ten minutes of improvisation was explored along with whether this effect could be determined within the domain of verbal improvisation.

Experiment Five therefore aimed to investigate whether the effects of verbal improvisation previously observed could be found after less than twenty minutes of improvisation and whether the findings in the AUT could be replicated in other verbal divergent thinking tasks. The experimental hypothesis was that scores of verbal divergent thinking tasks would significantly increase following ten minutes of improvisation in comparison to a control equivalent.

7.2 METHOD

7.2.1 Participants

The study consisted of a convenience sample of 43 participants from the University of Hertfordshire who each took part via the SONA online participation sign-up system in return for one hour's course credit. The experiment was carried out in groups of between three and eight people and due to the nature of the tasks, it was requested that English was the first language. Groups were randomly divided by condition, resulting in 20 participating in the improvisation condition and 23 in the control condition.

7.2.2 Design

A 2x2 mixed design was implemented, consisting of two factors. 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 10 minutes of improvisation or 10 minutes of a verbal discussion. The Independent Variable was the treatment condition. The Dependent Variables were the scores and sub-scores on tests of verbal divergent thinking; the AUT and COWA.

This study has received ethical approval, protocol number: PSY/10/10/CL

7.2.3 Materials and Apparatus

Two verbal divergent thinking tests were used; the AUT and COWA. The AUT required participants to write down as many different uses for a common object within three minutes and used the same instructions as in Experiment One (see Chapter 3.2.3).

The COWA, a verbal fluency task, required participants to write down as many different words as they could think of in three minutes. A different target letter was used for each minute of the task. These letters were chosen by Benton (1969) as they have a similar number of words in the English dictionary and are of equal difficulty. Instructions given to participants were:

" I am going to give you a letter from the alphabet. I would like you to think of as many words as you can think of which begin with that letter in the space of one minute. The words can be anything you like other than proper names, such as names of people or places; or a word you have already used but with a different ending. For example, if was to give you the letter 'S', you could write 'slow' but you would not get another point for writing 'slower'. This test will last three minutes in total. You will be given three different letters, a minute for each different letter. Do you have any questions?"

Two versions of the same test were used and counterbalanced. The two letters given to participants were C, F, L and P, R, W.

Interventions were the same as that of Experiments One and Two and consisted of either ten minutes of verbal improvisation exercises (Appendix B) or ten minutes of a control condition consisting of verbal interaction exercises (Appendix C). These conditions were kept the same as previous experiments by halving the twenty minute verbal exercises such that improvisation games were only performed once each.

7.2.4 Procedure

Participants were recruited through the University of Hertfordshire's research study participation system. Eight slots were given for each study time advertised and an hour was awarded to each participant who took part. Following consent, participants were then given the AUT and COWA. Once completed, participants then took part in a verbal intervention; improvisation or verbal interactions in an adjacent room. After ten minutes, participants were then asked to complete the AUT and COWA again. Upon completion of the tests, they were then debriefed and thanked for their time.

7.3 RESULTS

Both the AUT and COWA were scored for Response and Fluency. In addition Flexibility was scored for the AUT. Originality was not scored due to inconsistencies described in Chapter 8. With responses being added to a common response list, originality scores were not consistent across experiments, as the larger the sample that the list is based on, the less likely originality points will be obtained.

Mixed ANOVAs were carried out to determine if there were any changes in scores pre and post treatment, as well if there were any differences between the two treatment conditions. There were two factors; factor 1: Condition and factor 2: Time. Condition was the between groups factor, consisting of two levels – improvisation and control. Time was the within groups factor, again consisting of two levels – before and after the treatment.

AUT

Table 7.1 – Experiment Five Mean (SD) AUT scores before and after treatment

		Response	**Fluency**	**Flexibility**
Improvisation (n=20)	**Before**	8.30 (3.29)	6.65 (3.91)	5.48 (2.90)
	After	9.40 (3.75)	8.90 (3.61)	6.98 (2.85)
Control (n=23)	**Before**	7.17 (3.38)	6.78 (3.20)	5.13 (2.40)
	After	7.48 (3.50)	6.91 (3.46)	5.76 (3.05)

AUT Fluency

For the AUT Fluency scores there was no significant main effect of condition, $F(1, 41) = .86$, $p > .05$. There was a significant main effect of time, $F(1, 41) = 8.06$, $p = .007$, partial $\eta^2 = .164$. There was a significant interaction between time and condition, $F(1, 41) = 6.39$, $p = .015$, partial $\eta^2 = .135$.

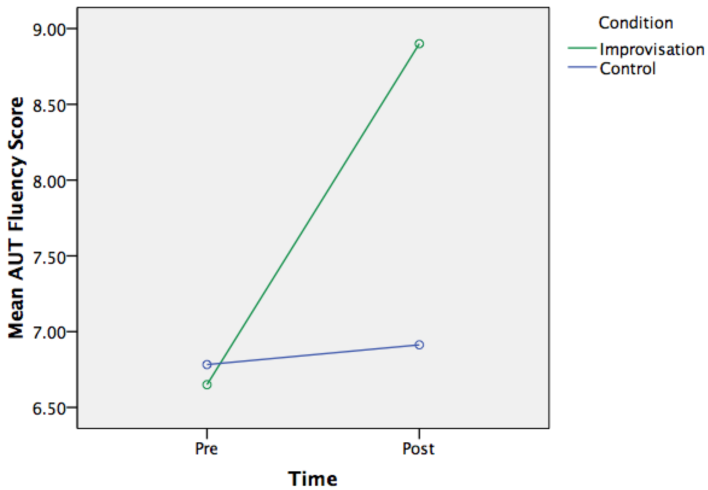

Figure 7.1: Experiment Five AUT Fluency scores pre and post treatment

The interaction between time and condition can be seen in Figure 7.1, suggesting that the improvisation group improved in AUT fluency scores post treatment whereas there was no difference between scores in the control condition. This is confirmed by paired samples t-tests which showed a significant difference for the improvisation group before and after treatment, $t(19) = -3.68$, $p = .002$, $r = .65$, but no significant difference for the control group, $t(22) = -.23$, $p > .05$. Independent samples t-tests, however showed that there was no significant difference between the improvisation and control groups pre-scores, $t(41) = -.12$, $p > .05$ and no significant difference between the improvisation and control groups post-scores, $t(41) = 1.84$, $p > .05$.

AUT Response and Flexibility

AUT Flexibility scores showed a significant effect for time, $F(1, 41) = 8.94$, $p = .005$, partial $\eta^2 = .179$ while AUT Response scores showed no significant effect of time $F(1, 41) = 2.82$, $p > .05$. AUT Response and AUT Flexibility scores showed no significant main effect of treatment ($p > .05$) and no significant interaction between time and treatment ($p > .05$). These results indicate that there were no differences in AUT Response or Flexibility between conditions.

COWA

Table 7.2 – Experiment Five Mean (SD) COWA scores before and after treatment

		Response	Fluency
Improvisation (n=23)	**Before**	38.15 (7.06)	37.95 (6.99)
	After	41.55 (6.16)	41.10 (6.23)
Control (n=20)	**Before**	36.57 (7.95)	35.48 (8.02)
	After	38.17 (8.95)	37.30 (9.15)

COWA: Response and Fluency

COWA Response scores showed a significant effect for time, $F(1, 41) = 6.53$, $p = .014$, partial $\eta^2 = .137$, as did COWA Fluency scores, $F(1, 41) = 5.70$, $p = .022$, partial $\eta^2 = .122$. However, no significant main effect of treatment ($p > .05$) and no significant interaction between time and treatment ($p > .05$) was found. These results indicate that there were no differences in COWA scores between conditions.

COWA Fluency results were analyzed further to test for ceiling effects. However, no interaction between time and treatment was found when looking at the highest (30%) and lowest (30%) scorers. (See Appendix E for matrix table).

7.4 DISCUSSION

The results of the present study found a significant difference in fluency scores of the AUT following ten minutes of verbal improvisation or a control equivalent.

The aim of this study was to replicate the findings of the AUT found in Experiments One and Two while extending these previous findings in two other ways; firstly, to another task of verbal divergent thinking, more specifically the COWA, a verbal fluency task and secondly; to investigate whether a shorter length of treatment could produce a significant difference following improvisation in comparison to the control condition. More specifically, this was to determine whether effects observed in previous experiments could be observed following a shorter treatment time.

The results of this study suggest that improvisation can have significant benefits on divergent thinking following ten minutes of verbal improvisation. However, findings could not be extended to other forms of verbal divergent thinking tasks, in this case the COWA. In the case of the AUT, estimates of effect size, as observed by partial eta squared are small across all experiments. However, they do show consistency between the ten and twenty minute verbal improvisation studies. AUT Fluency effect sizes were .164 for time with an effect size of .135 for the interaction between time and condition. Effects of time were slightly higher for Experiment One, with .244 being reached, while an effect size of .107 was reached for the interaction between time and condition. Finally, although no interaction was observed in Experiment Two, time remained consistent with an effect size of .139. The same patterns were observed with AUT Flexibility across experiments for time where effect sizes were .179 for the current experiment, .295 for Experiment One and .104 for Experiment Two. Finally, it is also worth noting that paired sample t-tests also revealed similar effect sizes for the improvisation conditions in AUT Fluency for Experiment One (r = .64), Experiment Two, (r = .50) and the current experiment (r = .65).

Findings in the AUT not being extended to the COWA could be due to a number of reasons. It is unclear whether the length of treatment has an impact on results in two different ways. Firstly, the length of improvisation may have an impact on the size of the effect being observed therefore resulting in the effect size not being large enough, and in turn producing a type II error. Furthermore, the length of the effect post treatment may also have an impact on the results of the COWA. All participants completed the AUT followed by the COWA. It is unknown how long the effect of improvisation lasts for and it may be that it lasts for a longer period of time following twenty minutes of improvisation than ten minutes of improvisation. How long the effect of improvisation lasts needs to be observed in future. This should look at both short-term effects and continue the idea that improvisation can have long-term benefits in divergent thinking. In this sense it would therefore be interesting to observe whether scores in the COWA are significantly different in expert compared to novice improvisers, as was observed with the AUT (see Chapter 6).

Another reason why effects were observed with the AUT and not the COWA could be due to a different type of thinking that is being assessed. The COWA is a measure of verbal fluency while the AUT looks at creativity and the number of ideas that are created. In this sense, different ways of thinking may not influence having to come up with more words. In relation to the schema theory, it is thought that improvisation helps in breaking away from set patterns of thinking, resulting in novel and original ideas due to the different ways that people think. This increases scores in tasks such as the AUT due to its requirement to generate multiple ideas. These ideas should preferably be novel and are therefore more likely to be achieved by thinking in different ways. Verbal fluency, however simply requires people to list as many words as possible beginning with a letter of the alphabet. Participants rarely, if ever, run out of words to write down in the time frame given and breaking away from set patterns of thinking is unlikely to help this form of cognitive thinking. Thinking of words with similar endings or meaning may in fact be quicker than trying to access a number of different schemas. Should this be the case, it would therefore be interesting to determine a score of originality and flexibility to determine whether people do use different styles of thinking following improvisation.

One final reason as to why results may not have been observed in the COWA could be due to the method of recall being tested. Participants in the current study were asked to write down as many different words as they could think of. However, this was originally designed as an oral test where participants had to speak as many words within the same timeframe. As writing answers down is more time consuming, it may be that when people start to run out of words for the COWA, this is when the effects of improvisation may occur, as, by thinking in different ways, more word options would appear.

The finding that ten minutes of verbal improvisation can result in a significant increase in AUT Fluency scores is positive. The intensity of improvisation, however should be observed. It may be that due to the time constraint, participants may have undertaken a faster pace of the improvisation classes without the experimenter's awareness. This would therefore need to be taken into consideration of both the optimum length of treatment and how long the cognitive effects of improvisation last for. However, as observed in Experiment Three, these findings indicate that scores in divergent thinking tasks can increase following as little as ten minutes of improvisation.

Ceiling effects, as indicated by Experiments Two and Three were not determined in the current study. It would therefore be beneficial to determine whether there is consistency among the scoring of the AUT across the various experiments looking at the AUT in novice improvisers. If Experiment Two presents significantly higher results in AUT pre-scores, this may determine why ceiling effects were observed here, as well as a discrepancy in the scoring of the AUT (see Chapter 8).

Further analysis looking at the level of improvisation that participants scored in the experiment revealed that whether someone had improvised before or whether people were good or bad improvisers had no impact on the results.

Future research needs to be carried out on the effects of improvisation following different time frames. It would be interesting to determine whether the effects observed after a shorter time frame of improvisation are as strong as those following a longer length of improvisation. In relation to this, how long the effect lasts for needs to be observed, including whether how long the effect lasts differs according to how long participants improvise for. It may be that the effects do not last as long if participants have taken part in a shorter length of improvisation. This could also explain why effects in the COWA were not seen. The COWA was always completed second and it may therefore be that the effect of improvisation had worn off by this point.

Overall, the present findings suggest that an increase in divergent thinking, as measured by the AUT can be observed after as little as ten minutes of verbal improvisation. These findings could not be extended to a verbal divergent thinking task, measuring verbal fluency. However, this may be due to a different kind of thinking being required for the two different tasks. Future studies should focus on how long the length of improvisation lasts for, while relating this to further research concerning the optimum length of improvisation.

7.5 SUMMARY OF IMPROVISATION AND COGNITION EXPERIMENTS

Throughout this program of research, four experiments have been carried out looking at the effects of various cognitive tasks following a series of improvisation games, in comparison to a control condition consisting of verbal discussion. The preceding experiments have presented results from various divergent and convergent thinking tasks. In this section, an overall summary is presented of the results collected from Chapters Three, Five and Seven.

7.5.1 Divergent Thinking Tasks

AUT

The AUT has been used in all four experiments where significant effects were found in experiments looking at the domain of verbal improvisation but not in dance improvisation. Experiment One found a significant difference pre and post treatment in AUT Fluency, Originality and Flexibility scores for the improvisation condition but not the control condition. AUT Fluency and Flexibility findings were replicated in Experiment Two. AUT

Fluency scores were also replicated in Experiment Five. Finally a further experiment found AUT Fluency and Originality scores to be significantly different in expert improvisers when compared to novice improvisers. It is also worth noting that a significant difference in AUT Fluency was also observed in music improvisers in Pilot Study Three.

ATTA

The third part of the ATTA was administered in Experiment One which revealed a significant effect for the improvisation group in comparison to the control condition for ATTA Response and Fluency. It is also worth noting that ATTA Originality scores almost reached significance.

Alternate Additions (Divergent Maths Task)

Alternate Additions was administered in Experiments Two and Three. Experiment Three, looking at dance improvisation showed significant effects in the improvisation but not the control condition for the Response score. No effects were found in Experiment Two, looking at verbal improvisation, although changes in Originality were close to significance (p = .057).

Matchsticks Task

The Matchsticks task was administered in Experiments Two and Three. Experiment Three, looking at dance improvisation showed significant effects in the improvisation but not the control condition for the Response score. No effects were found in Experiment Two, looking at verbal improvisation.

COWA

Two different versions of the COWA were administered in Experiments One and Five. Although effects in Response and Fluency were shown in Pilot Study Three looking at music improvisation, no significant differences were found for the COWA.

7.5.2 Convergent Thinking Tasks

LDT

The LDT was administered in Experiments Two and Three. When taking into account ceiling effects, it was found that the control group in both experiments elicited significantly faster reaction times post treatment in comparison to the improvisation group.

MRT

The MRT was administered in Experiments Two and Three. Experiment Three found that the control group elicited significantly faster reaction times post treatment in comparison to the improvisation group. Experiment Two also found this effect, but only when taking ceiling effects into account.

CMT

The CMT was administered in Experiments Two and Three. Upon further analysis, Experiment Three found CMT Response scores to improve post treatment in the improvisation condition when the top 20% of scores were excluded. Experiment Two however found that CMT Response scores improve post treatment when participants scored lower in the pre-test but that no improvements occurred simply in relation to improvisation and control conditions.

Overall, these experiments have shown that after taking part in a series improvisation tasks, scores in tasks of divergent thinking significantly improve for the improvisation condition. Furthermore, differences in divergent thinking appear to be dependent on the domain of improvisation such that the type of task that shows improvisation benefits differs according to the type of improvisation in which people are taking part. However, this is not the case when looking at tasks of convergent thinking. Significantly different improvements were observed in the reaction time of two convergent thinking tasks following the control condition but not following improvisation. While improvisation provided no benefits to convergent thinking, these findings suggest that the control tasks that participants took part in for the current experiments may enhance convergent thinking. While differences were only present in the reaction time of these tasks, it is worth noting that, as expected, near to ceiling effects are observed in scores of accuracy with tasks such as the LDT. Scores of accuracy would be expected to decline following a quicker reaction time. However, this was not the case in the effects observed with convergent thinking tasks, suggesting that the control tasks result in quicker performance without hindering accuracy scores.

Chapter 8: The Scoring of Divergent Thinking Tasks and Reliability of the Alternative Uses Task (AUT)

The AUT (Guilford, et al., 1978), designed to assess divergent thinking, has been used throughout Experiments One to Five. This chapter investigates the scoring method used in the AUT, which is a common method used in several tasks of divergent thinking. Further analysis showed that results can be heavily dependent on small changes in the judges perception of creativity. Despite issues relating to the scoring method, the results achieved in the previous experiments show a high level of consistency.

8.1 INTRODUCTION

The AUT asks people to list as many different uses for a common object as possible in three minutes. The instructions used are available in Chapter 3.2. For the purpose of Experiments One, Two, Three and Five, the AUT was scored according to Response, Fluency, Originality and Flexibility, as originally set out by Guilford (1957). (How to score these dimensions is described in Chapter 3.2.3).

It is worth noting that different versions of the AUT exist, including within the Torrance Test of Creative Thinking (TTCT; Torrance, 1966) where participants are asked to come up with as many 'unusual' uses for a cardboard box. Furthermore, Guilford et al., (1978) use a form of the AUT which asks people to list alternative uses for three different objects combined.

The scoring of divergent thinking tasks including the AUT is generally reported as being of adequate reliability, with a reliability of $r > .90$ for the TTCT reported by Rosenthal, Demers, Stilwell, Graybeal, and Zins (1983). In a review by Hocevar (1978) it was found that 82% of correlations for fluency and/or originality were above .50, the average being .69. Hocevar (1979) went on to report correlations of .89 for Fluency, and an intraclass correlation of .92 for Originality. These high levels have been supported by Runco (2004) who found Cronbach alpha ratings of .86 for Fluency, .86 for Originality and .79 for Flexibility. Intra-class correlations for the AUT have recently been reported as between .84 and .97 across all measures by Fink, Grabner, Gebauer, Reishofer, Koschutnig and Ebner (2010). However, Plucker, Qian and Wang (2011) have recently suggested that reliability and validity results are inconsistent with discriminant validity being particularly poor.

Furthermore, how these dimensions are scored have considerable variability and a number of research papers report no use of reliability among raters (Shamay-Tsoory, et al., 2011).

The definition that surrounds the scoring of flexibility is generally agreed in the literature as being the number of different categories that people use when completing the AUT. However, flexibility elicits the lowest scores of reliability. With this in mind, it may be possible to create an objective measure of flexibility by creating a database of categories to fit responses into, instead of simply asking raters to state how many categories each participant uses. For example, in response to 'paperclip', set categories of Accessories, Harm and Picking things could be used to categorize responses such as earring, fashion accessory, stab someone, pick a lock and to scratch yourself.

The scoring dimension of originality is commonly agreed upon as the least common responses earn points of originality (Runco, 2004; Silvia, 2008; Silvia, et al., 2008; Torrance, 1966) such that a high score indicates a high level of originality. However, variability still occurs within this dimension as to the exact point system being used. Some people assign one point to the top 5% (Milgram & Milgram, 1976) while other researchers (Guilford, 1967) divide this further into two points for the top 1% of the sample and one point for the top 5%. Problems with the outcome of originality scores also exist. Silvia et al. (2008) defined three main problems associated with originality. Firstly, the larger the database of original responses, the less likely an answer is to be seen as original. Secondly, the definition of the word original can result in confusion. Does original mean creating random answers or is this different to being creative? For example, it can be unclear whether an answer such as 'to have a brick as a pet dog' is highly original or random but not original. Finally, originality often correlates highly with scores of fluency. The higher the score of fluency, the higher the likelihood of obtaining a higher originality score. Runco, Okuda and Thurston (1987) suggested a method of weighting responses in relation to fluency scores while Clark and Mirels (1970) suggested only scoring the first three responses for originality. However, these methods of scoring did not achieve high scores of reliability or validity with a lot of variability in results occurring. Silvia et al. (2008) have suggested a new method to assess originality which involves obtaining the top two most creative responses in a sample. What is clear, however, is that fluency scores need to be taken into account when scoring for both originality and flexibility as the number of responses will reflect both of these scores.

The last two problems of originality scoring also overlap into the scoring of fluency. Fluency refers to the number of valid responses, such that the original use of an item given to participants (e.g. build things for a brick) is not considered to be an alternative use. However, whether random answers are constituted as an original response also relates to whether they should be considered as valid responses.

It is now recognized in the field of research 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). While it is agreed that fluency refers to the number of responses that people produce, what items are considered as valid differs among researchers. Many previous experiments take fluency to be simply the number of responses that each participant produces on the AUT, regardless of whether the response can be seen as an alternative use or not (Brittain & Beittel, 1961; Gilhooly, et al., 2007; Hocevar, 1981; Johns, Morse, & Morse, 2001; Katz & Poag, 1979; Martindale & Dailey, 1996). Others provide very little explanation regarding what they term fluency to be and how they obtained the fluency scores used in their data, leading to the assumption that these scores are also based on the number of responses (Coren, 1995; Farah, et al., 2009; Furnham & Bachtiar, 2008; Guilford & Hoepfner, 1966; Harvey, et al., 1970; Hocevar, 1981; Lissitz & Willhoft, 1985; Ryder, et al., 2002). Only a handful of studies were found to use more detailed methods of scoring than simply the number of responses. Although explanations were vague, Farah et al. (2009) used three independent judges to score fluency, suggesting that it was not simply the number of responses that participants elicited. Furthermore, Almeida et al. (2008) mention that scores of fluency were based on those that were seen as relevant alternative uses. However, no description of what was considered to be a relevant alternative use was given.

Gelade (1995) and Murray and Russ (1981) both mention the use of Guilford's scoring manual which gives examples of how to score the AUT including examples of responses that should not be included as correct. Although Guilford's scoring manual is mentioned in many papers, little reference is made to the use of this manual, largely due to difficulty in obtaining the manual.

The following experiments therefore aimed to assess reliability and develop more reliable methods of scoring divergent thinking tasks where needed. As well as looking at the various ways that fluency could be scored, the scoring of originality in the ATTA (see Chapter 3.4 for issues raised) is also investigated. Any issues in reliability raised could have an impact on both the experimental results. In addition to this, the scoring of fluency could also have an impact on the responses that end up being scored for originality and flexibility.

8.2 PILOT STUDY FOUR: OBTAINING ATTA ORIGINALITY SCORES FOR TEST VERSIONS A AND B

Experiment One (Chapter Three) raised the issue of scoring the two versions of the ATTA; circles and triangles. Goff and Torrance (2002) provide a manual for the original version of the ATTA which utilized triangles. Applying this manual to the circles version of the test was transferable for all scores other than the originality scoring. Although a list of common items was created, the same was not done for the triangles version of the test. By comparing the originality scores in two different ways, this then questions whether an accurate originality score is being achieved for both versions of the test. Therefore, a pilot study was carried out with an aim to achieve accurate and reliable sets of common response lists for both circles and triangles.

8.2.2 Method

Participants

The sample consisted of 26 participants (nine male and 17 female) through the use of convenience sampling. Of these 26 participants, the mean age was 39 where 11 were under 40 years of age and 15 were over forty.

Design

A between groups design was implemented to look at the differences between the two versions of the test. This had two levels; triangles and circles. A within groups design was used to compare the two originality lists constructed. This also had two levels; Originality list One and Originality list Two.

The Independent Variables were the version of the test and the two originality lists. The Dependent Variable was the originality score elicited.

From an a priori perspective the experimental hypotheses were that scores on the ATTA would not change according to the version of the task and according to the two originality lists.

Materials and Apparatus

The ATTA (Goff and Torrance, 2002) was administered to all participants using the same instructions found in Chapter 3.2.

Procedure

Participants were approached asking if they could spare some time to take part in a creativity test. Participants were taken into a quiet room and following consent asked to completed the ATTA. Half of the participants completed the triangles version of the ATTA, while half complete the circles. Upon completion, participants were debriefed regarding the purpose of collecting the data.

The ATTA was then scored for Originality using two lists of common responses. One list was created for both triangles and circles according to the current sample while the other score consisted of these responses along with the other 41 participants who took part in the test for Experiment One. Only one rater was used as it was consistency that was being measured as well as to obtain a more objective method.

8.2.3 Results

Two different lists of common responses to score originality were formed. Originality 1 scores represented a list of common responses based on the current sample, while Originality 2 scores represented a list of common responses based on the current sample combined with the sample from Experiment One.

Paired samples t-tests were carried out to determine whether there were any differences between the triangles and circles versions of the ATTA.

Table 8.1 - ATTA Mean (SD) Originality Scores

	ATTA Originality 1	ATTA Originality 2
Triangles	8.77	7.69
(n=13)	(1.92)	(2.90)
Circles	9.15	6.31
(n=13)	(5.18)	(3.54)
Total	8.96	7.00
(N=26)	(3.83)	(3.25)

For Originality One scores, a paired samples t-test revealed no significant difference between the triangles and circles versions of the ATTA, $t(15.24) = .25$, $p > .05$. A paired samples t-test also revealed no significant effect between the two versions for originality 2 scores, $t(24) = 1.09$, $p > .05$.

To determine whether any differences occurred between the two ways of scoring originality, an independent samples t-test on the total sample was carried out and revealed a significant difference between originality scores one and two, $t(25) = 3.51$, $p = .002$, $r = .68$ such that Originality one scores produced a higher score than that of originality two.

An independent samples t-test on the triangles version of the ATTA revealed a significant difference between originality scores one and two, $t(12) = 2.42$, $p = .032$, $r = .57$ such that Originality one scores produced a higher score than that of originality two. Furthermore, an independent samples t-test on the circles version of the ATTA revealed a significant difference between originality scores one and two, $t(12) = 2.89$, $p = .014$, $r = .64$ such that Originality one scores produced a higher score than that of originality two.

8.2.4 Discussion

The aim of Pilot study Four was to construct two common lists for two different originality scoring of the ATTA; circles and triangles. Two originality scores were created, one based on a sample of 26 participants and another based on a sample of 67 participants. Twenty-six participants were subsequently scored for originality using these two lists. Results revealed that no significant differences were present in originality scores between the triangles and circles versions of the test, meaning that they could be used effectively as pre and post treatment tests. However, significant differences were found between the two originality scores based on the different common response lists.

The significant difference between these two scores suggest that common lists differ according to the sample size that they are based on. As discussed in 8.1, the sample size of originality lists is a common problem with originality scoring. The original common response list that Goff and Torrance (2002) produce does not indicate the sample size that this was created with. The larger the sample size, the smaller the originality score will be. This pattern is shown in the current pilot study with a lower score based on the sample of 67 participants. This raises the question of what is a true score of originality?

In order to determine which sample size should be used in the ATTA, the triangles method should be matched to the response list in the ATTA manual (Goff and Torrance, 2002). By identifying equal means, this will determine how many participants the circles response list should be based on. However, it does not address the question of what sample size should be used to elicit a true score of originality.

8.3 THE AGREEMENT OF AUT SCORES BETWEEN RATERS

As with the method of Farah et al. (2009), Experiments One to Three asked three independent raters to score responses to the AUT. It is generally agreed upon (Silvia et al, 2008) that subjective methods of scoring should be scored by more than one person and analyzed for reliability. Upon achieving a high level of reliability between judges (r =.70 or above), the sum of the judges scores is created and an average score per participant across judges subsequently taken for analysis purposes.

8.3.1 Method

The AUT results from Experiment One (N=41) and Pilot Study Three on music improvisation (Lewis, 2008; N=36) were taken in order to investigate reliability in scoring methods of the AUT. AUT responses were scored by the experimenter for both experiments along with two other independent judges, resulting in three sets of scores for each experiment. One judge, the experimenter was a trained expert in the area and the two remaining judges were novices. These judges were given brief training prior to scoring responses. Instructions for scoring the AUT are provided in Appendix F.

High levels of reliability (see 8.1 above) have previously been found with the AUT (Murray & Russ, 1981). Therefore, inter-judge reliability was obtained to determine how consistent scoring was amongst each set of three judges for scores of both fluency and flexibility. This was investigated using Pearson product-moment correlation coefficient as well as using Intraclass Correlations (ICC).

8.3.2 Inter-judge reliability

Data from Experiment One; Verbal improvisation: Fluency

Pearson product-moment correlation coefficients revealed a strong, positive correlation between judge 1 and judge 2's scores of fluency, r =.89, n=82, p < .001, as well as a strong, positive correlation between judge 1 and judge 3's fluency scores, r =.97, n=82, p < .001 and between judge 2 and 3's scores of fluency, r =.89, n=82, p < .001. This showed a high level of agreement on fluency scores across the three judges.

ICC across all three judges revealed a strong, positive correlation, r =.89, n=82, p < .001 suggesting a high level of agreement on fluency scores across the judges scores.

Data from Experiment One; Verbal improvisation: Flexibility

Pearson product-moment correlation coefficient revealed a strong, positive correlation between judge 1 and judge 2's scores of fluency, r =.75, n=82, p < .001, as well as a strong, positive correlation between judge 1 and judge 3's fluency scores, r =.89, n=82, p < .001, and between judge 2 and 3's scores of fluency, r =.68, n=82, p < .001.

ICC across the three judges revealed a positive correlation, r =.71, n=82, p < .001, suggesting a high level of agreement on flexibility scores across the judges ratings. However, it is worth noting that the reliability of flexibility was not as strong as of that for fluency.

Data from Pilot Study Three; Music improvisation: Fluency

Pearson product-moment correlation coefficient revealed a strong, positive correlation between judge 1 and judge 2's scores of fluency, r =.94, n=72, p < .001 as well as a strong, positive correlation between judge 1 and judge 3's fluency scores, r =.89, n=72, p < .001 and between judge 2 and 3's scores of fluency, r =.89, n=72, $p < .001$. This again showed a high level of agreement on fluency scores across the three judges.

ICC across all three judges revealed a strong, positive correlation, r =.82, n=72, $p < .001$ suggesting a high level of agreement on fluency scores across the judges ratings.

Data from Pilot Study Three; Music improvisation: Flexibility

Pearson product-moment correlation coefficient revealed a strong, positive correlation between judge 1 and judge 2's scores of fluency, r =.88, n=72, $p < .001$ as well as a strong, positive correlation was also found between judge 1 and judge 3's fluency scores, r =.81, n=72, $p < .001$ and between judge 2 and 3's scores of fluency, r =.79, n=72, $p < .001$. This showed a high level of agreement on flexibility scores across the three judges.

ICC across all three judges revealed a strong, positive correlation, r =.71, n=72, $p < .001$ suggesting a high level of agreement on fluency scores across the judges ratings. However, it is again worth noting that the reliability of flexibility was not as high as that of fluency.

8.3.3 Results: ANOVA comparisons

It has been suggested that when high levels of reliability are obtained, it is acceptable to use the ratings from one expert judge (Tinsley & Weiss, 1975). These scores were used in the original analysis (see Chapter 3.3).

Table 8.2: Mean (SD) of original AUT Fluency and Flexibility scores pre and post treatment for Verbal (Experiment One) and Music (Pilot Study Three) improvisation

		Mean Fluency Verbal	**Mean Flexibility Verbal**	**Mean Fluency Music**	**Mean Flexibility Music**
		n = 21	n = 21	n = 24	n = 24
Improvisation	**Pre**	5.48 (2.11)	3.71 (1.38)	7.92 (4.20)	4.83 (2.30)
	Post	8.19 (2.48)	5.90 (1.58)	11.33 (4.60)	6.58 (2.45)
		n = 20	n = 20	n = 12	n = 12
Control	**Pre**	5.40 (2.74)	3.75 (1.71)	7.92 (4.30)	5.58 (2.11)
	Post	6.45 (3.05)	4.40 (2.06)	8.25 (5.53)	5.83 (3.86)

Experiment One: Verbal Improvisation; Original scores

Original scores for Experiment One; verbal improvisation revealed significant differences following a mixed ANOVA. Fluency revealed no significant effect of condition, $F(1, 39) = 1.39$, $p > .05$. A significant main effect of time was found, $F(1, 39) = 24.69$, $p < .001$, partial $\eta^2 = .388$ and a significant interaction between time and treatment, $F(1, 39) = 5.72$, $p = .022$, partial $\eta^2 = .128$. Flexibility revealed no significant effect of condition, $F(1, 39) = 2.59$, $p > .05$. A significant main effect of time was found, $F(1, 39) = 27.84$, $p < .001$, partial $\eta^2 = .417$ and a significant interaction between time and treatment, $F(1, 39) = 8.19$, $p = .007$, partial $\eta^2 = .174$.

Pilot Study Three; Music Improvisation; Original scores

The average score by all judges was then taken and mixed ANOVAs carried out on pre and post AUT scores. The results for Experiment One; verbal improvisation are presented in Chapter 3.3. These show that significant interactions were still observed with the average score across the three judges.

Original scores of Lewis (2008) also revealed significant differences following a mixed ANOVA. Fluency revealed no significant effect of condition, $F(1, 34) = 1.13$, $p > .05$. A significant main effect of time was found, $F(1, 34) = 6.75$, $p = .014$, partial $\eta^2 = .166$ and a significant interaction between time and treatment, $F(1, 34) = 4.57$, $p = .040$, partial $\eta^2 = .118$. Flexibility revealed no significant effect of condition, $F(1, 34) = .00$, $p > .05$. A significant main effect of time was found, $F(1, 34) = 7.62$, $p = .009$, partial $\eta^2 = .183$ and a significant interaction between time and treatment, $F(1, 34) = 4.29$, $p = .046$, partial $\eta^2 = .112$.

Mixed ANOVA: Average Scores

The average score by all judges was then taken and mixed ANOVAs carried out on pre and post AUT scores to determine whether there were any differences in results when compared to original scores. There were two factors; factor 1: Condition and factor 2: Time. Condition was the between groups factor, consisting of two levels – experimental and control. Time was the within groups factor, again consisting of two levels – before and after the treatment.

The results of Experiment One are presented in Chapter Three, where it can be seen that results remained significant. Therefore, using one rater or an average of three raters scores provided no significant differences in the repeated measures analyses.

Pilot Study Three; Music Improvisation

Table 8.3: Mean (SD) of AUT average Fluency and Flexibility scores pre and post treatment for pilot study; music improvisation

		Mean Fluency Score	**Mean Flexibility Score**
Improvisation (n=24)	**Pre**	7.93 (4.22)	6.28 (3.24)
	Post	9.43 (3.22)	6.93 (2.67)
Control (n=12)	**Pre**	8.08 (3.79)	7.11 (3.22)
	Post	7.81 (4.75)	6.33 (3.41)

Pilot Study Three; Music Improvisation: Fluency

For AUT Fluency scores, there was no significant main effect of treatment, $F(1, 34) = .37$, $p > .05$. There was no significant main effect of time, $F(1, 34) = .80$, $p > .05$ and no significant interaction between time and treatment, $F(1, 34) = 1.70$, $p > .05$.

Pilot Study Three; Music Improvisation: Fluency

For AUT Flexibility scores, there was no significant main effect of treatment, $F(1, 34) = 1.67$, $p > .05$. There was no significant main effect of time, $F(1, 34) = .013$, $p > .05$ and no significant interaction between time and treatment, $F(1, 34) = 1.67$, $p > .05$.

8.3.4 Discussion

Following high inter-rater reliability scores in both verbal and music improvisation, an average score of judges ratings was obtained and mixed ANOVAs carried out looking at pre and post scores according to treatment condition. These were then compared to the original findings as these findings only used the first judge's ratings (see 3.3).

No differences between the two scores were found in verbal improvisation, with the same effects being obtained for both original and average ratings. However, despite these high levels of inter-rater reliability, mixed ANOVAs using the average raters scores changed the results such that AUT following music improvisation were no longer significant for both fluency and flexibility.

These results are surprising, particularly within fluency, where reliability between judges' scoring is deemed as high. This leads to the question of whether an average of three randomly selected judge's scores is the best method to use in assessing the AUT. However, it is important to note, that while a strong correlation is still present, ICC ratings were lower than that of Pearson-product correlation. As ICC presents ratings of absolute agreement between judges, this suggests that there may be small amounts of disagreement concerning the definition of fluency and what alternative uses are considered as valid. It is unknown whether all judges have the same views as to what a valid alternative use is and furthermore, whether their own level of creativity may have an impact on whether they think an alternative use should be scored as valid or not.

8.4 EXPERIMENT SIX: WHAT IS AN ALTERNATIVE USE?

8.4.1 Introduction

The above findings raise concerns surrounding the current method of this scoring. Obtaining high levels of inter-rater reliability and then using an average of these raters scores may not be an adequate way of obtaining a fluency score and the changes in results raise questions concerning the validity of scoring the AUT. Are fluency scores measuring what is intended?

Therefore, two main questions concerning the scoring of the AUT were asked.

1. Do people agree on what is considered to be an alternative use?
2. Do raters' individual levels of creativity influence scoring of the AUT, and what they consider to be an alternative use?

In order to look at creativity levels, it is important to determine the answer to the first question. Do people agree on what is considered to be an alternative use? This can only be measured looking at fluency and therefore it was decided to take the dimension of AUT fluency and look at the method of scoring in further detail.

The aim of this experiment was therefore to look at whether judges agreed on whether the various AUT responses given were valid alternative uses.

8.4.2 Method

Data from a total sample of 298 completed AUTs were gathered. These were taken from Experiment One; Verbal improvisation (N=82), Music Pilot Study Three (N=72), and Experiments Two and Three (N=144). All responses were input into excel spreadsheets according to the common object that had been used in the AUT, 131 participant responses for a paperclip, 90 for a newspaper, 59 for a remote control and 18 participants' answers for a brick.

Any answers that were repeated between participants were only included once. However, should they be written in a different way which could imply a different meaning, both versions of the answer were included. For example, the responses 'starting a fire' and 'keeping a fire going' were both included in the list of different responses for a newspaper.

This resulted in 556 different responses for a paperclip, 495 for a newspaper, 340 for a remote control and 130 for a brick. Each list was randomized and then divided into separate files consisting of no more than 250 responses in each, resulting in eight files (Appendix G). Each file was then put onto surveymonkey as a separate experiment. Instructions were as follows:

Instructions

Please read this carefully.

An Alternate Uses Task (AUT) requires people to come up with different uses for a common object that DOES NOT involve the actual intended use/what the object was originally designed to do.
For example, if the common object was a remote control, then aspects such as changing the channel or opening a garage would not be classed as an alternate use.

This task asks you to judge whether an answer for the alternate use of a paperclip is valid or not. Answers can be as abstract as participants wanted to make and do not have to necessarily work in real life. However, an answer is not deemed as valid for one of two reasons:

1. the answer involves what the object was originally intended for.
2. the response is not a USE.

Please note that these are actual responses from participants. Therefore, there is no specific number of valid uses, nor are there any right or wrong answers. We are just after your opinion as to whether you think the response counts as a valid alternative use or not.

For example, when thinking about alternative uses for paperclip a response such as "To clip paper together" would not be an alternative use, whereas a response such as "as a screwdriver" would be an alternative use.

After reading the above instructions about the AUT and how it is scored, they were simply asked to indicate whether they thought a response was valid alternative use or not by ticking a 'yes' or 'no' option.

Five independent judges were obtained for each list of AUT responses, resulting in 40 participants. All participants were students studying Psychology at the University of Hertfordshire.

8.4.3 Results; Inter-rater Reliability

Due to the nominal data that was received by the surveys, methods of inter-rater reliability were not suitable for this type of data. With five raters and more than 100 response ratings, neither kappa, Phi nor Cramer's V could be applied. Therefore, reliability was assessed in relation to the percentage of the number of people who agreed an item was an alternative or use or not.

Table 8.4: Frequencies (percentages) of agreement between three, four or five people according to item for Experiment Six.

	Agreement level		
	5	4	3
Set 1	21	53	56
(Brick; N=130)	(16.15)	(40.76)	(43.08)
Set 2	156	56	35
(Newspaper; N=247)	(63.16)	(22.67)	(14.17)
Set 3	67	91	89
(Newspaper; N=247)	(27.13)	(36.84)	(36.03)
Set 4	17	82	88
(Paperclip; N=187)	(9.09)	(43.85)	(47.06)
Set 5	39	71	76
(Paperclip; N=186)	(20.97)	(38.17)	(40.86)
Set 6	17	69	97
(Paperclip; N=183)	(9.29)	(37.7)	(53.01)
Set 7	20	69	83
(Remote Control; N=172)	(11.63)	(40.12)	(48.26)
Set 8	107	40	21
(Remote Control; N=168)	(63.69)	(23.81)	(12.5)

Table 8.4 displays the level of agreement as to whether judges rated a response to the AUT as a valid alternative use. A rate of five indicated total agreement across all five raters. An agreement of four displays that all but one judge agreed on whether an item was an alternative use, while an agreement of three indicates a split decision, with three judges out of five agreeing on the response. Table 8.4 is best interpreted through percentages due to the different numbers in each set of the AUT administered. It can be seen that agreement between all five raters is very low in all but set 2 and set 8 of the AUT survey data. In all but these two sets, more than 30% of items in every other set show split agreement between raters. Appendix H displays individual judges ratings for all sets of surveys. In all cases, disagreements occur across all judges scorings, indicating that the level of disagreement shown is not due to one or two individual raters.

8.4.4 Discussion

Overall, the above findings showed that agreement regarding what was considered to be an alternative use was very low, with only two (sets 2 and 8) out of eight list sets reaching a total agreement of above 50%. Furthermore, the tables in Appendix H indicate that disagreements vary among judges and that these agreements are not due to one particular judge disagreeing with others. These results therefore suggest that people are not agreeing over the simple question of whether a response should be classed as an alternative use. This could be due to a number of reasons, such as not all raters being experts in the field (see Chapter 8.8 for further discussion).

It may be that instructions regarding how to score the AUT were not detailed or clear enough – a common problem that can arise through internet surveys as there is no experimenter at hand to answer any questions the judges may have. Another reason that these results may have occurred could be due to random scoring. Participants were given many different responses to rate as valid or not and it may be that participants found the task too tedious. Participants may have randomly clicked the yes or no boxes in order to complete the experiment as quickly as possible and in turn still receive their course credit. This would indicate why answers are so varied and should be looked at in future experiments.

8.5 PILOT STUDY FIVE: SCORING A SMALL NUMBER OF ALTERNATIVE USES

In order to determine whether random scoring could be occurring, a pilot study was undertaken with a new method adopted. It was important to perform this before any experiments were carried out asking people to rate a larger number of responses. The aim of this pilot study was to see whether rating a small number of items resulted in a higher agreement level and therefore higher reliability.

8.5.1 Method

Twenty responses were taken randomly from all of the 495 possible uses of 'newspaper' obtained previously. A twenty-item survey, using the same method as Experiment Six (8.4.2) was then set up (see Appendix I). Five people were given the same instructions as

Experiment Six and asked to state whether the responses given to them could be classed as an alternative use or not.

8.5.2 Results; Inter-rater reliability

As for Experiment Six, the level of agreement between raters was calculated. All five raters agreed on whether a response for a **newspaper** was an alternative use on four responses (20%). Three responses had an agreement of four raters (15%) and 13 responses had an agreement between three raters (65%). Appendix J displays individual coders ratings, showing that disagreement occurred between all judges, although judge four recorded more uses as not being valid.

8.5.3 Pilot study Five conclusion

It is therefore concluded that scoring a smaller number of AUT responses has no impact on the agreement and reliability between judges. This also suggests that the results obtained are not due to random sampling errors and instead are due to disagreement between the judges opinions on what is seen as an alternative use. Should people have been randomly ticking boxes in a likert scale, it is unlikely that this would continue in an extremely small version of the task.

8.6 EXPERIMENT SEVEN: SELECTION CRITERIA FOR SCORING THE AUT

Scoring smaller items of AUT responses had no effect on the reliability of results that were obtained in Experiment Six. Therefore, the idea of using selection criteria for people scoring the AUT was investigated. By selection criteria, it is meant that people should only be allowed to score the AUT if they answer a few alternative uses questions that have obvious answers as to whether they should be classed as an alternative use or not. Therefore, answers such as 'reading' for a newspaper or 'changing the channel' for a remote control are answers that are obviously what the items were originally intended for and therefore should be a definite no.

The aim of this experiment was to see whether higher levels of reliability could be obtained by excluding people who answer yes to answers that definitely should not be classed as an alternative use.

8.6.1 Method

Participants responses from Experiment Six were looked at in relation to items that were definitely considered as not being an alternative use. An item classed as strictly invalid consisted of simply what the item was originally used for. Therefore, responses for a brick were considered invalid if they were to do with building things such as a house, wall or fireplace. Newspaper responses were considered invalid if someone stated to read, complete various games, to read horoscopes or to read the news. Paperclip responses were considered invalid if they stated uses such as clip items together, clip paper together, as stationary and finally, remote control responses were seen as invalid if they involved actions of actual remote controls such as changing channels, volumes etc, opening garage doors.

After lists of strictly invalid items were compiled, anyone who had scored these items as valid alternative uses from the validity data collected in Experiment Six were excluded as all items scored were not considered reliable.

Using the same method as Experiment Six and Pilot Study Four, 29 participants were recruited to replace those that had been excluded. Data were collected until all the alternative use responses that were definitely seen as unacceptable had 100% agreement of this among all five raters.

8.6.2 Results; Inter-rater reliability

Results were re-scored according to this new data and reliability assessed in the same way as Experiment Six. Results are presented in table 8.5.

Table 8.5: Frequencies (percentages) of agreement between three, four or five people according to item for Experiment Seven.

	Agreement level		
	5	4	3
Set 1	27	39	64
(Brick; N=130)	(20.77)	(30.0)	(49.23)
Set 2	168	48	34
(Newspaper; N=250)	(67.2)	(19.2)	(13.6)
Set 3	69	91	94
(Newspaper; N=253)	(27.27)	(35.97)	(37.15)
Set 4	33	66	88
(Paperclip; N=187)	(17.65)	(35.29)	(47.06)
Set 5	65	66	55
(Paperclip; N=186)	(34.95)	(35.49)	(29.57)
Set 6	77	66	40
(Paperclip; N=183)	(42.08)	(36.07)	(21.86)
Set 7	52	64	56
(Remote Control; N=172)	(30.25)	(37.21)	(32.56)
Set 8	107	40	21
(Remote Control; N=168)	(63.69)	(23.81)	(12.5)

Table 8.5 displays the level of agreement as to whether three, four or five judges rated a response to the AUT as a valid alternative use. Sets 2 and 8 remain the as the two sets of responses that judges agreed upon the most. Set 8, however did not gather any new data as reliability levels were already higher than other surveys. All other sets, with the exception of set 3 increased in total reliability when compared to the results of Experiment Six. However, these agreement levels are still low at either 30% or below other than set 6 which increased to 42.08%. In the majority of cases, agreement between three and four raters does not appear to differ a lot to the figures in table 8.4. Set 5 and set 7 do however have less scores of disagreement. Appendix K displays individual judges ratings. As before, disagreements occur across all judges scorings. It is however worth noting that judge 5 in set seven uses a higher proportion of the answer 'No' in comparison to other judges.

8.7 SCORING THE AUT

8.7.1 Introducing a new scoring method

Although scoring issues still remain, slightly higher agreement scores were observed in Experiment Seven than that of Experiment Six. These ratings were used to re-score the results of Experiment One and Pilot Study Three on music improvisation.
All items with 100% agreement to being invalid were excluded and the fluency score compiled by the remaining responses. By using this method, it was possible to eliminate those items which were obviously invalid uses, while keeping ambiguous items which raters may not necessarily agree upon. Due to the varying levels of agreement between raters, each possible AUT response ended up with a score ranging from 0 – 5. A score of 0 indicated an invalid use. Scores of 2 or above were taken to be valid alternative uses, in order to allow ambiguity in scores. It was then possible for fluency in both verbal and music improvisation to be re-scored.

8.7.2 RESULTS

ANOVA comparisons

Mixed ANOVAs were carried out on the new AUT Fluency scores pre and post treatment to determine whether there were any differences in results.

Table 8.6 - Mean (SD) of new AUT fluency scoring for Verbal (Experiment One) and Music (Pilot Study Three) improvisation, pre and post treatment

		Verbal improvisation	Music improvisation
		n = 21	n = 24
Improvisation	**Pre**	6.14 (1.98)	8.88 (4.69)
	Post	8.52 (2.40)	11.04 (5.47)
		n = 20	n = 12
Control	**Pre**	5.95 (3.12)	10.00 (5.46)
	Post	6.90 (2.97)	8.17 (5.32)

Data from Experiment One; Verbal Improvisation

For AUT Fluency scores, there was no significant main effect of treatment, $F(1, 39) = 1.53$, $p > .05$. There was a significant main effect of time, $F(1, 39) = 19.11$, $p < .001$, partial $\eta^2 = .329$. However, no significant interaction was found between time and treatment, $F(1, 39) = 3.53$, $p = .068$. However, it is worth noting that with a p value of .068, these results suggest that with the new method of scoring, the difference between conditions is not large enough to be significant, meaning that both groups improved in AUT scores post treatment. This differs to the original results observed (see 8.2) which found a significant different between conditions such that the improvisation group increased post-treatment in comparison to the control condition.

Data from Pilot Study Three; Music improvisation

For AUT Fluency scores, there was no significant main effect of treatment, $F(1, 34) = .28$, $p > .05$ and no significant main effect of time, $F(1, 34) = .04$, $p > .05$. However, a significant interaction was found between time and treatment, $F(1, 34) = 6.21$, $p = .018$, partial $\eta^2 = .154$.

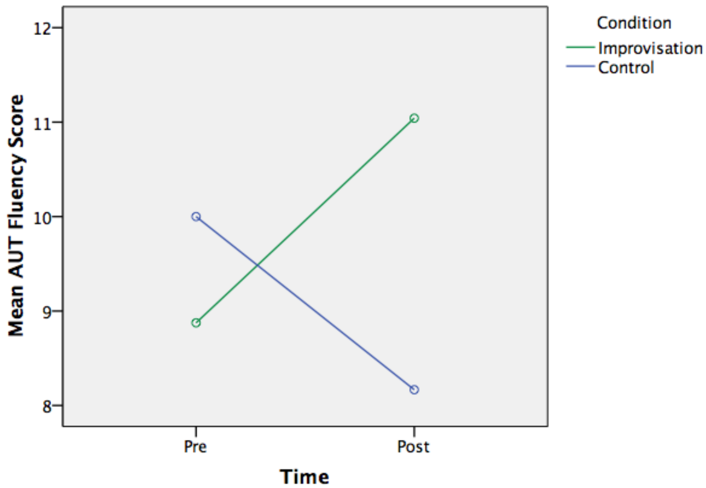

Figure 8.1: Music improvisation Pilot Study Three new scoring method; AUT Fluency scores pre and post treatment.

The interaction between time and treatment can be seen in Figure 8.1, which shows the improvisation group to increase in AUT Fluency scores, when compared to the control group. This difference is confirmed by paired samples t-tests, which revealed a significant difference for the experimental group pre and post improvisation, $t(23) = -2.40$, $p = .025$, $r = .45$ but not for the control group, $t(11) = 1.33$, $p > .05$. These results show that the new method of scoring now elicits significant results as was originally observed.

8.7.3 Discussion

The above findings suggest that the results of the AUT can be influenced by a different method of scoring. However, in an attempt to make scoring AUT Fluency more of an objective method, this has compromised reliability significantly. Results with the highest levels of reliability should therefore be used as the best methods of scoring the AUT in terms of fluency.

8.8 GENERAL DISCUSSION

The purpose of the above studies in Chapter Eight was to evaluate the efficiency of the scoring method concerning the AUT. Due to high inter-rater reliability affecting the original fluency results of the AUT, it was asked how much agreement occurred between what should be considered as a valid alternative use.

Previous studies using the AUT described either vague scoring instructions or simply counting the number of uses thought of, regardless of whether the use was originally intended for the common object. By asking participants what was considered as a valid alternative use, it was hoped that a more objective method could be created for scoring the AUT. However, after re-scoring the AUT according to a number of methods, it can be concluded that there is little consistency between the agreement of what counts as a valid alternative use. In turn, this questions the reliability of the current method of scoring the AUT, with different results being determined with the same data set, according to what method of scoring is being used.

Regarding the current results, it is worth noting that in the final scoring method used, uses where two or more people had said the response was valid were included. However, the threshold for this could be changed which could, again in turn influence the results. It is also worth noting here that fluency scores differed pre-treatment using this scoring method between verbal and music improvisation, such that musicians scored higher to begin with than those in the verbal group. While this could be an effect of musicians simply being better at the AUT, it could also indicate a discrepancy in this new method of scoring or between the items that are given in the AUT.

It is also worth noting that by asking people whether a response was simply a valid alternative use means that people can no longer score responses by participant. Previous methods of scoring have involved scoring the list of alternative uses that each participant creates. Therefore, a measurement error may be occurring here as scoring the AUT may depend on the other items that a response appears with. It may be that scoring on the basis of responses that each participant makes increases reliability, such that people judge whether an answer is valid based on the previous answers that the participant has given in a set of answers.

Why people do not seem to agree as to what constitutes to be an alternative use could be due to a number of influencing factors. Firstly, and perhaps primarily, the creativity levels of the judges themselves could have an impact on how the AUT is scored.

Everyone exhibits different levels of creativity and the level of creativity that one person has may determine what they think counts as an alternative use. For example, it may be that the more abstract an alternative use is, someone who has high creativity may relate to the answer and judge it as an alternative use, while others with low creativity may see the answer as too abstract and not be able to relate the idea as to how it could work as an alternative use. In other words, less creative judges may judge responses more literally, while more creative judges will score both literal and abstract answers as valid. Different levels of creativity among the judges could also explain why the inter rater reliability varied so much. It would therefore be beneficial in future experiments to determine whether creativity levels have an impact on how people score the AUT. Should a difference be found, it would therefore be useful to get people with higher levels of creativity to score the AUT in order for more abstract responses to be taken into account. Furthermore, it would be useful to look at differences in scoring between experts and novices in the field. Amabile (1983) states that when using the CAT, it is best to use expert raters and has been adopted by researchers such as Howard-Jones et al. (2005). The current experiment used both novice and experts in the field of creativity to score the AUT. Future studies should compare the use of novice and expert raters to determine whether this is essential for scoring both the AUT and other tasks of divergent thinking.

As well as creativity, knowledge may also be a contributing factor as to why judge's scores differ. People with previous experience of the AUT or similar tasks may have a clearer idea of how to score it. Within this idea, the instructions that participants were given may have been either too detailed or not detailed enough for scoring of the AUT. Being an online survey when assessing the validity of the AUT, it is unknown how well participants read the instructions before completing the task and no opportunities to ask the experimenter questions about how to score the AUT were available. Furthermore, the majority of participants were completing the task in return for course credit and would have therefore wanted to complete the task as quickly as possible. Both time and knowledge could be tested in future experiments.

There is quite clearly a problem in scoring the AUT and more specifically, the agreement among what is considered a valid alternative use. The current methods of scoring tested question the validity of scoring the AUT. If high inter-rater reliability can have an impact on the scores which in turn can again be changed by a different method of scoring, this provides uncertainty towards the results of previous studies using the AUT, especially those that give only a vague description concerning how they scored the AUT.

What is considered as an alternative use needs to be agreed upon in order to achieve more reliable results when scoring the AUT. The first step towards this would be to obtain Guilford's (1967) manual of scoring to assess how precise his instructions are towards the validity of alternative uses. Data should be re-scored according to any more specific criteria that may be mentioned here to see if any further differences are found in scores of the AUT.

Creativity levels of judges needs to be assessed along with the issue of scoring flexibility and originality need to be assessed. Flexibility scores in music improvisation were also affected by the average scores in the pilot study of music improvisation, despite good reliability levels. It may be possible that a more objective approach of scoring flexibility can be created by assigning pre-defined categories. One effective way of doing this could be via thematic coding (Braun & Clarke, 2006), as suggested by Sowden and Dawson (Under review). This method would involve three raters, two of which score flexibility by identifying categories into which participants answers fit and a third judge to allocate responses to these categories.

An alternative method of scoring originality was also put forward by Sowden and Dawson (under review). This method suggests that instead of giving points of originality to the answers that are the least common, an average of the frequency of the item should be taken. This method could potentially overcome some of the problems and give more detailed scores of originality scoring, such that scores will be able to provide a more comprehensive range of how original participants scores were. However, the question of sample size still remains, such that should frequencies be taken from the current sample or should they be taken from a database of many responses?

8.9 EXPERIMENT EIGHT: ASSESSING THE AUT VIA A LIKERT SCALE AND THE IMPACT OF CREATIVITY ON SCORING THE AUT

It has been observed that discrepancies occur in the reliability and validity of scoring the AUT. Despite high reliability scores in AUT scores of fluency, an average score between the three judges used resulted in different results in the analysis of Experiment One such that AUT Fluency scores no longer showed a significant interaction between time and treatment. Experiments Six and Seven revealed that there was very low agreement as to whether a response was simply a valid alternative use or not. This raises further questions concerning how adequate the AUT is as a measure of divergent thinking, including whether scores are consistent across various samples, equal among different items and whether aspects such as the level of creativity judges possess can have an impact on how they score the AUT.

The results of Experiments Six and Seven showed that people do not agree on whether a response should be classed as a valid alternative use. However, this problem does arise from the many ambiguous responses that exist. For example, the response of 'creating a boundary' for the item brick results in ambiguity regarding whether this is part of the original use of a brick or not. Silvia et al. (2008) looked at new ways in which divergent thinking tasks, in particular the AUT, could be scored. One of these methods was by scoring alternative uses according to a 5-point scale and then averaging the score. This method of scoring, although subjective, thus allows responses in the AUT to be classed according to the quality of the answer (Harrington, Block, & Block, 1983) and has been carried out with both five and seven point scales by Grohman, Wodniecka and Klusak (2006), Harrington (1975), Mouchiroud and Lubart (2001). Silvia et al. (2008) concluded that this method of scoring resulted in some variability between raters (10-12%). However, G-coefficients of reliability were high and increased according to the number of raters (0.92 for five raters). This method of scoring was also found to have high validity. This was determined by obtaining the same relationships with personality and fluency scores that had been achieved in previous experiments which used the original methods of scoring. Furthermore, Silvia et al. (2008) concluded that using this method of scoring eliminated the usual high correlations of scores between fluency and originality. Therefore, it may be beneficial to score responses on the AUT according to a likert scale method. It would be beneficial to determine whether people agree on which items of the AUT are ambiguous, as well as assessing the validity and reliability of this scale. This may, in turn, affect scores on the Flexibility scoring dimension on the AUT. Furthermore, due to the high correlations often found between fluency and originality scores, if Silvia et al.'s. findings show that fluency is different from originality, this would suggest that fluency and originality should be assessed as two separate scores.

As discussed in 8.8, creativity differences exist among individuals (Torrance & Sternberg, 1988; Wolfradt & Pretz, 2001) and it is therefore feasible that an alternative use that requires more abstract thought may be scored differently according to how creative the individual scorer is seen to be. As a result, the creativity of an individual could have an impact on scores of the AUT and other tasks of divergent thinking. It has been suggested that the AUT may benefit from a method of Likert scale scoring (Silvia, et al., 2008) and that creativity levels of judges may affect how they rate the AUT, in terms of what items should be considered as valid.

Experiment Eight therefore aimed to look at a method of scoring according to a 5-point likert scale and the reliability associated with this method. Furthermore, this study aimed to look at whether creativity scores on the AUT could predict how participants scored other versions of the AUT.

8.10 METHOD

First and second year undergraduate Psychology students from the University of Hertfordshire provided screening data for Experiment Five by taking part in an AUT (N = 245). Of these 245 participants, 83 completed the AUT for a brick, 49 for a paperclip, 63 for a remote control and 50 for a newspaper. This screening data from Experiment Five was gathered and responses input into excel spreadsheets according to each common object that had been used in the AUT. This resulted in a total of 1140 responses, 400 for a brick, 164 for a paperclip, 352 for a newspaper and 224 uses for a remote control.

Each list was randomized and divided into separate files consisting of no more than 135 responses in each, resulting in nine files (see Appendix L). Each file was then put into alphabetical order and as an individual experiment on surveymonkey. Participants were all students from the University of Hertfordshire. All had taken part in an AUT themselves. Participants were then given the following instructions and asked to rate AUT responses according to a five-point likert scale, where one indicated the response was not a valid alternative use and five indicated that it was definitely a valid alternative use.

Instructions

An Alternate Uses Task (AUT) requires people to come up with different uses for a common object that DOES NOT involve the actual intended use.
For example, if the common object was a brick, then aspects such as building a house or a wall would not be classed as an alternate use.

This task asks you to judge whether an answer for the alternate use of a remote control is valid or not. Answers can be as abstract as participants wanted to make and do not have to necessarily work in real life. However, an answer is not deemed as valid for one of two reasons:
1. the answer involves what the object was originally intended for.
2. the response is not a USE.

Please note that these are actual responses from participants. Therefore, there is no specific number of valid uses, nor are there any right or wrong answers. We are just after your opinion as to whether you think the response counts as a valid alternative use or not.

For example, when thinking about alternative uses for a remote control a response such as "To change the channel" would not be an alternative use, whereas a response such as "to use it as a lightsaber" would be an alternative use.

8.11 RESULTS: AGREEMENT AMONG RATERS AND LIKERT SCALE RELIABILITY

8.11.1 Inter-Rater Agreement

Both ICC and Pearson's Coefficient correlation was carried out to assess the reliability of the likert scale. ICC was calculated for each survey that was generated in order to be able to measure absolute agreement among raters. Results are presented separately according to each set and are categorized by item.

Set 1: The likert scale for set one was found to have strong reliability with a Cronbach's coeffiecient alpha of .76. ICC for a **brick** revealed a weak (to moderate) correlation, r =.31, n=134, p < .001 between the five raters. However, if an average score of the five raters is taken, the ICC rises to a large moderate correlation, r =.69, n=134, p < .001.

Set 2: The likert scale for set two was found to have strong reliability with a Cronbach's coeffiecient alpha of .72. ICC for a **brick** revealed a weak (to moderate) correlation, r =.31, n=133, p < .001 between the five raters. However, if an average score of the five raters is taken, the ICC rises to a large moderate correlation, r =.69, n=133, p < .001.

Set 3: The likert scale for set three was found to have strong reliability with a Cronbach's coeffiecient alpha of .75. ICC for a **brick** revealed a weak (to moderate) correlation, r =.30, n=135, p < .001 between the five raters. However, if an average score of the five raters is taken, the ICC rises to a large moderate correlation, r =.68, n=135, p < .001.

Set 4: The likert scale for set four was found to have strong reliability with a Cronbach's coeffiecient alpha of .61. ICC for a **remote control** revealed a weak correlation, r =.08, n=113, p < .001 between the five raters. If an average score of the five raters is taken, the ICC rises to a moderate correlation, r =.30, n=113, p < .001.

Set 5: The likert scale for set five was found to have moderate reliability with a Cronbach's coeffiecient alpha of .53. ICC for a **remote control** revealed a weak correlation, r =.18, n=113, p < .001 between the five raters. If an average score of the five raters is taken, the ICC rises to a moderate correlation, r =.51, n=113, p < .001.

Set 6: The likert scale for set six was found to have weak reliability with a Cronbach's alpha of .23. ICC for **paperclip** revealed a weak correlation, r =.08, n=136, p > .05 between three raters. If an average score of the four raters is taken, the ICC remained a weak correlation, r =.23, n=136, p > .05.

Set 7: The likert scale for set seven was found to have weak reliability with a Cronbach's coeffiecient alpha of .11. ICC for a **newspaper** revealed a weak correlation, r =.02, n=118, p > .05 between the five raters. If an average score of the five raters is taken, the ICC remained a weak correlation, r =.08, n=118, p > .05.

Set 8: The likert scale for set eight was found to have strong reliability with a Cronbach's coeffiecient alpha of .74. ICC for a **newspaper** revealed a weak (to moderate) correlation, r =.40, n=118, p < .001 between four raters. If an average score of the five raters is taken, the ICC rises to a strong correlation, r =.73, n=118, p < .001.

Set 9: The likert scale for set nine was found to have weak reliability with a Cronbach's coeffiecient alpha of .11. ICC for a **newspaper** revealed a weak correlation, r =.03, n=119, p > .05 between three raters. If an average score of the five raters is taken, the ICC remained a weak correlation, r =.09, n=119, p > .05.

Further Analysis

Spearman's rank order correlation coefficients were performed to determine whether any judges strongly disagreed with the rest of the sample (see Appendix M). Versions 5, 7 and 9 displayed weak correlations throughout. The only version to suggest an outlier were versions 3 and 4, which indicated judge 3 to have less agreement in comparison to the other judges. Therefore, ICC was carried out again with judge 3 excluded in both cases.

The ICC for set 3 showed a moderate, positive correlation, r =.46, n = 135, p <.001. If an average score of the four raters is taken, the ICC rises to a large, positive correlation, r =.77, n=135, p < .001. The ICC for set 4 showed a weak, positive correlation, r =.20, n = 113, p <.001. If an average score of the four raters is taken, the ICC rises to a moderate, positive correlation, r =.49, n=113, p < .001.

These results show that by excluding potential outliers among judges, reliability can increase. However, set 3 already had a high ICC and this does not take into account the sets of scores that have low agreement across scores.

8.11.2 Likert Scale Reliability

An average score of the likert scale was taken and compared to the original scoring method used for the AUT. A Pearson product-moment correlation coefficient revealed almost no correlation between AUT Fluency scores and AUT likert scale scores, r =.03, n=23, p > .05.

These results therefore suggest that the two scores are measuring different aspects of the AUT.

8.12 THE IMPACT OF CREATIVITY ON SCORING THE AUT

Simple linear regression was applied to determine whether scoring of the AUT could be predicted by the judge's creativity score. The scatterplot of the relationship between AUT scores and creativity scores (figure 8.2) suggest that there is no correlation between the two variables.

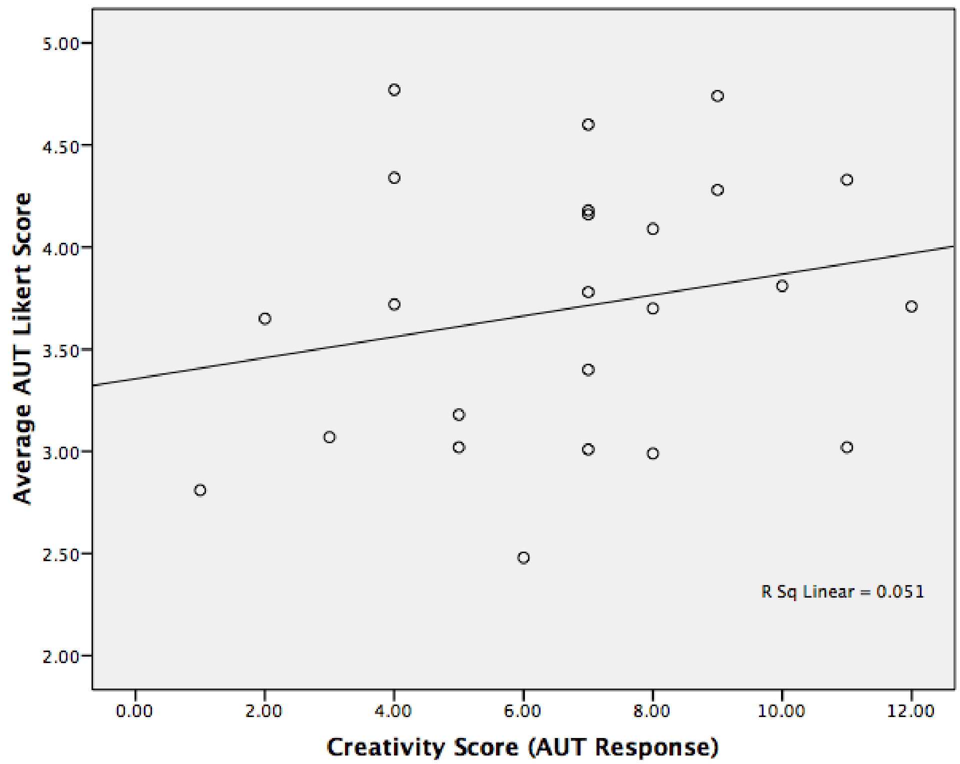

Figure 8.2 - Scatterplot of the relationship between creativity score and AUT score

This is confirmed with a simple linear regression which shows that it is not possible to accurately predict AUT likert scores from their individual creativity score elicited from the AUT, Y'=3.36 + (-0.05X) where X is an individual's creativity score and Y' is the best prediction of their AUT likert score. The 95% confidence interval for the slope of the regression line is -.05 to to .15. As this confidence interval includes 0.00, the slope does not differ significantly from a horizontal straight line.

8.13 DISCUSSION

Experiment Eight found that a five-point likert scale style of scoring the AUT, as suggested by Silvia et al. (2008), was more reliable than the method attempted at the beginning of this chapter but still has strong issues of reliability among raters. Furthermore, preliminary analysis suggests that this method of scoring may not be an accurate measure of scoring fluency but may be scoring a different aspect of the AUT overall. Experiment Eight also found that the creativity score of the raters (as measured by the AUT) could not predict how participants scored the AUT, with almost no correlation being observed between the two.

This experiment aimed to extend the findings and start to solve the issues that were observed with scoring the AUT in Experiments One to Five. By introducing a likert scale when scoring the AUT, it was hoped that this would allow for a higher agreement between raters, particularly when scoring ambiguous answers.

Nine sets of AUT responses were created for judges to score. For all but two sets, moderate to strong scale reliability was observed. Set 7 and set 9, both looking at alternative uses for a newspaper were found to have low scale reliability. This suggests that internal consistency for these items are low, likely due to particular low agreement between raters. Despite this, high internal consistency is particularly good in likert scales, as it is well-known that replicating a score on a likert scale is difficult. This in turn suggests that reliability of likert scales may be affected.

Inter-rater agreement was carried out using ICC, revealing weak correlations between raters. However, if ICC is carried out on an average score across the five raters, these correlations rose to be moderate to strong correlations for all but three sets (set four, seven and nine). This was expected in versions seven and nine as internal consistency was low. This also suggests that using an average score between raters is the most reliable method and this was done to score AUT responses by participant.

As the ICC produces one score for the agreement across all five raters, it is possible that correlations are low due to outliers. If one or two judges have completely different opinions, this could have an impact on the overall ICC. Inter-rater correlations were therefore calculated using Spearman's Rho correlation coefficient in order to be able to see the correlation between each pair of judges (see Appendix M). In the majority of cases, reliability between judges remained low. However, an agreement of .6 or above was observed between three raters in some sets. By selecting these judges within sets, the intraclass correlation would increase and therefore reliability would increase for these sets. Although, judge 3 was excluded from both sets 3 and 4, it is however difficult to exclude judges who may have weak agreement with one judge and strong agreement with another. It may therefore be beneficial in future to form an average likert scale score formed of the judges with the highest reliability between them and employing more raters when necessary.

Finally, no correlation was observed between AUT Fluency scores and the average likert score. While this may be due to the low reliability between raters, it may also be that the likert method of scoring is measuring something different to fluency. Measuring how much of an alternative use something is means people are not being scored as to how many valid responses they come up with but also according to another dimension of exactly how valid they really are. This prompts further investigation into the use of average scoring by means of a likert scale.

This experiment has therefore started to address the issues observed in the scoring of the AUT. Likert scale scoring suggests positive results in comparison to the reliability observed in Experiments One to Three. However, there is still a long way to go until an accurate and reliable scoring method is achieved. Furthermore, other methods of scoring as suggested by Silvia et al. (2008; Silvia, Martin, & Nusbaum, 2009), such as top two scoring should also be looked at in more detail.

This study also found that the creativity levels of the raters themselves (as measured by the AUT) did not have an impact on how they scored the AUT. These results did not change when looking at the AUT likert scores in relation to AUT fluency instead of response. It is likely that these results are simply due to the reason that creativity scores do not predict the way people score the AUT according to a likert scale. However, it would be interesting to determine whether any patterns exist when a higher level of reliability is established. As mentioned above, it may be possible to obtain higher levels of reliability by looking at the reliability between individual judges and selecting the two or three people who agree most highly with one another. This may in turn have an influence on whether creativity levels can predict how they score the AUT. Do people with the highest reliability have similar levels of creativity? In this sense, it may be beneficial to obtain categorical data of those who did and did not agree with one another and applying inferential tests to determine whether or not people with high levels of agreement have similar levels of creativity.

Furthermore, future research regarding creativity levels may wish to address the use of experts and novices in scoring. Amabile's (1982) CAT suggests that experts in creativity should be used when using this scoring method. Although the above does not utilize the CAT, it does look at creativity and differences in scoring between experts and novices may occur due to the extra knowledge that experts have regarding the topic area.

8.14 THE RELIABILITY OF THE AUT

As the AUT in the current program of research has been used pre and post treatment, as well as among a number of different experiments, at various times, it is important to look at reliability. Experiments One to Five indicated that issues of reliability may occur in the AUT.

Although all items for the AUT are counterbalanced, scores could be affected by uneven sample sizes for the different items. It is unknown whether certain items of the AUT elicit more responses than others and this could in turn have an impact on AUT pre and post scores due to carry over effects. It would therefore be useful to determine what the best items to use together would be. Therefore, the idea of whether AUT response scores were equal among the four different items used to administer the AUT throughout this program of research was investigated. Furthermore, test-retest reliability will indicate whether the AUT is a thorough measure across two different time points for within subjects measures.

Any discrepancies in item reliability could in turn have an impact on the pre-treatment scores of the AUT across the various experiments that have been carried out, such that those experiments that have used a newspaper, for example, will have higher AUT pre-scores than those that did not use this item. This in turn could have an impact on the reliability of the AUT across experiments. Therefore it would be useful to determine whether there were any significant differences across Experiments One, Two, Three and Five pre-treatment scores to ensure that they are consistent across experiments. Should results not be consistent across pre-treatment scores, this may explain why ceiling effects in the AUT appeared in Experiment Two but not in other experiments.

The final aspect of reliability that will be looked at is the use of paper versus computer based tasks. The AUT, as a divergent thinking task can be regarded as a task of creative thinking. It has been suggested that the way tasks are administered can influence creativity and affect the results of divergent thinking tasks. Wierenga and van Bruggen (1998) found that the number of ideas that people generated on the Creativity Inventory test was more if they did it on a computer than if they did a pen and paper version of the task. Furthermore, Massetti (1996) suggested results using computer software resulted in greater novelty in responses.

However, other studies have found the opposite effect such that paper based tasks resulted in significantly higher results (Dillon & Clyman, 1992). Lee and Weerakoon (2001) also suggested that paper based tasks elicited higher results in tasks of divergent thinking. However, these results were not found to be significantly different. In fact the majority of studies have either found inconsistent findings or no significant differences between these two methods of scoring (Burke & Normand, 1987; Finegan & Allen, 1994; Hicken, 1993; Mazzeo & Harvey, 1988; Vansickle & Kapes, 1993). The varying and inconsistent results in the literature may be due to differences in what task was used and the methodology associated with the tasks. It was therefore seen as important to look at whether the experiments using paper or computer based versions of the AUT differed as this could have an impact on the results seen.

The aim of the current research and analysis was therefore to look at the reliability of the AUT in more depth. Various ways of assessing the reliability of the AUT were analyzed including test retest reliability, item reliability and consistency across pre-treatment scores and across the methods taken (paper vs. computer administered versions of the AUT).

8.15 METHOD

8.15.1 Participants

Psychology students from the University of Hertfordshire provided screening data by taking part in an AUT (N = 245, see Experiment Five; Chapter 7). Of these 245 participants, 61 participants, all students from the University of Hertfordshire took part in another version of the AUT a minimum of three weeks after. Of these 61 participants, thirteen completed the AUT for a brick, 14 for a paperclip, 13 for a remote control and 20 for a newspaper.

8.15.2 Design

The Independent Variables were the time of when the AUT was assessed, the item used in the AUT, the experiment that the AUT was administered in and the version of the AUT; paper or computerized.

The Dependent Variables were scores elicited on AUT Response, Fluency.

If it is assumed that the AUT is highly reliable, then from an a-priori perspective, it was predicted that the null hypotheses would be accepted:

- There will be no difference in AUT scores between the two time frames at which the AUT was administered.
- There will be no difference in AUT scores between different items that were administered.
- There will be no difference in pre-treatment scores of the AUT across experiments.
- There would be no differences in AUT scores between paper and computer based versions of the task.

8.15.3 Materials and Apparatus

The AUT was administered on two separate occasions. Standardized instructions were used which can be found in Chapter 3.2.

8.15.4 Procedure

Participants from the University of Hertfordshire were recruited via two lectures at the university; one first year and one second year undergraduate lecture. During each lecture, students were asked to give informed consent and standardized instructions of the AUT were then administered. They were asked to indicate their student number in order to be able to identify them anonymously if they were to take part in a further experiment. Two items were administered in each lecture. This was determined according to which side of the lecture theatre students were sat. The items, brick and a paperclip were administered in the first year lecture, while a newspaper and remote control was administered in the second year lecture. Following completion of the AUT, participants were verbally debriefed about the purpose of the experiment.

Participants were invited to come back and complete another AUT a minimum of three weeks after the original AUT. Participants signed up to take part in this. This was administered in groups of between two and eight people. Following informed consent, the same instructions were followed but a different item given to participants. They were asked to indicate their student id numbers in order to match numbers up with their screening scores.

8.16 RESULTS

8.16.1 Test Re-Test Reliability

A within-subjects design was implemented which consisted of two levels; screening scores and pre-treatment scores.

A Pearson product-moment correlation coefficient was carried out to determine the inter-item reliability. This revealed no significant correlation with a weak correlation showing between AUT Screening Response scores and AUT Baseline Response scores of Experiment Five, r =.21, n=61, p > .05.

A paired samples t-test was carried out on participants screening scores (M = 7.39) and re-test scores (M = 8.61). This revealed a significant difference $t(60)$ = -2.23, p = .03, r =.28 such that participants performed better in the AUT in their re-test scores in relation to screening scores carried out at least three weeks prior to testing.

8.16.2 Reliability across Items of the AUT

A between-subjects design was implemented consisting of four levels, according to what item was used; brick, paperclip, newspaper and remote control.

Table 8.7 - Mean (SD) AUT Response Scores according to AUT item

AUT Item	AUT Response
Brick (n=400)	7.89 (3.14)
Paperclip (n=164)	5.73 (2.29)
Newspaper (n=352)	10.26 (4.11)
Remote Control (n=224)	5.57 (2.58)

A one-way ANOVA was carried out to determine if there were any differences between the AUT item administered and the AUT response score. There was a significant effect across the four AUT items administered on the AUT response score, $F(3, 241)$ = 27.08, p < .001.

Post hoc using Bonferroni adjusted alpha levels tests revealed a newspaper to have a significantly higher average AUT response score than a brick, paperclip and remote control. A brick also revealed significantly higher scores than that of a paperclip and remote control. The only two items not found to have significantly different average scores from one another were a remote control and paperclip.

8.16.3 AUT Pre-scores across Experiments One, Two, Three and Five

The total sample consisted of 159 participants. This was comprised of AUT pre-scores from Experiments One (n=41), Two (n=46) Three (n=29) and Five (n=43). Experiment One consisted of the AUT items, 'remote control' and 'paperclip'. Experiments Two and Three used the AUT items, 'newspaper' and 'paperclip'. Experiment Five used the items 'brick', 'newspaper', 'remote control' and 'paperclip'.
A between-subjects design was implemented with four levels, according to each experiment.

Table 8.8 - Mean (SD) AUT Response pre-scores according to experiment

	AUT Response
Experiment One	6.76 (2.91)
Experiment Two	8.28 (4.07)
Experiment Three	6.34 (4.89)
Experiment Five	7.70 (3.35)

A one-way ANOVA was carried out to determine if there were any differences between the AUT Response pre-scores across the experiments carried out. There was no significant effect across the four experiments on the AUT response score, $F(3, 155) = 2.06$, $p > .05$, suggesting equal AUT response scores across experiments.

8.16.4 Paper Versus Computerized versions of the AUT

Data consisted of a combination of Experiments One and Five for the paper based tasks (n = 84) and Experiments Two and Three for the computer based tasks (n = 75). The total sample consisted of 159 participants.
A between-subjects design was implemented consisting of two levels; paper based and computer based tasks.

An independent samples t-test was carried to look at the difference between AUT pre-scores administered by paper (M = 7.24) and by computer (M = 7.53). This revealed no significant difference $t(157) = -.49$, $p > .05$ such that there was no difference according to how participants carried out the AUT.

8.17 DISCUSSION

The overall findings of these analyses suggest that while there is high reliability in some areas of the AUTs used throughout this program of research, there is also cause for concern in other areas. Results showed that AUT pre-treatment scores were not significantly different across Experiments One, Two, Three and Five. Furthermore, response scores showed no significant differences for paper versus computer-based versions of the task. However, the results raise questions over the reliability of the AUT. Significantly different results were established over two different time points suggesting low levels of test re-test reliability, while significant differences among the various items administered across experiments were also found.

It was found that the different items that were used in the AUT resulted in significantly different means. This has implications for the results seen across experiments as although counterbalanced, pre and post treatment differences may still be affected. Although counterbalancing is designed to address small differences occurring between the scoring of these items, it is not ideal and should be treated as a precaution at best. Counterbalancing does not omit any carry-over effects therefore suggesting that pre and post differences can still be affected even when counterbalancing is used. The only items found not to be statistically different from one another were a paperclip and remote control. It is interesting to observe here, that Experiment One, which found the best interactions between time and treatment in the AUT, used these two items. However, those experiments that have elicited variability in results of the AUT have used items that are significantly different from each other. Experiment Five was reanalyzed for only the items of remote control and paperclip. This did not change the results that were observed with this experiment, suggesting that the results of Experiments Two and Three are reliable.

It may be that the difference found between AUT items explain the significant difference found in test re-test scores. The differences found among the AUT item that is administered may be due to the differences that occur according to the various items. In order to determine whether this is the case, it would be beneficial to look at test re-test scores using only the items remote control and paperclip. These two items were the only two items found not to differ from one another.

The findings that the AUT elicited consistent results across pre-treatment scores of experiments however provide very encouraging results, especially when the results of test re-test and item reliability are taken into account. With differences between items observed, it might be expected that pre-scores across Experiments One, Two Three and Five may differ, particularly when the same items were not used in every experiment. However, results showed that pre-scores across experiments were equal, meaning that despite variability, the norms remain consistent. This also provides more reliability given the different averages among the various items used in the AUT, such that despite various items being given in experiments, pre-score means still remain the same across experiments. This reliability is further backed up by the consistent results between paper and computerized task versions, showing high reliability in how the AUT is administered. These findings are also in line with the majority of findings that find no difference in the two ways that the tasks are administered (Burke & Normand, 1987; Finegan & Allen, 1994).

Overall, it can be concluded that the AUT has shown reliability across the experiments in this program of research. However, care and further research needs to be taken in regards to what item of the AUT is administered. At present, future studies using the AUT should focus on the items paperclip and remote control, until more items of similar response scores can be determined. Furthermore, the test re-test reliability should be tested according to these two items.

8.18 GENERAL DISCUSSION

Chapter Eight has raised issues regarding the reliability of the AUT, in particular with the methods of scoring the AUT. Agreement levels as to what is classed as a valid alternative use are low, indicating low reliability in scoring of the AUT. Furthermore, test-retest was not found to be reliable with the AUT and the items used in the AUT were not found to have equal response scores. However, despite these results, results do not differ across pre-scores of Experiments One, Two, Three and Five, and furthermore, the method of administration, paper or computer, does not have an impact on results.

In addition to the results found regarding the AUT, a new common response list to score originality for the circles version of the ATTA was also developed, showing no difference in scores between the triangles and circles version of the ATTA. This can now be administered in further experiments using two versions of the figural test in the ATTA.

As indicated in 8.8, the results surrounding the scoring of the AUT suggest further implications. Firstly, items that elicit equal average scores need to be established and used consistently across experiments. Test re-test reliability should then be tested using these items of equal response rate. Furthermore, the method of scoring should continue to be addressed. Firstly, alternative methods of scoring, as suggested by Silvia et al. (2008) should be tested. This could include methods such as top two scoring, which involves scoring items according to what are seen as the two most creative answers. This results in a creative score, as opposed to fluency. Average scoring has also been suggested by Silvia et al. (2008). It may therefore be that this is also resulting in a measure of creativity as opposed to fluency and the question of what the likert scale really is measuring needs to be addressed. Furthermore, reliability of the scales need to be increased. It may also be beneficial to take average scores of people who have high inter-rater agreement according to Pearson's Correlation Coefficient and determining whether this has an impact both on reliability and results.

Importantly, a set of standardized instructions and items need to be established, for use across the AUT in general. Furthermore, it may be that people both utilising and scoring the AUT should take part in some training in order to try and establish consistency in research concerning the use of the AUT. Without these standardized instructions and without a standardised and reliable scoring method, the AUT will continue to have problems in terms of both validity and reliability across creativity research.

Chapter 9: Experiment Nine - The Role of Gestures in Improvisation and Cognition

Throughout this program of research, a cognitive change has been observed following improvisation tasks in comparison to a control condition. However, the improvement that is observed may vary according to participant and according to the cognitive workload that they experience when improvising. Observing gesture can indicate the level of cognitive workload an individual is experiencing. This chapter analyzes the link between gesture production and outcome measures such as quality of improvisation and cognitive improvement.

9.1 INTRODUCTION

Cognitive changes are often a function of the cognitive workload an individual is experiencing. By cognitive workload, it is meant that people may find tasks more cognitively demanding, meaning that areas such as Working Memory have more to do along with extra pressure for the task to be done. This in turn will have implications for the level of workload experienced on the Central Executive in working memory. The more resources required in working memory, the greater the amount of cognitive workload. For some people, improvisation will require a greater cognitive workload than for others and as consequence will have a different impact across the range of people who take part in improvisation.

Cognitive workload is related to the amount of information that is needed to be processed via working memory (see Chapter 2.2.2). The more novel information presented to someone at a particular time, the higher the cognitive workload. Cognitive workload is likely to be high in improvisation and is increased by fast pace of new information presented to somebody in a short space of time. It is thought that the level of cognitive workload is eased during improvisation through the use of past knowledge and schemas. By accessing schemas when improvising, people are able to use their cognitive resources to try and find something novel and original to fill in the slots. Furthermore, by utilizing a particular schema while improvising gives people time to think of a new schema to introduce once the current schema has been used.

One possible way to try and determine the level of cognitive workload that improvisation has across various people is to look at their hand gestures. As well as serving communicative purposes, gestures have been shown to reflect the cognitive workload that someone is experiencing (Goldin-Meadow, 2000), such that the higher the cognitive workload, the higher the gesture rate. People gesture even when no-one can see them (Alibali, Heath, & Myers, 2001), suggesting that gesturing does not only occur for communicative purposes. This is reflected through the type of gesture, from gesturing about the particular object they are referring to (iconic or representational gestures), gesturing about things that aren't there (metaphorical gestures) through to pointing to specific things (deictic gestures).

It has been suggested that gestures may show or help out with the thinking that goes on while people are talking (Iverson & Goldin-Meadow, 1998; McNeill, 1992; Rauscher, Krauss, & Chen, 1996). Rauscher et al. (1996) found that preventing adults from gesturing could have a detrimental effect on the person speaking such that speech is not as fluent if someone is prohibited from gesturing. Goldin-Meadow (2000) went on to suggest that gestures reflected the process of cognition and that gesturing could ease the cognitive load for the speaker. It may be that a freeing of cognitive workload through gesture could help lexical retrieval such that it is easier to retrieve words from short-term memory.

The idea that gestures could lighten cognitive load was demonstrated by Goldin-Meadow, Nusbaum, Kelly and Wagner (2001) who looked at both children and adults' use of gestures when trying to solve maths problems. Forty children and 32 adults were asked to solve a series of maths problems, followed by a list of words or letters to remember. Following this, all participants were asked to explain how they solved the maths problems under two conditions; allowed to gesture or not allowed to gesture. Finally, upon completion they were asked to recall the list of words or letters given to them. Goldin-Meadow et al. (2001) found that adults and children recalled more letters or words if they gestured in their explanation of the maths problem. This had nothing to do with how good they were at solving these problems. It was therefore suggested by Goldin-Meadow (2000)that gesturing while explaining the solutions to the maths problems lightened the cognitive workload, freeing up more space in working memory. The extra space in working memory is why, they hypothesized, memory recall was greater following the gesturing condition.

However, Goldin-Meadow and Wagner (2005) also suggested an alternative view that instead of lightening cognitive workload, gesturing allows people to switch between parts of their working memory. More specifically, they suggested information was being shifted from a verbal processing area (the phonological loop) to a visuo-spatial processing (the visuo-spatial sketchpad) area. Applied to Baddeley's (1986) working memory model, this would suggest that information in the phonological loop was being moved over to the visuo-spatial sketchpad. It would also indicate the use of the Central Executive (CE). The CE would be controlling the use of the phonological loop and visuo-spatial sketch pad and allocate space accordingly, in order to free up more resources in the phonological loop for the memory recall task, which is another verbally based task. However, Wagner, Nusbaum and Goldin-Meadow (2004) demonstrated that gesturing in relation to a spatial task where they had to remember patterns within a grid, elicited the same results as having to remember strings of words, suggesting that gestures in relation to working memory is not specific to the phonological loop. If the above theory was the case, this task should be harder because more resources are being used in the visuo-spatial sketchpad, leading the authors to conclude that gesturing is in fact lightening cognitive workload.

The above research suggests that gesturing lightens cognitive load so that some of the cognitive burden when talking is reduced. Ping and Goldin-Meadow (2010) wanted to extend this research and see whether the previous cognitive benefits observed could be seen if people were talking about objects that were not physically present. Following the same method as Goldin-Meadow et al. (2001), they asked children to solve the Piagetian (1952) liquid conservation task, learn some words and then explain how they solved the problem before recalling the words. However, as well as being told whether to gesture or not, conditions were further split into explaining how the task was done with the objects either being present or not. Ping and Goldin-Meadow (2010) replicated the previous findings in relation to recall and gesture such that people who were allowed to gesture remembered more words. They also concluded that it did not matter whether the objects were present or not such that children gestured at equal rates. However, the type of gesture that was produced differed, such that less use of deictic gestures in comparison to iconic gestures were used when the objects were not present. Again, it was suggested that gesturing may lighten cognitive workload, freeing space up to recall words in working memory. Furthermore Ping and Goldin-Meadow (2010) suggest that gesturing helps people to represent mental models that are in their head. In this sense, it may be that people gesture according to the schemas that they are accessing at that particular point in time.

Other theories for why people gesture have also been suggested including the idea that it is to help motor function and provides the information needed, as well as the idea that gestures help us to organize things (Louwerse & Bangerter, 2005). In this sense, it may be that it helps to organize all the information as it enters the central executive. It has been proposed that gestures prepare an individual for speech (Information Packaging hypothesis Kita, 2000). Furthermore, Morsella and Krauss (2005) found that lexical retrieval was related to gestures, such that as lexical retrieval difficulty increased, so did the participants gesture rate.

Based on the previous research that suggests speech may help to lighten cognitive workload, Experiment Nine examined participants hand gestures to explore their role towards whether gestures serve as a retrieval cue. The idea that gestures could reflect a higher level of cognitive workload was investigated.

Goldin-Meadow (2000) suggested that gestures could help people "bring in new information" (pg. 237). Furthermore, Goldin-Meadow and Wagner (2005) also suggested that gesturing can help with the production of novel ideas. An idea is recognized as novel partly because the idea does not fit in with schemas. This could in turn be beneficial for improvisation. Applied to improvisation, bringing new information into working memory would encourage the use of new ideas both creatively and cognitively. Gesturing may also therefore reflect the quality of improvisation as the more novel and original ideas are, the better an improvisation is classed to be (see Chapter 1).

If it is the case that gesturing lightens cognitive load, then gesturing frees up more resources for other tasks. Therefore, the aims of the next experiment was to determine whether people gesture more when they improvise, whether the amount people gestured was reflected in their quality of improvisation and finally, whether those who gesture more, do better in cognitive tasks due to more resources being available in working memory

9.2 EXPERIMENT NINE: GESTURE RATE IN RELATION TO IMPROVISATION

It is thought that improvisation is a cognitively more demanding task than speaking in normal conversation. It is suggested that by gesturing more, people lighten their cognitive load, making the task easier for themselves (Goldin-Meadow, 2000).

Goldin-Meadow and Wagner (2005) also suggested that gesturing can increase novelty by bringing new information into working memory. Gesturing could therefore reflect the quality of improvisation as the more novel and original ideas are, the better an improvisation is classed to be. Furthermore, if gesturing lightens cognitive workload, and even helps people with lexical retrieval, gesture rate may be an indication of the quality of improvisation such that those who gesture more produce a higher quality of improvisation due to having more resources available in working memory.

In relation to the idea that gesturing can lighten cognitive load and to the findings of Goldin-Meadow et al. (2001) and Goldin-Meadow and Wagner (2005), it may also be that gestures reflect the cognitive increase seen in pre and post cognitive scores. The cognitive burden of improvisation is likely to vary across participants. Gestures may reflect how much cognitive workload is being experienced. Alternatively, it may indicate that those who gesture are able to free up more resources in working memory.

The aim of Experiment Nine was to see whether any differences occur in gesture rate in relation to improvisation. More specifically, this experiment aimed to look at whether people tend to gesture more when they improvise in comparison to verbal discussion, to see whether there was a difference in gesture rate according to participants quality of improvisation such that better improvisers gesture significantly more. Finally, in relation to the idea that people gesture to lighten cognitive load, this experiment aims to find whether gesture rate is associated with cognitive performance following improvisation or a verbal discussion. The experimental hypotheses for this experiment were that there would be significant differences in gesture rate when compared between improvisation and control treatment tasks, between ratings of improvisation and in relation to performance in cognitive tasks.

9.3 METHOD

9.3.1 Participants

This study consisted of a convenience sample of 90 participants from the University of Hertfordshire. Prior to collecting data for this study, participants had either completed Experiment Five (n=43) or a twenty minute version of the study (n = 47). All data was collected after all cognitive tests such that after the experiment was completed, they were called out to improvise individually.

9.3.2 Design

Treatment consisted of one minute of verbal improvisation and one minute of a verbal discussion. The Independent Variables were the treatment condition, improvisation rating. The Dependent Variables were gesture rate and scores on cognitive tasks.

The experimental hypotheses for this experiment were:

- There will be a significant difference in gesture rate between the improvisation and control treatment tasks.
- There will be a significant difference in gesture rate and quality of improvisation scores, such that better improvisers will gesture significantly more.
- There will be a significant difference in cognitive scores pre and post treatment in relation to gesture rate.

This study has received ethical approval, protocol number: PSY/10/09/CL.

9.3.3 Materials and Apparatus

All participants completed one minute of verbal improvisation and a one minute verbal discussion. The verbal improvisation task involved answering the following question: "What's that bleublepip on your shoulder?" After the participant answered this question, they continued to improvise around with the topic with the experimenter.

Verbal discussion consisted of answering the following three questions:

"Tell me about the secondary school you went to."

"Why did you decide to come here and study Psychology?"

"What would you like to do after this degree?"

A video recorder was used to capture the gestures of participants.

9.3.4 Coding gestures

In order to analyze gestures, videos were loaded onto version 8 of Observer XT, a computerized coding system. A coding scheme was designed which allowed videos to be coded for speech and gesture with the use of state events. Coding can take place using either state or point events. Point events are events that are coded as simply the frequency of occurrence while state events measure both the occurrence and the duration of an event.

The onset of a gesture was measured by pressing a predetermined key when a communicative hand movement began. When the hand movement finished, a corresponding key was pressed to signal the end of the gesture. The same process applied for speech to measure the duration of each verbalization. For this experiment, talking and gesturing were coded as state events. A gesture was defined as any hand movement that was related to the participant talking. For example, tucking hair behind the ears was not considered as a gesture. Talking was stopped for any pauses greater than one second. Only representational gestures were coded. Representational gestures reflect those that are spontaneous and semantically related to the context (Rauscher, et al., 1996).

A gesture rate for each participant in each condition was then calculated by taking the number of gestures per session and dividing this by the total duration of the participant's speech.

9.3.5 Rating Improvisation

In addition to this, improvisations were rated for quality of improvisation. Improvisations were transcribed for each participant before scoring. Improvisations could have been rated by participants watching the videos themselves, the improvisations were being rated by fellow students in the undergraduate Psychology course at the University of Hertfordshire. Therefore, by transcribing the videos, this eliminated the risk of raters recognizing the participants.

Improvisation quality was then assessed based on Amabile's Consensual Assessment Technique (CAT; Amabile, 1982, 1983). Two raters were asked to read through all the transcriptions. Once all the transcriptions had been read, participants were given a written definition of improvisation.
"Improvisation is the process of creating in real time. Improvisation, therefore, is exploring in a spontaneous manner to form something that is new, unique and imaginative."

They were then asked to read through them again but to organize the transcriptions into rank order, such that the transcriptions ranged from best to worst. Upon completion the two raters were then asked to go through the transcriptions in order and assign them a score of one to five. One stood for a poor quality improvisation while five stood for an excellent improvisation.

9.3.6 Procedure

Once participants had completed an initial experiment, they were individually asked to enter a separate room in order to film them improvising and talking for a short amount of time. Upon agreement, each participant was asked to sit in a chair facing the video camera. They were then verbally explained the procedure of what would happen and upon agreement, recording started. Each participant then completed both the improvisation and control conditions. The order in which participants completed these was counterbalanced such that participants who originally took part in the improvisation condition improvised first, while those who had taken part in the control condition participate in a verbal discussion to begin with. Upon completion, participants were thanked for their time and debriefed.

Videos were then individually recorded onto a computer and labeled by both participant and condition for analysis. Following coding using Observer OX, results were imported into SPSS for analysis.

9.4 INTER-RATER RELIABILITY

9.4.1 Gesture Rate

To determine accurate reliability of the observational analysis, a second coder, experienced in the use of observer analyzed 10% of the videos for both talking and frequency of gestures. The relationship between the two judges' frequency of gestures was investigated using Pearson product-moment correlation coefficient. This revealed a strong, positive correlation between the two judges' ratings, r =.82, n=17, $p < .001$, showing a high level of agreement between the two judges ratings. The relationship between the two judges' agreement of for participants speech was investigated using kappa coefficient where a strong, positive correlation was found for the control videos, $k = .75$, $p < .001$ and a moderate, positive correlation was found for the improvisation videos, $k = .64$, $p < .001$.

9.4.2 Improvisation Ratings

In order to determine the agreement between raters, the relationship between the two judges scoring was investigated using a Pearson product-moment correlation coefficient.

Both judges were postgraduate students at the university of Hertfordshire. However, one judge was an experienced researcher in creativity while the other did not carry out research in this area. A strong, positive correlation was found between the two scores, r =.72, n=79, p < .001. This indicates a high level of agreement between the two raters. Due to this results were analyzed using rater one's scores as this rater was experienced in the field of creativity.

9.5 RESULTS

Of the 160 improvisation and control videos, 30 (16 Improvisation and 14 Control) did not produce any gestures. This was formed of 20 participants. Furthermore, 72 videos (39 improvisation and 33 control) had a gesture rate of three or less. This was formed of 57 participants.

9.5.1 Does gesture rate differ according to condition?

A within subjects design was implemented consisting of two levels (improvisation and control).

Improvisation gesture rate (M=.18, SD=.2) was compared with the control condition gesture rate (M=.13, SD = .1) using a paired samples t-test. This revealed a significant difference, $t(56) = 2.29$, $p = .026$ such that participants gestured more when they were improvising compared to when participating in verbal discussion.

9.5.2 Does gesture rate differ according to improvisation ratings?

A between subjects design was implemented consisting of one factor; quality of improvisation. This factor had five levels; 1 – Worst improvisers, 2 – Bad improviers, 3 – Average improvisers, 4 – Good improvisers and 5 – Best improvisers.

Table 9.1 - Mean (SD) of gesture rates according to quality of improvisation

Improvisation Rating	Gesture rate – Improvisation	Gesture rate – Control
1 (Improv, n = 14, Control, n = 12)	.24 (.22)	.14 (.18)
2 (Improv, n = 17, Control, n = 12)	.09 (.11)	.13 (.15)
3 (Improv, n = 14, Control, n = 11)	.15 (.15)	.17 (.17)
4 (Improv, n = 24, Control, n = 23)	.18 (.20)	.12 (.12)
5 (Improv, n = 10, Control, n = 7)	.30 (.19)	.15 (.13)

A between subjects ANOVA was conducted to compare the effect of the quality of improvisation on gesture improvisation rate, where 1 indicated a bad improvisation and 5 an excellent improvisation. There was a significant effect of improvisation quality on the improvisation gesture rate for the five categories, $F(4, 74) = 2.84$, $p = .03$. Post hoc comparisons using Fisher's Least Significant Difference (LSD) revealed a significant difference between improvisation scores of one and two. Furthermore a significant difference was also revealed between participants with improvisation scores of two and those with a score of five, and three and five, suggesting that people gesture more when they score higher in improvisation but also suggesting that people who achieve the worst possible score for improvisation quality also gesture more.

A between subjects ANOVA was conducted to compare the effect of the quality of improvisation on gesture control rate, where a score of one indicated a bad improvisation and 5 an excellent improvisation. There was no significant effect of improvisation quality on the improvisation gesture rate for the five categories, $F(4, 60) = .23$, $p > .05$. This suggests that there is no difference among how good people were at improvising and how much they gestured when participating in verbal discussion.

To investigate these effects further, ratings were divided into categorical data of good and bad improvisers. Anyone who had scores 1 or 2 for their improvisation scores were seen as 'bad' improvisers while those who had scored 4 or 5 were classed as 'good' improvisers. Paired samples t-tests were then carried out comparing whether good and bad improvisers differed in their improvisation and control gesture rates.

Improvisation gesture rate (M=.19, SD=.2) was compared with the control condition gesture rate (M=.11, SD = .1) for good improvisers only. This revealed a significant difference, $t(30) = 2.93$, $p = .006$ such that participants gestured more when they were improvising compared to when participating in verbal discussion.

Improvisation gesture rate (M=.18, SD=.2) was compared with the control condition gesture rate (M=.16, SD = .2) for bad improvisers only. This revealed no significant difference, $t(25) = .43$, $p > .05$ such that participants gestured equally when improvising and participating in a verbal discussion.

9.5.3 Is gesture rate related to performance on cognitive tasks?

A between subjects design was implemented with one factor; gesture rate. Factor one had two levels; high and low gesture rates. Gesture rate was manipulated to be the Independent Variable such that participants were divided into high or low gesturers.

Table 9.2 - Mean (SD) of cognitive tasks in relation to gesture rate

		AUT Fluency score	**COWA Fluency score**
Improv. Gesture rate – Low (N=41)	Pre	7.32 (3.02)	36.41 (8.19)
	Post	9.15 (3.37)	40.76 (7.77)
Improv. Gesture rate – High (N=37)	Pre	7.30 (3.49)	36.76 (8.05)
	Post	8.32 (3.68)	37.78 (9.83)
Control Gesture rate – Low (N=33)	Pre	7.21 (3.36)	37.24 (6.26)
	Post	8.79 (3.75)	39.64 (7.74)
Control Gesture rate – High (N=32)	Pre	7.34 (3.72)	37.28 (9.12)
	Post	8.66 (4.07)	39.41 (9.48)

COWA and Gesture Rate

For the COWA Fluency scores, there was no significant main effect of treatment, $F(1, 76) = .53$, $p > .05$. There was a significant main effect of time, $F(1, 76) = 17.34$, $p < .001$, partial $\eta^2 = .186$ and a significant interaction between time and treatment, $F(1, 76) = 6.61$, $p = .012$, partial $\eta^2 = .080$.

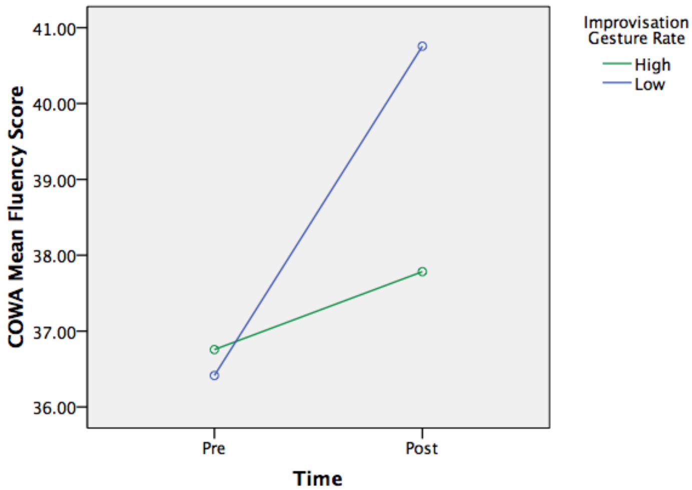

Figure 9.1 - COWA Fluency scores pre and post treatment according to gesture rate

Figure 9.1 shows the relationship of COWA scores according to improvisation gesture rate. It can be seen here that people who did not gesture as much improved in scores of COWA. This is confirmed with paired samples t-tests which revealed a significant effect pre and post treatment for low gesturers $t(40) = -5.82$, $p < .001$, but no significant effect for high gesturers, $t(36) = -.96$, $p > .05$ pre and post improvisation.

Furthermore, an independent samples t-test on scores of high (M=1.02) and low (M=4.34) gesturers on COWA fluency difference scores was also significant, $t(76) = -2.57$, $p = .012$ such that low gesturers showed a bigger change in COWA fluency scores.

For the COWA Fluency scores in relation to control gesture rate, there was a significant main effect of time, $F(1, 63) = 7.87$, $p = .007$, partial $\eta^2 = .111$. There was no significant main effect of treatment, $F(1, 63) = .003$, $p > .05$ and there was no significant interaction between time and treatment, $F(1, 63) = .03$, $p > .05$. This suggests cognitive differences only occur in relation to gesture rates of improvisation.

AUT and Gesture Rate

For the AUT Fluency scores in relation to improvisation gesture rate, there was a significant main effect of time, $F(1, 76) = 18.59$, $p < .001$, partial $\eta^2 = .197$. There was no significant main effect of treatment, $F(1, 76) = .37$, $p > .05$ and there was no significant interaction between time and treatment, $F(1, 76) = 1.47$, $p > .05$.

For the AUT Fluency scores in relation to control gesture rate, there was a significant main effect of time, $F(1, 63) = 11.28$, $p = .001$, partial $\eta^2 = .152$. There was no significant main effect of treatment, $F(1, 63) = .00$, $p > .05$ and there was no significant interaction between time and treatment, $F(1, 63) = .09$, $p > .05$. These results suggest that there were no differences for AUT fluency scores according to how much people gestured.

9.6 DISCUSSION

Experiment Nine aimed to determine whether looking at gestures could indicate any differences between improvisation and verbal discussion. Overall, it was found that participants gesture more when they are improvising compared to taking part in verbal discussion. Furthermore, differences were observed according to improvisation quality such that the worst and best rated improvisers gestured significantly more in comparison to the rest of the sample. Finally, participants who gestured less, did better in a verbal fluency task post treatment, irrespective of the intervention condition.

The results that when compared to a verbal discussion, people gesture more when improvising, means the experimental hypothesis is accepted and provides support towards the idea that gestures lighten cognitive load. Improvisation is a cognitively more taxing task than that of verbal discussion and therefore may use more gestures to lighten the workload. Furthermore, gesturing may help novel information to be produced (Goldin-Meadow, 2000; Goldin-Meadow & Wagner, 2005). However, these findings could also be explained by the lexical retrieval hypothesis (Morsella & Krauss, 2005) such that gesturing more when improvising means that people are able to retrieve words that they need at a faster rate. Improvisation requires people to think of new verbal information, in real time. As such, there is a huge pressure being applied to working memory to retrieve the words that are needed. In this sense, according to Morsella and Krauss, people may gesture more when improvising in order to try and access the words and ideas that they need to in such a short space of time.

It may be that both of these explanations apply to the current results. Improvisation, which involves a higher cognitive burden than a simple verbal discussion may incur a higher gesture rate to ease the workload and free up space in working memory. As such, this may free the phonological loop to retrieve more words as well as novel material. Gesturing may help lexical retrieval by the process of lightening the cognitive workload. This in turn, may leave the CE to access more schemas when improvising. Furthermore, these results suggest that by lightening cognitive workload, more schemas can then be accessed in working memory in the cognitive tasks post intervention. Should this be found, this would comply with the results of Goldin-Meadow et al. (2001) and Ping and Goldin Meadow (2010).

A significant difference was also found in gesture rate of improvisations according to improvisation quality, such that those who were rated a score of one or five and therefore the worst and best improvisers gestured significantly more than those who were scored a two or three and were therefore considered bad or average. Furthermore, it was found that good improvisers gesture more when they are improvising compared to when they are participating in verbal discussion. This was not the case for those rated as bad improvisers, where no difference in the amount of gesturing between the two gesture rates was found.

There are a number of reasons that could begin to explain these results. The results according to CAT scores were that the best improvisers gestured significantly more than bad or average improvisers. These results are in line with the hypothesis and suggest that a higher rate of gesturing may lighten cognitive load, leading to a higher quality of improvisation. Furthermore, it may lead to greater lexical access and novel information (Goldin-Meadow & Wagner, 2005). The finding that good improvisers gestured more when improvising in comparison to a verbal discussion and that this was not replicated with poor improvisers also suggests that gestures are serving a cognitive benefit which in turn improves the quality of improvisation such that the more gestures that are produced, the more likely a better improvisation will be produced. Therefore, these findings again provide support for both the theory that gesturing lightens cognitive load, such that the best improvisers gestured more, and the lexical retrieval hypothesis, such that the worst improvisers gestured more, most likely to try and retrieve words for the improvisation. The finding that the worst improvisers also gestured significantly more could be due to the different levels of cognitive demand that improvisation has on people. It could be that those who were found to be worse at improvisation found the task cognitively more challenging and as a consequence, more gesturing may have been implemented to help lexical retrieval. This would indicate why they did not improve in scores of improvisation quality.

The method of scoring improvisation in this study should be looked at further. For the current study, improvisation transcriptions were used to rate improvisations. However, it would be beneficial to determine whether the same ratings are given to participants if raters were to watch the original videos and rate people in this way. Although this was not possible in the current experiment, it would be beneficial to determine whether there was a change in scores in the different way improvisations can be assessed. Furthermore, Amabile (1983) states that only experienced people in the field should analyze creativity using the CAT. Again, this was not possible in the current study where one judge researched creativity and the other did not. However, with the agreement found between raters, it would be interesting to determine whether improvisation should be scored by experts in the field or whether results that are just as reliable can be achieved by novices with a small amount of training. It is also worth bearing in mind that gestures themselves could influence rater scores of improvisation when watching the actual video of improvisation itself.

The last finding that was found in Experiment Nine revealed that scores in COWA fluency significantly increased with low levels of gesturing when improvising but not high levels of gesturing. No other differences were found between cognitive scores and gesturing. These results again indicate that gesturing reflects the amount of cognitive workload that is being experienced. In this case, people with low levels of gesturing may find improvisation cognitively less taxing than those who gestured significantly more. This would also explain why the worst rated improvisers gestured more. As well as a way to help gain resources within working memory, gesturing is a reflection of how much cognitive burden the participant is experiencing as a result of improvisation.

These results were only found when comparing gestures in the improvisation condition. It is interesting that these effects were only observed in the COWA and were not found in the AUT. It may be that tasks of verbal fluency, such as the COWA need fewer resources devoted to it and therefore this could be why it appears that gesturing is simply a reflection of the cognitive load being experienced. These results would also be in line with the lexical retrieval hypothesis as this theory suggests that we gesture to access more words. If we do not need to do this, then there is no reason to gesture. Furthermore, it is interesting to observe that the AUT was found to increase post intervention in cognitive chapters (see summary in Chapter 7.5). No differences in gesture were observed in the AUT, but they were observed in the COWA which suggests the two tasks require different aspects of cognitive functioning.

If gesturing lightens cognitive load, higher gesturers would be expected to score more highly on cognitive tests. However, the opposite was found such that those who gestured the least improved on the COWA, a task of verbal fluency. These results therefore suggest that gesturing may reflect the cognitive load that an individual experiences. As those who provided the best and worst quality improvisation gestured more, it cannot be assumed that the low gesturers simply did not need to gesture. However, the type of task that was found to relate to low gesturers may have had an impact on the results. No results were found with the AUT, the task that was found to have a significant difference between people who improvised and those who participated in a control condition. This, along with tests that found the treatment condition had no impact on the COWA suggests that gesturing does not relate to how well people will do following either improvisation or verbal discussion. Therefore, gesturing may indeed reflect individual differences in the cognitive workload participants experience. Furthermore, the idea that verbal fluency tests fluid intelligence may also have had an impact on results. Therefore, it may be that those who gesture less are experiencing a smaller cognitive workload and therefore have more resources available to access lexical information. These findings, in relation to Morsella and Krauss (2005) would imply that the COWA is a cognitively less challenging task than the AUT, showing why people who gestured less when improvising still showed a larger cognitive difference in the COWA.

It is also worth noting that all tests were also carried out according to condition; improvisation or control. This had no impact on results in all cases such that gesturing did not relate to the cognitive increase observed in the improvisation condition only. It is clear that further research in relation to gesture and cognitive tests are needed. These results indicate that low gesturers are more likely to do better in a task of verbal fluency, irrespective of the treatment intervention that they take part. Finally, the results demonstrated by Goldin-Meadow et al. (2001) and Goldin-Meadow and Wagner (2005) demonstrated an increase in memory tasks if people gestured more when explaining how they solved a maths problem. It would therefore be useful to look at memory in relation to improvisation in future, to see whether cognitive differences occur here according to the amount of gesturing people use when improvising, as well as to see whether the findings of Scott et al. (2001; see Chapter 2.1.1) can be replicated and extended.

Further research and in-depth analysis should also be carried out here. The type of gesture that participants used could be implemented into analysis. This is however, beyond the scope of this program of research. The current study simply looked at participants' gesture rate, irrespective of what kind of gestures they produced. Gestures, however can be analyzed according to duration and according to the type of gesture. Gestures could be analyzed to determine whether they are congruent with speech. Findings in this area would have implications for the lexical retrieval hypothesis. This is because if we gesture to retrieve words, then if people gesture something which is later mentioned in conversation, it suggests people are gesturing in order to access these words. Gestures can also be divided by type such that it is possible to observe whether people are carrying out representational or iconic gestures, such that the speaker is directly referring to the object they are talking about; metaphorical gestures, such that the participant is talking about something that is not there; deictic gestures, such that the participant is pointing or referring to something in particular; and beat gestures – gestures which do not specifically relate to someone. Caution however, should be taken while distinguishing between these gestures with improvisation, as people are instructed to talk about objects that are not there, causing potential discrepancies between scoring iconic and metaphorical gestures.

In addition to this, a more elaborate coding scheme should be used to express the precise coding used across raters. Although inter rater reliability was high (r =.82), these results need to be taken with caution. Upon scanning the raw data, it was clear to see that reliability between raters is not accurate among higher gesturers. While this would not have an impact when looking at high and low gesturers, the difference could potentially change the gesture rate of higher improvisers. One rater's gesture rates were used ensuring consistency in the current experiment. However, a clearer, more precise coding scheme with equally concise instructions needs to be implemented in future. Experienced coders should also be used who are familiar with Observer OS X and coding schemes. Within this, exact gaps for pauses in talking (>1s) should be indicated along with brief descriptions concerning the different types of gestures that can be coded.

Gestures were only looked at for a brief amount of time. It would be useful to observe gestures throughout the entire improvisation session that takes place in each experiment to see whether the amount of gesturing differs. Should gesturing differ this may have an implication on the results seen. However, should it not differ, this would provide support for taking a short improvisation clip and analyzing gestures based on this. In addition to this, it would be interesting to investigate the idea of prohibiting gestures within improvisation as there is evidence to suggest that prohibiting people from gesturing can have an impact in lexical retrieval (Goldin-Meadow, et al., 2001). It would be interesting to look at this both in relation to improvisation and their cognitive performance post improvisation.

Finally, it would be interesting to look at gesture rate in relation to expert and novice improvisers. It has been suggested that gesture research could differ in relation to experts and novices (Goldin-Meadow & Singer, 2003). As well as this, due to the differences found between expert and novice improvisers in Experiment Four (see Chapter Six), experiments looking at the differences between expert and novice improvisers could reveal more information in relation to the idea that gesturing lightens cognitive load. If experts are used to improvising, a lighter cognitive load would be expected in comparison to novice improvisers. However, it would be interesting to determine whether experts gesture less or whether they in fact gesture more as they use gestures to their advantage by the constant need to free up resources in working memory for novel ideas. It would also be useful to look at expert and novice improvisers in relation to cognition here. If a test can be found where novice and expert improvisers are equal in pre-scores, it may be possible to see whether cognitive load or working memory is related here. If more resources are available in working memory, a higher cognitive improvement would be expected. Future work may therefore benefit by assessing differences in improvisation between those who are allowed to gesture and those who are specifically told not to.

Overall, these results provide support towards the idea that gesturing may be a reflection of the cognitive burden that individuals experience. These findings suggest that observing gestures in relation to improvisation could provide support to the idea that working memory is being used and may explain the individual differences observed according to the quality of improvisation. Furthermore, these results also provide support towards the idea that gesturing can lighten cognitive load, and may even help in lexical retrieval. Experiment Nine found improvisers to gesture more than those in the control condition. Improvisation is a cognitively more demanding task, suggesting that people gesture at a significantly higher rate in order to lighten cognitive workload and free up more resources in working memory. As such, it is likely that lexical access is also increased. The highest and lowest rated improvisations gestured significantly more than the rest of the sample. The finding that the best improvisers gestured at a significantly higher rate again suggest that gesturing can lighten cognitive workload. Furthermore, these findings also provide support towards the idea that gesturing can improve lexical access.

Chapter 10: Real-World Applications; Pilot Study Six; The Benefits of Improvisation on Parkinson's Disease

The current program of research has demonstrated improvements in cognition following a series of improvisation tasks in a normal, healthy population. This pilot study aimed to extend these findings to determine whether improvisation could be beneficial within a real-world setting and, furthermore, whether dance improvisation had the potential to provide improvements in the context of research and health.

10.1 INTRODUCTION

Parkinson's Disease (PD) is a progressive neurological condition which is characterized by a loss of dopamine-carrying cells, which can lead to movement related symptoms of tremor, rigidity and slowness of movement.

There is a growing body of literature suggesting a link between dance and PD. Hackney, Kantorovich, Levin and Earhart (2007) compared the functional mobility of two small groups of people with PD before and after completing either 20 sessions of Tango dance or 20 exercise classes, over a 13-week period. Hackney et al. (2007) found that those in the Tango group showed a significant improvement in balance (on the Berg Balance Scale) but those in the exercise group did not suggesting that for people with PD, engagement with Tango dance may be beneficial to certain aspects of functional mobility that other forms of exercise do not provide.

These findings have since been replicated and extended. Hackney and Earhart (2009b) looked at how dance could affect the quality of life for those with PD. They found that after twenty tango dancing sessions improved mobility, social support and higher scores on the Parkinson's Disease Quality of Life (PDQoL) was reported. However, these findings could not be extended to other forms of dance, such that those who took part in a waltz/foxtrot condition did not show the same benefits. On the other hand, Hackney and Earhart (2009a) found results of functional ability improvements that could be extended to the waltz/foxtrot such that both groups improved significantly on balance and walking in comparison to a control group. These findings suggest that dance can lead to improvements in balance and walking in people with PD that other forms of exercise do not.

Marchant, Sylvester and Earhart (2010) have since found that dance improvisation can show improvements in PD. This pilot study looked at eleven people with PD who took part in ten dance classes over a period of two weeks. Each dance class lasted for one and a half hours and consisted of a particular form of dance improvisation, contact improvisation, a more physical form of dance improvisation involving body contact. Various measures of functional mobility were taken one week before and after the dance classes. Marchant et al. (2010) found participants to improve on scores of functional mobility such that they demonstrated improvements in balance, swing and general motor symptoms known to be associated with PD. These findings suggest that participating in dance, including dance improvisation can help balance and functional mobility in people with PD.

Creativity, Cognition and Parkinson's Disease

It has been suggested that levels of creativity relate to dopamine levels (Reuter, Roth, Holve, & Hennig, 2006). Furthermore, it is suggested that people with PD have a reduced level of creativity and that this may be due to lower dopamine activity as well as impairments in frontal lobe areas (Drago, Foster, Skidmore, & Heilman, 2009). Chermahini and Hommel (2010) found that dopamine levels can influence types of thinking. Dopamine levels were assessed by Eye Blink Rate (EBR), a clinically linked method of assessing dopamine through various studies on people with dopamine dysfunctions. More specifically, a higher EBR is present in schizophrenics (Freed, 1980), while a lower EBR is found in those with Parkinson's (Dreuschel & Goddemeier, 1998). These findings are in line with the idea that Parkinson's is caused by too much dopamine and schizophrenia by too little (Seeman & Niznik, 1990). They found medium levels of dopamine, as measured by EBR, resulted in an increase in flexibility on a divergent thinking task, as measured by the Alternative Uses Task (AUT). In relation to these findings and the finding that people with PD have reduced levels of dopamine and impaired frontal lobe functioning, it has been suggested that people with PD do not do well in tests of divergent thinking (Azuma, et al., 1997; Maruyama, 2000).

It has been consistently suggested throughout this program of research that divergent thinking is a way of measuring creativity (Guilford, 1950; Kaufman, Plucker, & Baer, 2008; Runco, 2007). Furthermore, it is thought that improvisation encourages people to think in more divergent ways (see summary in Chapter 7.5), and this program of research has found that following a series of improvisation tasks, people improve in scores of divergent thinking tasks but not in convergent thinking tasks.

Different forms of dance could therefore have different effects on the way that people think, which has been suggested to be impaired in people with PD (Azuma, et al., 1997; Elgh, et al., 2009; Rodriguez-Ferreiro, Cuetos, Herrera, Menendez, & Ribacoba, 2010). Contact improvisation has already shown to improve motor symptoms of people with PD (Marchant, et al., 2010). Furthermore, exercise has been found to show benefits in cognitive tasks that are related to frontal lobe functions (Cruise, et al., 2011) – known to be impaired in PD (Drago, et al., 2009). Cruise et al. (2011) also suggested that improvements in mood were also possible following exercise. It is important to take mood into account due to the high levels of depression that occur with PD (Cruise, et al., 2011; Emre, 2003).

The following study therefore aimed to further investigate the link between dance and PD by looking at whether improvised dance can benefit the cognitive symptoms of PD, and, in particular whether different forms of dance may enhance different forms of thinking (in relation to divergent and convergent thinking). The experimental hypothesis was that participants would show significant improvements in Quality of Life and divergent thinking test scores after ten, improvisation based, dance sessions.

10.2 METHOD

10.2.1 Participants

This study consisted of 12 people with mild to moderate PD who volunteered to take part in the study. The total sample consisted of seven women and five men with a mean age of 67 years (range = 52 – 76). One participant was excluded from analysis due to scoring above a mild to moderate level of Parkinson's symptoms, as measured by the Hoehn and Yahr scale (1967, see Appendix N). One participant was unable to attend the final assessment, meaning the data were analysed on a total of ten people.

10.2.2 Design

A repeated measures design was implemented which consisted of two levels; pre and post treatment scores.
The Independent Variable was the treatment time; pre or post dance classes. The Dependent Variables were scores on the cognitive tasks; the AUT, ATTA, LDT and MRT.
The experimental hypothesis was that participants would show significant improvements in Quality of Life and divergent thinking test scores after ten, improvisation based, dance

sessions. It was hypothesised that there would be no difference in convergent thinking task scores following ten sessions of dance improvisation.

This study has received ethical approval, protocol number: PSY/04/11/Lovatt et al – PL/LA/SD/CA

10.2.3 Materials and Apparatus

This experiment was part of a larger stuffy looking at both the psychological and physical benefits of improvisation for Parkinson's Disease. A battery of tests was developed to measure a range of aspects here. However, only cognitive-based tests are described for the purposes of this program of research.

Mini Mental State Examination (MMSE)

The MMSE is a test to determine whether people show any signs of cognitive impairment. This was used to screen participants in the current experiment. A score below 15 indicates signs of cognitive impairment.

Divergent and Convergent Thinking

Two tests of divergent thinking and two tests of convergent thinking were used in the current experiment and were designed to assess verbal and visuo-spatial thinking. The two tests of divergent thinking consisted of the AUT and ATTA (see Chapter 3.2.3 for instructions). Both tests were counterbalanced, where the two items for the AUT were 'newspaper' and 'brick', and the two items for the ATTA were triangles and circles. The two tests of convergent thinking consisted of the LDT and the MRT (see Chapter 5.3 for instructions). Two versions of these tests were used and counterbalanced.

Parkinson's Disease Quality of Life (PDQoL) questionnaire

The Parkinson's Disease Quality of Life (PDQoL) was also administered (see Appendix Q). The PDQoL is a self-administration questionnaire, designed to look at the various ways that Parkinson's can have an impact on the daily life of those suffering from Parkinson's. There are eight elements that are measured within the PDQoL; Mobility, Activities of Daily Life (ADL), Emotional Well-being, Stigma, Social Support, Cognitive Abilities, Communication and Bodily Discomfort. A total score can also be computed to assess the overall quality of life of Parkinson sufferers. A lower score on the PDQoL indicates greater satisfaction or improvement.

10.2.4 Procedure

Participants were asked to complete a battery of tests four days prior to any dance classes taking place in order to provide baseline measures. Upon arrival, they presented questionnaires that they had been asked to complete at home. This consisted of the PDQoL and other health related questionnaires to ensure they were physically fit to take part in dance classes. After ensuring consent had been received, the MMSE was administered to participants. In the current study, all participants scores above 15 meaning they were all cognitively able to take part in the study and no significant symptoms of cognitive impairment were shown. Therefore, no-one was excluded from the study for this reason. Participants then completed a series of tests including the cognitive tests described above, as well as functional mobility based tests, administered by qualified physiotherapists. Furthermore, physiotherapists also assessed symptoms of PD using the Hoen and Yahr scale (1967) in order to determine what state of Parkinson's they presented. As this experiment wanted to look at the effect of dance on people with mild to moderate symptoms, a score that was higher than three (of five) meant the participant had to be excluded from analysis. In this case, one participant was excluded from the analysis.

Participants then took part in ten dance sessions, two times a week over a period of five weeks. Each session lasted between 50 and 60 minutes and consisted of dance improvisation. This was led by an experienced dance teacher who specialized in contact improvisation, a physical form of dance improvisation.

Following the ten dance classes, participants were tested on the same battery of tests four days after the last dance class. Following the final assessment the participants were also asked if they wanted to take part in a semi-structured interview in order to give qualitative feedback on their experience of taking part in the study.

10.3 RESULTS

PDQoL

Table 10.1 - Mean (SD) PDQoL scores pre and post dance intervention

	Mobility	ADL	Emotional well being	Stigma	Social Support	Cognitive abilities	Comm.	Bodily Discomfort	Total
Pre	22.20 (18.14)	17.92 (19.84)	20.00 (17.87)	8.13 (9.79)	12.50 (16.78)	26.25 (15.81)	25.00 (18.00)	40.83 (22.03)	31.90 (20.00)
Post	14.25 (11.25)	12.71 (14.38)	8.33 (9.21)	3.75 (11.86)	5.42 (8.34)	25.63 (12.31)	16.67 (16.20)	21.67 (19.72)	20.20 (13.42)

Lower scores on the PDQoL indicate higher satisfaction in the corresponding area.

A paired sample t-test revealed a significant difference between pre-test and post-test scores of PDQoL Emotional well being, $t(9) = 3.1$, $p = .013$, $r = .72$. Emotional well-being scores decreased, suggesting that people had greater emotional well being post treatment.

A paired sample t-test revealed a significant difference between pre-test and post-test scores of PDQoL Bodily discomfort, $t(9) = 5.13$, $p = .001$, $r = .81$. Bodily discomfort scores decreased, suggesting that people had less bodily discomfort post treatment.

A paired sample t-test revealed a marginally significant change between pre-test and post-total test scores of PDQoL, $t(9) = 2.19$, $p = .056$, $r = .59$. Total PDQoL scores decreased, suggesting that people had a better quality of life overall post treatment.

Paired samples t-tests revealed no other elements of PDQoL were significant ($p > .06$ in all cases).

ATTA

Table 10.2 - Mean (SD) ATTA scores pre and post dance intervention

	ATTA Response	ATTA Fluency	ATTA Originality	ATTA Elaboration	ATTA Flexibility	ATTA Total
Pre	6.40 (2.22)	7.10 (5.47)	3.90 (4.68)	6.80 (5.01)	3.10 (2.00)	19.20 (10.02)
Post	6.80 (2.82)	6.50 (3.27)	6.20 (4.80)	8.30 (3.8)	2.60 (1.26)	23.60 (9.23)

The ATTA was scored for Response, Fluency, Originality, Elaboration and Flexibility. As well as this, a total score was computed across Fluency, Originality, Elaboration and Flexibility.

A paired sample t-test revealed a significant difference between pre-test and post-test scores of the total $t(10) = -2.86$, $p = .019$, $r = .69$, suggesting that ATTA total scores increased post treatment.

A paired sample t-test also revealed a significant difference between pre-test and post-test scores of ATTA Originality, $t(10) = -3.54$, $p = .006$, $r = .76$, suggesting that ATTA originality scores increased post treatment.

Paired samples t-tests revealed no other significant differences in the ATTA ($p > .1$ in all cases).

AUT

Table 10.3 - Mean (SD) AUT scores pre and post dance intervention

	AUT Response	AUT Fluency	AUT Flexibility
Pre	8.10 (4.61)	7.10 (5.47)	5.20 (3.65)
Post	8.40 (3.84)	7.40 (3.95)	5.30 (2.36)

The AUT was scored for Response, Fluency and Flexibility. Paired samples t-tests on all three scores revealed no significant differences in the AUT ($p > .05$ in all cases).

Convergent Thinking Tasks

Table 10.4 - Mean (SD) LDT and MRT scores pre and post dance intervention

	LDT Response	LDT Reaction Time	MRT Response	MRT Reaction Time
Pre	87.50 (31.65)	1568.41 (463.98)	53.33 (14.14)	6461.37 (3790.91)
Post	96.10 (5.21)	1337.96 (400.33)	68.89 (23.69)	7788.84 (2088.63)

The LDT and MRT were scored for Response and the total reaction time. Paired samples t-tests on all scores revealed no significant differences in both the LDT and MRT ($p > .05$ in all cases).

10.4 DISCUSSION

The results of this study found that after participating in ten sessions of contact improvisation dance classes, people with PD scored higher in a visuo-spatial divergent thinking task and in scores of the PDQoL. However, scores in the AUT, a verbal divergent thinking task and scores in convergent thinking tasks remained the same pre and post treatment. These results suggest that dance improvisation can help people with PD in cognitive as well as physical ways.

Emotional stability, Bodily discomfort and the total scores on the PDQoL were found to improve after the five weeks of dance improvisation, showing that cognitive wellbeing was improved. A significantly better score of emotional stability may be achieved due to people with Parkinson's exhibiting a more flexible approach to dealing with the many difficulties of Parkinson's Disease.

Two tasks of divergent and two tasks of convergent thinking were both assessed pre and post treatment. These consisted of a verbally based task and a visuo-spatial task. Only the task assessing visuo-spatial divergent thinking was found to show any changes pre and post treatment. These findings are consistent with previous findings in this program of research. No effects in tasks of convergent thinking were observed in the current study, replicating the effects of Experiments Two and Three and suggesting that improvisation only helps in tasks of divergent thinking. Furthermore, Experiment Three found that following dance improvisation, improvements in a visuo-spatial task were observed in comparison to a control condition but these findings could not be extended to the AUT. The finding that significant increases were observed in the ATTA and not in the AUT for the current study, suggest that these findings have been replicated and that improvements in the AUT are specific to tasks of verbal improvisation.

However, it should be noted that in comparison to the experiments carried out in this program of research, the improvisation intervention for this study was set over a longer period of time. While this indicates that findings can be extended to longer interventions than what was previously seen, the results should be taken with caution, particularly concerning the AUT as it may be that significant differences were not observed with the AUT, due to the AUT not producing long lasting effects. In addition to this, it should be noted that post tests occurred several days after the last dance improvisation class and it is therefore unknown whether a type II error has occurred on the AUT, particularly as previous experiments have administered the AUT straight after improvisation has taken place. Furthermore, the current study used the items ‘Newspaper’ and ‘Brick’, and although counterbalanced, have since been shown to have different average item uses (see Chapter 8.14).

Future research looking at the cognitive benefits of Parkinson’s Disease needs to carry out cognitive tests on age matched controls to determine if there is an impairment in divergent thinking, as suggested by Azuma et al. (1997) and Maruyama (2000).

These findings can only be taken as preliminary findings due to the small sample size. One disadvantage means that it is not possible to carry out any further detailed analysis. At the time of writing, this investigation is ongoing as part of a larger study. The current study is looking at structured forms of dancing in relation to thinking and functional mobility. This is being carried out on 38 participants, of which 21 have mild to moderate PD and 16 are age-matched controls.

In conclusion, these findings both replicate and extend those found by Hackney and colleagues. Furthermore, they demonstrate that the cognitive benefits that are observed in divergent thinking following improvisation may be able to be extended to people with PD, a condition which is thought to have deficits in divergent thinking.

Chapter 11: Conclusion

11.1 INTRODUCTION

The primary aim of this program of research was to investigate whether taking part in improvisation tasks could have an impact on cognitive processes and, more specifically, whether this could influence scores on problem solving tasks. As a result, this research has found that after taking part in improvisation activities, an improvement in divergent thinking is observed. Furthermore, a theory of schemas to understand the underlying cognitive processes was applied to the findings.

This research was originally motivated by a practicing teacher in improvisation, Keith Johnstone (1979), who observed that after his students had improvised, they reported changes in perception such that colours seemed brighter, objects sharper and of different sizes. Although this effect could have been partly due to his students improvising in a darkened room, the indication that improvisation may have an impact on other cognitive processes prompted further research into this area.

The literature reviews provided in Chapters 1 and 2 lead to the indication that improvisation could have an impact on our cognitive processes. In particular, one of the elements required to repeatedly produce high quality improvisations is flexibility. The ability to think flexibly involves being able to think in different ways. This in turn suggests that improvisation could encourage different ways of thinking. Schmidt et al. (1975) discovered that following eight weeks of improvisation classes, children improved in tests of creativity. Karakelle (2009) has since found that a ten week course of dramatic play, heavily based around improvisation increased scores on divergent thinking tasks; more specifically on combined scores of the AUT and a circles drawing task. However, both these studies had important methodological flaws such that control groups did not carry out an equivalent task. Furthermore, effect sizes stated in Schmidt et al. (1975) were small with varied results and Karakelle (2009) only reported a total combined score for the divergent thinking tasks – tasks which assessed two cognitive domains – verbal and visuo-spatial abilities.

Other evidence to suggest that improvisation may have an impact on cognition includes Scott et al. (2001) who found memory to improve on a dramatic monologue following 30 minutes of improvisation based on that character. Furthermore, brain imaging studies have revealed that when involved with creative activities, including improvisation, areas know to be linked to Working Memory are activated (Howard-Jones, et al., 2005; Limb & Braun, 2008).

To investigate the short-term effects of improvisation and cognition, four experiments were carried out in this program of research which found scores in cognitive tasks to increase post improvisation in comparison to a control group. Furthermore, this program of research indicates that improvisation may provide long-term benefits such that expert improvisers were found to have higher baseline scores in a task of divergent thinking. A theory of schemas was applied to the current research such that improvisation encourages people to break away from their set patterns of thinking. The idea that this is applied in Working Memory was also put forward and investigated through the use of hand gestures, thought to be related to cognitive workload (Goldin-Meadow, 2000).

11.2 THE EFFECTS OF IMPROVISATION ON COGNITION

Four experiments were conducted in order to look at the short-term benefits of improvisation. Experiment One found that after twenty minutes of verbal improvisation, participants scored higher in the AUT and ATTA, in comparison to a control equivalent consisting of verbal discussion. Furthermore, these results were not related to changes in mood as a consequence of improvisation. Experiment Two replicated the results of Experiment One with the AUT as well as finding a significant difference in a convergent maths task following improvisation. Experiment Three followed the same procedure as Experiment Two but looked at the domain of dance improvisation and found that following ten minutes of dance improvisation, participants improved in Response scores of two divergent thinking tasks; Divergent maths and the Matchsticks task which assessed visuo-spatial abilities as well as the convergent maths task when the top 20% of the sample were excluded. Furthermore, these studies indicated that ceiling effects occurred in tasks of convergent thinking but also that reaction times became quicker in both Experiments Two and Three in convergent thinking tasks assessing verbal and spatial abilities. Experiment Five found that ten minutes of verbal improvisation tasks still elicited significant results in the AUT following improvisation. However, this could not be replicated to a divergent thinking task assessing lexical retrieval (COWA).

Following from these results, a small study investigating the long-term benefits of improvisation was conducted which found AUT baseline scores to be higher in expert improvisers when compared to novice improvisers.

A theory of schemas to explain the effect observed between improvisation and cognition has been proposed in the current program of research. Improvisation can be seen as the process and product of creativity. Creativity is often said to be reflected in tasks of divergent thinking. Improvisation requires a flexible style of thinking, which involves the ability to deviate from habitual patterns of thought. Incorporating the use of schemas into a theory of improvisation and cognition explains why scores in divergent thinking tasks increase as well as why improvisation can be such a difficult task in the first place.

In an unpublished manuscript, Pressing (1988) suggested that music improvisation was linked to the use of schemas. He suggested that schemas could both help and hinder improvisation. By using slots of material to improvise, it is possible to be able to rearrange and vary these to produce something novel. This is supported by Montuori (2003). However, it is precisely relying on this method that makes free improvisation so hard. You can never have anything completely novel – it is always based on something.

This theory of schemas also links to the differences presented with expert and novice improvisers. Experiment Four found lasting effects in the AUT of expert improvisers. This could be due to lasting effects such that the more experience gained in improvisation, the larger the range of schemas that are available. This is supported by Borko and Livingston (1989) who suggested that expert teachers are able to improvise away from their lesson plans due to the number of different schemas they have gathered about the topic area. In relation to the current program of research, this explains that by rearranging already existing schemas, people can keep thinking of new ideas and therefore novel improvisations.

The four experiments conducted to look at the effect of improvisation and cognition support the idea of a theory of schemas. By observing a greater change in divergent thinking tasks in comparison to convergent thinking tasks it can be suggested that improvisation results in a greater degree of flexibility. It is unknown whether the effects of improvisation are due to breaking away from set patterns of thinking and being able to access more schemas. Alternatively, breaking away from schemas may encourage flexibility to switch between a wider range of schemas, therefore extending the options of schemas available. A third possibility is that the same schemas are being accessed but the slots that accompany these schemas are being filled in different and novel ways.

These four experiments found stronger effects in tasks of divergent thinking. Furthermore, the domain of improvisation that was tested had an influence on what cognitive tasks were affected. However, it should be noted that whether these skills are transferable across different domains of cognition is unclear. Perkins and Salomon (1992) said that when skills are transferred, they are usually required to be closely related concepts. This would explain why effects of verbal divergent thinking tasks are more prominent in tasks of verbal improvisation and tasks concerning visuo-spatial abilities more closely associated with dance improvisation.

Further limitations surrounding the tests should also be identified in future research. Firstly, issues surrounding the AUT (see Chapter 8) should be addressed along with a wider range of divergent thinking tasks addressed. Furthermore, the order in which cognitive tests were administered were the same, meaning the reason some tasks did not see any effects could be due to the effect of improvisation wearing off. In all experiments, the AUT, which showed the most consistent results was administered first. Furthermore, Experiments Two and Three gave convergent thinking tasks after divergent thinking tasks in all cases. However, it is worth noting here that effects regarding the CMT Response score resulted in significant differences and this task was the last test administered in Experiments Two and Three.

11.3 WHAT GESTURING REVEALS ABOUT THE COGNITIVE PROCESSES OF IMPROVISATION

It has been suggested that hand gestures can reflect the cognitive workload that is being experienced. Two main theories regarding gestures and cognition are provided. Goldin-Meadow (2000) suggested that by gesturing, people are lightening their cognitive workload. Morsella and Krauss (2005) however, said that we gesture due to the lexical retrieval hypothesis. This suggests that people gesture in order to be able to retrieve words that they are trying to access.

Experiment Nine therefore investigated the idea that gesturing could indicate cognitive differences while improvising. Experiment Nine found that people gestured significantly more when improvising in comparison to a normal conversation. Furthermore, participants gestured significantly more if they were rated as either the best or worst improvisers. Finally, those who gestured the least were found to achieve the highest improvement in scores on the COWA.

These results are consistent with both theories concerning why we gesture. Participants may have been gesturing as a way to lighten cognitive workload in which case a higher gesture rate would be expected in comparison to the control condition. However, the reason people may gesture more while improvising could also link to the lexical retrieval hypothesis, such that improvisation is a cognitively more demanding task. Therefore, to access novel and varying ideas in real-time involves having to access lexical information in order to have something to say. Furthermore, the finding that the best and worst improvisers gesture more is also consistent with both theories. In line with the idea that gestures lighten cognitive workload, the best improvisers scored highly, suggesting that gestures freed some cognitive workload space, allowing for more resources to concentrate on the quality of improvisation. However, the finding that the worst improvisers also had the highest gesture rates is in line with the lexical retrieval hypothesis, such that those who were finding the task more cognitively demanding and therefore searching for the right thing to say. The last finding that found COWA scores were highest in the lowest gesturers could again be interpreted using both theories. The fact that gesture rates were lowest in the highest scorers of the COWA could indicate that gestures lighten cognitive workload. As the COWA does not require such a strong element of flexible thinking, if a participant can think of enough words, then the task is not quite cognitively demanding enough for the need of a great number of gestures. This also relates to the lexical retrieval hypothesis, such that participants could retrieve enough words and therefore did not need to gesture to access any more.

The links between gesturing and cognitive workload observed in Experiment Nine can be applied to a theory of schemas. It has been suggested that gesturing can lighten cognitive load. By this, it is meant that gesturing can relieve some of the pressure that is placed on working memory. Improvisation, as discussed in Chapter 2 involves a lot of pressure on Working Memory, in particular in relation to the CE and the SAS. Being asked constantly to think of something new and beyond normal ways of thinking is a very cognitively challenging task. Working Memory holds the schemas that are needed in this task and, to think of something new continuously, the CE needs constantly to suppress schemas that are no longer needed in order to complete this task successfully. Gesturing could help this process in two ways. Firstly, through the idea that gesturing lightens cognitive workload (Goldin-Meadow, 2000). In this sense, gesturing helps people improvise by taking some of the pressure away from Working Memory. With this in mind, it would be interesting to look at the gesture rates of expert and novice improvisers. If expert improvisers build up a greater knowledge of schemas, the more experience they obtain, the easier improvisation should become. However, it would be interesting to see whether gesture rates reflect less pressure on Working Memory if the task is effectively easier and to see whether gesture rate differed once an improviser had built up a greater knowledge of schemas. Secondly, gestures could help via the lexical retrieval hypothesis (Morsella & Krauss, 2005). If improvisation encourages people to break away from set patterns of thinking and access a greater number of schemas, this may be because people are trying to access words through their schemas in working memory. Gesturing in this sense, simply helps improvisers find the words they are looking for.

It should be noted, however, that this is preliminary research and that a more vigorous coding scheme needs to be applied to this research (as discussed in Chapter 9.6). Kappa was found to be .75 for the coding of speech in the control videos, and although still adequate, the kappa for speech in the improvisation videos was found to be .64, still below the value of .7. Furthermore, the current research did not take into account the type of gesture being implemented, nor did it look at the use of prohibiting gestures to determine whether this had an impact on improvisation. Overall, these results should be taken as preliminary as more rigorous analysis could be applied to the gestures observed. This is however, beyond the scope of this program of research.

11.4 SCORING DIVERGENT THINKING TASKS: RELIABILITY OF THE AUT

While carrying out this program of research, the idea that the AUT may not be as reliable as initially reported was investigated. Initially the AUT was reported as having adequate levels of reliability, .69 or above (Harrington, 1975) and higher reliability scores achieved since (Runco, 2004). However, the question of how robust this reliability is has recently been raised (Shamay-Tsoory, et al., 2011).

It was discovered in the results of Experiment One and Pilot Study Three that the significant differences found in the AUT were eliminated when using an average score of three raters. This was despite reliability levels of .8 and above. This leads to the question that despite high reliability, if experimental results can change so drastically, how reliable a measure was the AUT? Chapter 8 carried out various tests of reliability and found that there was very little agreement regarding whether a response should be counted as a valid alternative use or not. Furthermore, different means across items and test re-test scores showed inconsistency across the use of the AUT. However, although these limitations were observed in regards to scoring the AUT, it is important to note that the results remained consistent across all the experiments in which it was used. No differences between pre-scores of Experiments One, Two, Three and Five were found. Furthermore, Response scores also showed some significant differences, particularly in Experiment One. Therefore, the results observed in regards to the AUT can still be taken as valid results.

A number of alternative scoring methods have been suggested in relation to scoring divergent tests and in particular the AUT. Silvia et al. (2008; Silvia, et al., 2009) suggested the use of average scores, such that an average likert scale score is determined or top two scoring, such that an average of the participant's best two answers is taken. Furthermore, the scoring of Originality and Flexibility also needs to be addressed. Originality scores differ according to the sample from which a common response list is derived. As a result, this means the larger the sample, the smaller the originality score. Furthermore, originality scores are often found to correlate highly with fluency. The current experiments may have benefited from the use of preliminary analysis as used by Sowden and Dawson (Under review) such that any results that correlated highly with each other were excluded from the main analyses. Finally, flexibility often results in the lowest levels of agreement between raters. It would therefore be beneficial to also look at the way in which this is scored in future.

11.5 APPLYING IMPROVISATION RESEARCH TO REAL WORLD SETTINGS

The effects that have been observed in this program of research suggest that improvisation can encourage a more flexible approach to thinking. This has the potential to provide positive benefits beyond an experimental setting such as in schools, dementia and learning difficulties. Improvisation could benefit people with impairments in divergent thinking. Improvisation may improve the activation of schemas and by encouraging people to think in different ways, the more people improvise and the more unconscious the process becomes, the more likely people will be able to think in a divergent style.

Furthermore, improvisation may provide positive benefits in relation to habit-breaking skills by again encouraging people to think differently. Introducing an element of spontaneity may encourage people to break away from their habits. This could also play a role in autism, where improvisation may encourage people to understand and cope with changes in routine.

Finally, improvisation may have an impact within education and the way lessons are taught. This is not just by introducing improvisation into the curriculum through performing arts but also by providing a more divergent way of teaching core subjects.

11.5.1 Improvisation and Parkinson's

Chapter 10 indicates that improvisation could have positive benefits on the cognitive symptoms of Parkinson's Disease as it has been suggested that divergent thinking can be impaired in Parkinson's, as shown by Marchant, Sylvester and Earhart (2010) who found that dance improvisation provided positive motor benefits for Parkinson's sufferers. Pilot Study Six extended these results and found that performance in a visuo-spatial task improvised after ten sessions of dance improvisation, over a period of five weeks. Furthermore, emotional wellbeing and bodily discomfort were reported far more positively following the five weeks of improvisation classes.

These findings demonstrate that improvisation could have positive benefits on Parkinson's Disease. Further research however, looking at the cognitive benefits of improvisation on Parkinson's including the type of task and type of improvisation would be useful. In addition to this, comparing the results of improvisation to a control equivalent would also be beneficial to determine the specific effects of improvisation.

11.5.2 Improvisation Applied to the Education System

There is research (Cheng, 2011; Maisuria, 2005) to suggest that creativity should play a larger part in education and brought more widely into the curriculum. This is not only with the area of Performing Arts but as a method of teaching other subjects to encourage more effective learning. As mentioned in Chapter 6, Borko and Livingston (1989) looked at mathematics lessons carried out by expert and novice teachers. Expert teachers were defined as having five or more years of teaching experience. They found that expert teachers were able to deviate away from lesson plans. They did this by what Borko and Livingston (1989) termed as being able to improvise according to the questions that students raised throughout the lesson. They said the reason expert improvisers were able to do this was because throughout experience they had built up a large number of schemas to use and switch between. Furthermore, it was verbally reported that students preferred this method of teaching as they felt their questions and problems were being directly addressed.

Deslaurier, Schelew and Wieman (2011) recently found that more interactive teaching styles in Science resulted in higher attendance and engagement in students. Furthermore, Scott et al. (2001) found memory for reciting a dramatic monologue increased following improvisation in the character that the monologue was based. This combined with the current set of experiments that suggest cognitive benefits following improvisation tasks, as well as potential long-term benefits in experienced improvisers means that introducing more divergent thinking styles into education could have benefits on learning and retaining information. In relation to divergent and convergent thinking, it may be that divergent teaching styles only help topics in which a question is styled in a divergent way, such as essay writing. Improvements in convergent thinking may depend on the complexity of the convergent thinking task (as discussed in Chapter Five).

Recent evidence supporting the idea of creativity being implemented in a scientific environment has been carried out by Cheng (2011) who found that through focus groups, classes that were more hands-on, active and creative resulted in a deeper level of understanding. In regards to this, future research looking at improvisation and more divergent ways of teaching should be looked at to determine whether children can learn more effectively with different teaching styles.

11.6 CONCLUSION AND FUTURE RESEARCH

Improvisation is the process of creating in real time. Improvisation, therefore, is exploring in a spontaneous manner to form something that is new, unique and imaginative.

This program of research has identified that taking part in tasks of improvisation can result in increased scores of cognition, particularly within divergent thinking. This has been found in both verbal and dance improvisation. Experiment Four, looking at experienced musicians and verbal improvisers indicates that beneficial effects are possible on a long-term basis. Furthermore, the idea that gestures could indicate the underlying processes in improvisation was also explored, showing differences in gestures according to the quality of improvisation as well as when improvising but not when participating in ordinary conversation.

This program of research has led to many questions to address in future research. In relation to the effect of improvisation on cognition, it would be interesting to determine how long the effect lasts for. As well as this, the intensity of the effect in relation to how long people improvise for should also be investigated. It has been determined that effects of improvisation can be seen when people have been improvising for as little as ten minutes. Although effects were seen in the AUT, the reason further effects may not have been seen is due to how long the effect lasts for when ten minutes of improvisation has taken place. In addition to this, further areas of cognition should also be assessed including the idea that improvisation could improve memory, as suggested by Scott et al. (2001), providing that it is a semantic context associated with the stimuli. In addition to this, the idea that individual differences such as gender or handedness could play a role in the results should be investigated (Hong & Milgram, 2010).

In relation to divergent and convergent thinking, the process of switching between the two styles of thinking should also be investigated. Firstly, the battery of tests carried out in Experiments Two and Three administered all divergent thinking tasks followed by the convergent thinking tasks. The results seen could relate to how long the length of improvisation lasts. However, as effects in divergent thinking were observed this is unlikely to be the case. It would however be interesting to determine how people find switching from convergent to divergent thinking tasks and whether improvisation could make this process quicker such that following improvisation people are more able to adapt to different thinking styles.

The idea of experts and novices also needs addressing in more detail, both in relation to improvisation and cognition, as well as in relation to scoring tasks of creativity and divergent thinking. In relation to cognition and improvisation, the idea that longer lasting effects can occur needs to be explored further. Experiments with larger sample sizes across a variety of domains and cognitive tasks need to be carried out. Furthermore, it should be determined whether the reason expert improvisers have higher baseline scores is due to longer-lasting effects and not due to personality characteristics or pre-existing individual differences, such that people who are expert improvisers do this because they are already higher than average when scored for divergent thinking (Walton, 2003). This could be addressed in the form of a longitudinal study to determine whether scores on cognitive tasks increase pre and post improvisation training. This could be done by following novice improvisers who join an improvisation group by assessing scores before they join the group and at regular time intervals (e.g. six months) after.

Further research into expert and novice raters for creativity should also be carried out. Amabile (1983) suggested that experts should rate tasks to do with creativity. It would therefore be beneficial to determine whether scores on the AUT increase in reliability if all raters are experts in the field. This could be investigated further when scoring other activities, such as the improvisation tasks themselves. Furthermore, the scoring methods for divergent thinking tasks also need further investigation. New methods of scoring Originality and Flexibility should also be investigated including the idea of having set categories that responses can fall into for Flexibility. These new scoring methods need to measure the same construct while not correlating highly with one another or with Fluency and obtaining high reliability scores.

Future research looking at gestures should also be implemented. The type of gesture that is used should be looked at to provide more rigorous analysis. Additionally, more detailed analysis to identify whether gestures are congruent with speech would be beneficial to try and determine whether people are gesturing to lighten cognitive load or whether it is to aid lexical retrieval. Prohibiting gestures in participants may also indicate the cognitive processes underlying improvisation. Determining whether improvisation differs according to whether participants are allowed to gesture would indicate that gestures are indicating underlying cognitive processes and that they are not being used as a mode of communication in improvisation, a more difficult message to convey than verbal discussion.

In summary, this program of research has demonstrated that improvisation has an impact on our cognitive processes. This has built on research by Schmidt et al. (1975), Scott et al. (2001) and more recently Karakelle (2009) who all suggested that improvisation may help aspects such as memory and problem solving. Over a series of experiments, it was found that taking part in improvisation activities resulted in improved scores on divergent thinking tasks. This could not be replicated with convergent thinking tasks, with significant effects only being observed in structured, control versions of the studies. While the cognitive workload involved in improvisation is likely to have an impact on the benefits observed following improvisation, results have been extended to show an improvement in divergent thinking in people with Parkinson's disease. This, along with the potential implications that improvisation could have within the domains of education and learning difficulties demonstrates how this knowledge can be applied in future.

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Appendix A – Profile of Mood States

<u>POMS standard form questionnaire</u>

Below is a list of words that describe feelings that people have. Please read each word carefully. Then tick the appropriate box that best describes how you feel RIGHT NOW.

	Not at all (0)	A little (1)	Moderately (2)	Quite a bit (3)	Extremely (4)
1. Friendly					
2. Tense					
3. Angry					
4. Worn out					
5. Unhappy					
6. Clear-headed					
7. Lively					
8. Confused					
9. Sorry for things done					
10. Shaky					
11. Listless					
12. Peeved					
13. Considerate					
14. Sad					
15. Active					
16. On edge					
17. Grouchy					

	Not at all (0)	A little (1)	Moderately (2)	Quite a bit (3)	Extremely (4)
18. Blue					
19. Energetic					
20. Panicky					
21. Hopeless					
22. Relaxed					
23. Unworthy					
24. Spiteful					
25. Sympathetic					
26. Uneasy					
27. Restless					
28. Unable to concentrate					
29. Fatigued					
30. Helpful					
31. Annoyed					
32. Discouraged					
33. Resentful					
34. Nervous					
35. Lonely					
36. Miserable					
37. Muddled					
38. Cheerful					
39. Bitter					
40. Exhausted					

	Not at all (0)	A little (1)	Moderately (2)	Quite a bit (3)	Extremely (4)
41. Anxious					
42. Ready to fight					
43. Good natured					
44. Gloomy					
45. Desperate					
46. Sluggish					
47. Rebellious					
48. Helpless					
49. Weary					
50. Bewildered					
51. Alert					
52. Deceived					
53. Furious					
54. Efficient					
55. Trusting					
56. Full of pep					
57. Bad-tempered					
58. Worthless					
59. Forgetful					
60. Carefree					
61. Terrified					
62. Guilty					
63. Vigorous					

	Not at all (0)	A little (1)	Moderately (2)	Quite a bit (3)	Extremely (4)
64. Uncertain about things					
65. Bushed					

Appendix B – Verbal Improvisation Tasks

Verbal Improvisation Tasks

(First, always introduce yourself, asking them what they think improvisation is and give it a quick definition.)

1. **Random number generation**

Every person has to shout out a random number each time the experimenter claps. Highlight how easy it is to get into patterns and repeat asking them to break away from any patterns they find themselves doing.

2. **Random letter generation**

As with random number generation but letters.

3. **Word at a time story** (groups of 3) twice

In groups, go around in a circle taking it in turns to say one word at a time to form a story. At the end of a sentence, simply say full stop and start another sentence. These should make up coherent sentences!

4. Tell a story which includes **three unrelated words**:

Banana, cup, chisel
Ash, umbrella, pig

In pairs, get one person to tell a story which includes three unrelated words and then swap pairs for another three random words.

5. Have a conversation but you can only use **three words at a time**. And the three words must make sense

Eg A: I love you
B: I hate you
A: I need you
B: I vomit now
A: clear it up
B: you eat it
A:…

6. (AB Pair)
Giving each other character. Always accept the characterisation.

A: Hello John, how's your bee collection?
B: It's great, got nearly 3000 now. I'm sorry to hear about your wife's affair.
A: Your brother's welcome to her…

7. **Exit on fourth line**.
(AB pairs and group)

A on. B enters with line. A replies, B replies, A replies and exits. B stays on and another A enters on line, repeat. (This can also be done by clapping each time someone should exit).

8. **Individual improvisation**:
Participants individually asked about something they may have on them that is made up, e.g. what's that bleublepip on your shoulder?

Appendix C – Verbal Control Tasks

Verbal Control Tasks

1. **Number generation**:

Count up and down

2. **Letter generation**:

As above but with letters

3. **Word at a time nursery rhyme** (groups) twice

Twinkle twinkle
Twinkle twinkle little star, how I wonder what you are?
Up above the world so high , like a diamond in the sky

Humpty Dumpty
Humpty Dumpty sat on a wall,
Humpty Dumpty had a great fall.
All the King's horses, And all the King's men
Couldn't put Humpty together again!

4. Talk about **recent events**.

- About route you took to this session today.
- What you had for breakfast and what you did last weekend.
- Your last holiday
- Hobbies

6. **Three key things**

Tell the other person about yourself. The other person has to remember three key things about you.

7. Change pairs. Tell new partner about old partner.

Appendix D – Matrix tables for Experiment Two, verbal improvisation and Experiment Three, dance improvisation; Post hoc analyses

For all analyses, subjects were divided into highest and lowest scorers and results reanalysed taking these groups into account. When this was not possible, due to too small a sample size being created, the top 20% of scores were excluded and reanalysed with a mixed ANOVA. Scores for significant results are not included, as by omitting some people from the sample, this does not change the significance of the results. Scores of fluency, and not response, were looked at in divergent thinking tasks as fluency is a more accurate measure of creativity.

Table D-1 – Matrix table for Experiment Two, verbal improvisation divergent thinking tasks, taking highest and lowest scores into account

		df	df error	*F*	*p* value
AUT Fluency	**Treatment**	1	32	1.25	.273
	Time	1	32	21.43	***p* < .001**
	Interaction	1	32	4.00	**.054**
AUT Flexibility	**Treatment**	1	17	2.76	.115
	Time	1	17	8.08	**.011**
	Time x condition	1	17	.68	.421
	Time x score	1	17	5.23	**.035**
	Time x condition x score	1	17	3.99	.062
Divergent Maths Fluency	**Treatment**	1	15	1.57	.230
	Time	1	15	6.41	**.023**
	Time x condition	1	15	1.33	.268
	Time x score	1	15	9.90	**.007**
	Time x condition x score	1	15	.289	.599
Matchsticks Fluency	**Treatment**	1	17	.43	.523
	Time	1	17	.004	.951
	Time x condition	1	17	.03	.858
	Time x score	1	17	3.05	.099
	Time x condition x score	1	17	.64	.434

Table D-2 – Matrix table for Experiment Two, verbal improvisation convergent thinking tasks, taking highest and lowest scores into account

		df	df error	*F*	*p* value
LDT Response	Treatment	1	29	3.12	.088
	Time	1	29	8.33	**.007**
	Time x condition	1	29	.92	.346
LDT – RT (Correct responses)	Treatment	1	20	.05	.834
	Time	1	20	23.60	***p* < .001**
	Time x condition	1	20	12.92	**.002**
	Time x score	1	20	23.96	***p* < .001**
	Time x condition x score	1	20	.001	.405
LDT – RT (Incorrect responses)	Treatment	1	22	.96	.339
	Time	1	22	12.66	**.002**
	Interaction	1	22	.11	.743
LDT – RT (Total responses)	Treatment	1	19	.06	.811
	Time	1	19	21.56	***p* < .001**
	Time x condition	1	19	4.49	**.047**
	Time x score	1	19	16.12	**.001**
	Time x condition x score	1	19	8.53	**.009**
MRT Response	Treatment	1	23	.16	.696
	Time	1	23	4.38	**.048**
	Time x condition	1	23	.00	1.00
	Time x score	1	23	3.36	.08
	Time x condition x score	1	23	1.71	.204
MRT – RT (Correct responses)	Treatment	1	23	7.60	**.011**
	Time	1	23	.38	.541
	Time x condition	1	23	4.27	**.05**
	Time x score	1	23	15.91	**.001**
	Time x condition x score	1	23	4.86	**.038**

MRT – RT (Incorrect responses)	**Treatment**	1	24	3.88	.061
	Time	1	24	1.62	.216
	Time x condition	1	24	.73	.40
	Time x score	1	24	2.27	.145
	Time x condition x score	1	24	.44	.514
MRT – RT (Total responses)	**Treatment**	1	27	1.63	.212
	Time	1	27	1.51	.230
	Time x condition	1	27	.94	.340
	Time x score	1	27	.11	.748
	Time x condition x score	1	27	1.40	.246
CMT Response	**Treatment**	1	19	.45	.701
	Time	1	19	.55	.603
	Time x condition	1	19	1.18	.194
	Time x score	1	19	14.30	**.001**
	Time x condition x score	1	19	5.10	**.036**
CMT RT (Correct responses)	**Treatment**	1	17	.06	.816
	Time	1	17	.23	.636
	Time x condition	1	17	1.89	.187
	Time x score	1	17	10.96	**.004**
	Time x condition x score	1	17	3.50	.079
CMT RT (Incorrect responses)	**Treatment**	1	15	1.28	.079
	Time	1	15	.36	.560
	Time x condition	1	15	.011	.919
	Time x score	1	15	6.60	**.021**
	Time x condition x score	1	15	.886	.362

Table D-3 – Matrix table for Experiment Three, dance improvisation divergent thinking tasks, taking highest and lowest scores into account.

		df	df error	*F*	*p* value
AUT Fluency	**Treatment**	1	32	.97	.335
	Time	1	32	26.14	***p* < .001**
	Interaction	1	32	.06	.810
AUT Flexibility	**Treatment**	1	13	.00	.984
	Time	1	13	1.93	.189
	Time x condition	1	13	.70	.418
	Time x score	1	13	5.79	**.032**
	Time x condition x score	1	13	.85	.372
Divergent Maths Fluency	**Treatment**	1	17	1.17	.294
	Time	1	17	1.26	.278
	Time x condition	1	17	2.13	.163
	Time x score	1	17	4.81	**.042**
	Time x condition x score	1	17	.15	.706
Matchsticks Fluency	**Treatment**	1	16	.51	.488
	Time	1	16	.07	.794
	Time x condition	1	16	.001	.981

Table D-4 – Matrix table for Experiment Three, dance improvisation convergent thinking tasks, taking highest and lowest scores into account

		df	df error	*F*	*p* value
LDT Response	**Treatment**	1	24	2.84	.105
	Time	1	24	23.32	***p* < .001**
	Time x condition	1	24	.001	.974
LDT – RT (Correct responses)	**Treatment**	1	17	10.31	**.005**
	Time	1	17	22.50	***p* < .001**
	Time x condition	1	17	.10	.761
	Time x score	1	17	15.28	**.001**
	Time x condition x score	1	17	1.06	.32
LDT – RT (Incorrect responses)	**Treatment**	1	22	.02	.900
	Time	1	22	.002	.968
	Time x condition	1	22	.14	.715
	Time x score	1	22	.05	.833
	Time x condition x score	1	22	.18	.677
LDT – RT (Total responses)	**Treatment**	1	19	4.51	**.047**
	Time	1	19	27.28	***p* < .001**
	Time x condition	1	19	.02	.881
	Time x score	1	19	15.84	**.001**
	Time x condition x score	1	19	1.02	.325
MRT Response	**Treatment**	1	22	.55	.466
	Time	1	22	8.25	**.009**
	Time x condition	1	22	.43	.519
	Time x score	1	22	34.30	***p* < .001**
	Time x condition x score	1	22	2.03	.168
MRT – RT (Correct responses	**Treatment**	1	32	6.86	**.013**
	Time	1	32	7.66	**.009**
	Time x condition	1	32	5.19	**.03**
	Time x score	1	32	2.14	.154

	Time x condition x score	1	32	3.14	.086
MRT – RT (Incorrect responses)	**Treatment**	1	18	8.41	**.01**
	Time	1	18	.14	.715
	Time x condition	1	18	4.59	**.046**
	Time x score	1	18	2.72	.117
	Time x condition x score	1	18	.160	.694
MRT – RT (Total responses)	**Treatment**	1	22	5.09	**.034**
	Time	1	22	2.27	.146
	Time x condition	1	22	1.58	.222
	Time x score	1	22	.96	.337
	Time x condition x score	1	22	2.99	.098
CMT Response	**Treatment**	1	33	.07	.790
	Time	1	33	2.27	.142
	Time x condition	1	33	4.89	**.034**
CMT RT (Correct responses)	**Treatment**	1	16	.08	.787
	Time	1	16	6.88	**.018**
	Time x condition	1	16	.64	.437
	Time x score	1	16	23.92	***p* < .001**
	Time x condition x score	1	16	.52	.482
CMT RT (Incorrect responses)	**Treatment**	1	16	4.77	**.044**
	Time	1	16	3.59	.076
	Time x condition	1	16	.71	.412
	Time x score	1	16	7.09	**.017**
	Time x condition x score	1	16	.01	.923
CMT RT (Total responses)	**Treatment**	1	34	.25	.620
	Time	1	34	9.40	.004
	Time x condition	1	34	.04	.842

Appendix E – Matrix tables for Experiment One, verbal improvisation and Experiment Five, dance improvisation; Post hoc analyses

Due to the distribution of scores, participants were excluded if they fell into the top 20& of scores in either the ATTA or COWA and a mixed ANOVA carried out for a second time on this sample. It was not possible to divide participants into highest and lowest scorers as this restricted the sample size greatly. Scores for significant results are not included, as by omitting some people from the sample, this does not change the significance of the results. Scores of fluency, and not response, were looked at in these divergent thinking tasks as fluency is a more accurate measure of creativity.

Table E-1 – Matrix table for Experiment One, verbal improvisation for ATTA and COWA, with high score omitted

		df	df error	*F*	*p* value
ATTA Fluency	**Treatment**	1	36	.07	.794
	Time	1	36	19.93	***p* < .001**
	Time x condition	1	36	6.74	**.014**
ATTA Originality	**Treatment**	1	36	2.39	.131
	Time	1	36	.87	.358
	Time x condition	1	36	2.71	.108
ATTA Elaboration	**Treatment**	1	36	.21	.652
	Time	1	36	1.08	.305
	Time x condition	1	36	.02	.901
ATTA Flexibility	**Treatment**	1	36	.04	.837
	Time	1	36	12.87	**.001**
	Time x condition	1	36	1.97	.169
ATTA Total	**Treatment**	1	36	.05	.381
	Time	1	36	10.22	**.003**
	Time x condition	1	36	3.40	.073
COWA Fluency	**Treatment**	1	27	.57	.458
	Time	1	27	8.48	**.007**
	Time x condition36	1	27	.68	.417

Table E-2 – Matrix table for Experiment Five, verbal improvisation for COWA, for highest and lowest scorers

		df	df error	*F*	*p* value
COWA Fluency	**Treatment**	1	25	1.68	.207
	Time	1	25	1.82	.189
	Time x condition	1	25	1.25	.274
	Time x score	1	25	4.85	**.037**
	Time x condition x score	1	25	.127	.724

Appendix F – AUT Scoring instructions

<u>How to Score the Alternative Uses Task (AUT)</u>

An Alternative Uses Tasks (AUT) involves people having to come up with as many alternative uses for a particular object as they can think of within a certain time limit.

This task involves you rating the scores of alternative uses.

The instructions that were given for the AUT that you are about to rate were as follows:

I am going to give you the name of a common object (e.g. chair) and I want you to list as many possible uses for that item as you can. When I tell you what the common object is you will have 3 minutes to write down as many uses as you can think of.

There were four versions:

1: paperclip
2: Newspaper
3: Brick
4: Remote control

<u>Scoring the AUT</u>

I would like you to rate the AUT according to two categories.

1. **<u>Fluency – the number of VALID items</u>**

Not all answers in the AUT are correct. In other words they are not classed as an **alternative use.** For example, to sit on a chair, would not be an ALTERNATIVE use as it is what the chair was made for! In a similar way turning up the volume on a remote control is also what the remote control is designed to do.

I would like you to count up the number of responses for each person according to what you class as a **valid** item.

The **exclusion criteria** for this is:

1. **If the use is mentioned more than once,** it should not be counted again.
2. **What the object was originally intended for** (e,g, - chair – to sit on).
3. **The response is not a USE** (e.g. – pick chair up. In order for this to be valid the response would have to indicate why the chair was being picked up, such as picking the chair up to hit someone.)

2. Flexibility – the number of categories

Flexibility refers to the number of categories that someone uses in all of their answers. In order to rate flexibility, you must put the different responses into categories and then state the number of categories there are.

For example, someone may list a variety of different toys an object could be used as – these would be all included in the one category. However, hitting someone would be entirely different and so two categories would be used here.

Flexibility scores should only be taken from those items that were scored as **valid.**

Consider the following example of alternative uses for a PAPERCLIP.

	Valid?
Clip paper together	No
Make a necklace	Yes
A ring	Yes
Put it onto clothing	Yes
Make some sort of accessory - headband	Yes
Make an earring	Yes
Make a collage	Yes
Use it to make a painting	Yes
Melt it – then mold into something else	Yes
Put in your pocket for later	No

As there are eight valid items in the above example, the fluency score would be 8.

For flexibility, making a necklace, earring, ring, accessory and even for clothing could all be classed as one category as they are all involving using the paperclip as an accessory. As well as this making a collage, painting and something else by melting it is another category. The flexibility score given here would therefore be 2.

Finally, while you are carrying out these ratings, please think of any ambiguities/issues in scoring these responses. Please write them down on the pad of paper next to you.

Appendix G – Experiment Six Survey Lists (Versions 1 – 8)

Version A – BRICK

Smooth mud
Build rockery
Shoes – heels
Mark out an area
Term for old phone
Prop up table
Put it in microwave
Throw through window
Weigh down objects
Increasing your weight!
Stand on to see over something slightly higher than you
Percussion instrument
Weight training
Mount car on it
Train arm muscles
Ashtray
Pile up
Heat up and put a potato on it
Play it with some drum sticks
Bat
Decoration
Stand for picture
Walking on
Cut it in two
Steal it
Build a fence
Prop up objects off the ground
Killing a chicken or other small animal
Sit on it
Lift it like weights
Give it to someone
Put it in a fire and wait for it to explode
Half brick in sock
Fix a computer
Paperclip holder
For drowning cats in a bag
Crunch into gravel
Weigh a fishing net down under water
Raise height of moveable objects
Carry it in your pocket
Building game
Feed it to an animal
Simple sculpture
Use it as a table
Try and cook it
Decoration in garden

As a counter weight on a market scales
Hold something together
Hold it
BBQ building material
Drop it
Working out too
Play painful football with it
Break windows
Throw it
Opening a door/window
Ornament
Weigh down dustbin
Drainage item – porous
Play catch with
Build a tower
Hurting someone's toe or finger or head
Make a table higher
Write on it
Stepping stones
Something to build stuff with
Roll it down a hill
Trip people up
Bookend
Tie to something – make it sink
Stand on it
Build patio
Build houses
Weigh down a balloon
Build a wall
Chop it in half use them as bookends
Flattening some pressed flowers
Weapon
Karate training (Japanese martial arts) – break into two with bare hands
Stroke it like a pet
Sculpt into shape
Put a hat on it.
Mark a boundary
Play with
Block holes
Jump over it
Weights
Hit someone with it
Digging a hole
Try and burn it
Use it as a chair
Build barriers
Border in a garden
Throw in a lake
Stop objects from rolling down a hill e.g. a car/wheeled object
Anchor objects that may fly away/float away

Put on see saw
Try and eat it
Object to pick up from the bottom of pools
Throw at someone/something
Hit on someone's head
Make a wonky table level
Use it as a pillow
Clap together
Cup holder
Build a fireplace
Heat it up for warmth during a night
Cook an egg on a hot one
Bang on a door
Footstool
Fire proofing
Put some string round it and take it for a walk
Make a path
Door stop
Balance on head (Deportment)
Hammer
Balance things on top of
Hide it
Break stones
Paperweight
Build a sculpture
For artistic purposes
Standing a coffee on
Pave driveway
Break glass
Weigh down a bag
Measure a right angle
Put a candle on
Paint it
Smash something with it

Version B – NEWSPAPER

research tool
floor mats
carrying
triangle
to wipe something with
trace over pictures in it
inspiration
throw
scrap paper
Walking stick
Burn it to make a fire
apply for jobs
packaging
providing football scores
cloth
carry fish and chips
Fill
Collage – pictures
Lay on the floor
check the people in power
recycle
roll up and hit someone with
Covering
dad
Photograph
to throw balls made from newspaper at someone
Use them for building a bridge in one of those team building exercises.
clean windows
Make a paper plane
Find ideas
Counting practice for kids
Ball
Megaphone
Scoop
house to rent
Access to overview of around the world
Cooking and eating with
doing puzzles in
Back brush
baseball bat
pick up dog poo
Dress
Edit
cross word
wallpaper
tear it
put inside your shoes to dry them
Fly

putting on car screen when cold
standing on with muddy shoes
see other peoples opinions
Child's stars
Hit people with
to make money
burry it
making visual art
used for crosswords
swat flies
Fan
to wrap up cutlery
cutting up for scrap paper
Cheap tablecloth
Protection
Hockey
look
Cover something
rope
sleep under (if you're a tramp)
Make a table (Rolled up)
Sun protection
Study
keep dry
damp proofing
Make it wet and put on a wall
Blow nose
boat
catch up on the gossip
Funnel
sudoku
cleaning floor
Read
line the litter tray for the cat
Build a bridge/rolled up
Make a collage out of
can be used to make your fingers dirty
food wrap
make clothes out of it
football
do the sudoku
Block sun from window
read horoscope
sit
Toilet roll
pointer
fire building
Lush
Hide behind
armour

show weather
confetti
fly splatter
Wedging – rolled up
see what's on locally, cinema etc.
find or sell a car
Drying a dog
to use as a papertowel
update
scribble on
paper
Make a ball
to look at
On stage
Xerox Collect
cook it
look up the travel section
work
mat
place for the dog to sit
blocking
Lining boxes
jobhunting
oven-glove
education
hamster bedding
hit someone over the head
Hiding your face
rubbish
Clean a spill
Use as a draught excluder
put a painted object on while drying
Record
word search
Cutting up – templates
material for team-building games
wrapping paper
kebab-wrapper
to stand on
reference
Anonymity letter
Boil
covering areas
cover windows
binliner
guidance
Foreign language practice
Probe
Wrap up bottles
Cover books with

Check reading age of
Steal
In piles – to raise height
Purse
Share
look busy
Underlay
metro, people read them to see what the latest news is.
put them on doorstep for muddy shoes
Burn
teach children to read
desk ornament
Inside wrapping for a parcel
advertise skills such as teaching
get news and articles from
Indicator of status/personality
clean muddy boots
for cutting
Paper mache
shelf lining
Telescope
Hold
Squash up to make briquettes
Eat
celebrity gossip/news
Musical instrument/effect
wipe feet
tray
cover ones face with
baton
Keep some entertained
cup of tea
read the problem page
old man
cutting out comic strips
Clean up dog/cat mess
Eggs
Draw on
Inner sole for shoe
tear it up
Cudgel
Stick
Game of hockey
measure
collect
throw balls of paper
Subscribe
free
Carpet
sport

Cover with
Fancy dress outfit
Mop
Cover over a window to block out light
cover floor so it doesnt get dirty when muddy footprints
cleaning wipe
box
making chairs even
messy
business man/woman
Check horoscopes
cleaning up liquid
soak up liquids
find a job
pile up and sit on (like a chair)
articles
Disguise
Cover head in rain
frisbee
Layering on a surface like a drawer
A pile of newspapers makes a good step
singles ads so to find a partner
make a boat with
press cuttings
bbc one
latest gossip
Make a hat
Start a fire
Collage
make origami
paper people
Pillow
Lighting a fire
stuffimg
Polish windows/mirrors with it
law
dry out wet shoes (put inside)
kindle
Filter
explain whats happening in the world
Sell
music
sales
Chip wrapper
post it
spitballs
Archive
roll it up
Aeroplane

Version C – NEWSPAPER

to understand
allows people to publicaly announce events or occasions
buy
crime
general knowledge quiz
Throw on to people
Cushion for falling object
to wipe
Christmas tree decoration
look up a cookery recipe
sledge
fake money
ingredients for a soup
storage
Draw liner
cut out
Cut out small hole, and pretend you are reading - in fact you are spying on somebody
Put in welly boots to keep shape
to put your feet up on
Line cupboards
make a mask
Paper soldiers
frying up a mess on the floor
Cover for painting
Umbrella
to rip
check tv listings
Weapon
find out the news
Discover
Deduct ink
gather information from
roll up and use as bat in a game
celebrities
throwing away
Stuffing bean bags
Shell
Make paper dollies with
build paper models
Clean
important
learning
Tissue
magic tricks - water
Keep a fire going (ie. Make a draft with).
politics
to stick to the windows, when refurbishing buildings
finding local events

subtitles
table-cloth
research
Fly swat
screw up to make something
Stuff a bra
Special effect (radio etc)
Keep an essay in to hide it
Use rolled up pieces as pellets in a catapult
Wrap around chicken and light and cook
Napkin
Swap
Find out todays date
Padding
make paper decorations
Parachute
roll up to hit with
blocking a hole
Thermal layer (stuffed under shirt)
buy from an adverisement
horoscopes
bags filler
Complete the gamed
keep things in it
Cut letters out of to make a threatening letter
Wrapping
Collect pictures from
hit someone with a rolled up one
Fill in a gap
Cat litter tray liner
Fill a bin
use to doodle on
Clip
Throw to
Bung up hole
Blanket
read gossip
available in local shops
make a house from it
get football scores from
Get dirty hands with
use it to stuff a teddy bear
see holiday offers
put in wet shoes
Eliminate
Keep warm
Games – stepping stones
what movies are on
Distribute
Wafer – for ice cream

White balance on camera
to rest on
read your star signs
placing in rabbit hutch
Paperchains
Wrap up fish & chips
Insulation
take quotes
spare time
gift wrapper
decoration
flag-pole
chew when I'm really bored
gossip
Groundsheet for a tent
ruler
Beat someone with
floor tiles
to wrap up rubbish in
crime stories
preserved as an artifact
Crop
titles
blocking light out
to play musical chairs with
bracelet paper jewellery
Prop a table leg up with it
Make noises
sculpturing
Cut letters from the titles
adverts
sleeping
Clothes
Cover up cracks in the walls
money
Throw at someone
horses bed
hair extensions for a party
to shred
Cricket
Dry something
read news
wrapping articles when moving house
to provide tips for horse racing
buying second-hand goods
make pass the parcel
cutting and sticking from
paperball
Art and craft
Lay down in dusty wardrobes/cupboards

feeding
Christmas cracker
to look educated
Cover himself
Hat
Paint on
Educate people
put inside shoes
toilet training dogs
Use as a pattern when cutting fabric
use it as a plate
Provide a journalist with work
Glued into T-shirt
Bat
decorate the walls of a room
Stuff in shoes
reminders
bug killer
car-boot protector
reading on trains,
holder for broken glass in the bin
stories
let your dog urinate on it
bet
comics
Cut into shapes like a magician
Make logs by compressing
reporting crime
rugby news
Fire lighter
Paddle
Write on
mould it into a fan
stepping-stone
selling second-hand items
Information
in games (pass the parcel)
cover from rain
read the obits
animal litter
Insulation from a cold seat
Light a BBQ
Pet bedding
wall decoration
Fertilize
roll it up and use in self defence
Print
Hold fish and chips in like a plate
to roll
relax

Rearing animals
find or sell other items
Stuff a duvet
Door stop
creative art
For warmth – fire
make slippers out of
Fuel
ear trumpet
paper boot
Erudicate
Line a trench in garden
schools, use for collage
Stuff a box with
Making new words – sentences
cut holes in and spy on people
blowpipe
argument
Protecting surfaces
wrap presents
entertainment
Block out draught by lining windows
old
Build a paper tower
time passer
blocking draft
Get your anger at it
agony aunt
advertising
Puppy house
doormat
Create a cipher/code from
houses
Cleaning up gunge
Ignore
Fence
do the newspaper from it
Adore
dry stuff with
in an animals cage/hut
tabloids
cover a surface
To wipe something up
protection of china in boxes
tablemat
fun
curtain
catch up on world events
deliver to people

Version D – PAPERCLIP

Pick-up line: “Is this your paperclip I found?”
gift
Ear scratcher
Piercing
fasten papers
Hold
binding objects
Hang washing instead of clothes peg !?
secure
Executive toy
fasten loose papers
Chew on
zip
can be used to stick on to things
Hang something up with it
use in dressmaking
putting on a magnet
Hold cardigan together
Draw it
to clip
Pierce ears
ear bud
making holes in wall
Make some sort of accessory – head band
put on paper
Distribute
to cut something
Use it in an A level chemistry experiment to find the % Mn in it
Demonstration of magnetism
needle
Attaching to a magnet
Clip cardboard
art material
Make a chain
picking
Probe
for show
Toothpick
Attracts to magnet easily
easy to use
Stencil
piercer
grouping
electric cable
Melt it – then mold it into something else
magnet attracter
Sample
to bookmark a page

filing
fasten
Pick a lock
Dog collar – attach name
bendable art
Mend my bassoon!
Using to open tins
Christmas tree decoration
Play with when bored
decorative ornamen
back-scratcher
money' in poker
To mend clothes e.g. if there is a rip
Sculpture
Poke holes in it
Stab someone
Hold clothes together
making paperclip sculptures
Link together for decoration
Decoration around the house
To gain spare staples
badge
Bend it into a tiny wire coat hanger
paperclip thowing olympic sport
Shaping into a pincer for fine object control
Walking stick for a mouse
hook to put your keys on
to take apart and use the wire for something
inter-personal projectile
Stick things to a corkboard
To build a tunnel in a tiny model city
to design a card
to stab someone
Secure an elastic band
put in a stationary box
To put in the stationary drawer
so you dont lose anything
Pick your teeth with it
clip
Cosmic
Pick a door
Link lots together to make a bracelet
Paralyze
putting objects together
Straighten wonky table
Export
to clip imoportant sheets together
dangerous for little kids
Gardening – tiing up etc…
Differentiate

Sell on ebay
Wire for a circuit
Different sizes
to make little 3d designes
Clip metal
Deduct
stationary
paperclip together
chainlink
cleaning your teeth
Fix
button pusher
Make into a picture holder thing
Test a cake
Scalpel
magnetic
Use as a pen
be magnetic
put on the table
Down the drain
poky
TV aerial
To stick magnets on
push something out of small space
complete a cicuit
link together as piece of art or fashion
Perform
cheap to buy
Straighten out to make straight edge
links
Scratch a scratch card with
Attach
To dislodge small items fallen into cracks (floor…)
Instrument
Scratch/itch
to puncture something
Conduct electricity
S' shape
Pin back your hair
Making tiny hole in paper to use as sunglasses to see an eclipse
glued
bird "attractor"
Note holding
Unfold and use to hold items together
to make wholes with the ends
Put on a zip to make it easier to pull
fashion item
stress release
Cakes – for decoration – tying on flags etc…
String together shoe laces

can be used to fiddle with during a boring lecture!
Weapon
Lock pick
Aim and shoot
Strum a guitar
Unblocking a smoking pipe
piece of wire
pick things from small places
room decorations
Fiddle with
To make a dream catcher (hang off ceiling etc…)
bookmaker
to put together
back scratcher
paperweight
Antenna
Electrocuter device
Expand
ornaments
Balloon popper
missile
to assist getting something out of a small space
Demonstration of metal fatigue
Necklace
use as a screwdriver
Make alternative shapes with
Page finder
Can bend out into one single metal strip
mend a buckle
To fasten a button
plastic coating
Hair clip
Lock for steering wheel
test magnet strength
scratcher
to hold
Mend a bag handle
Earrings

Version E – PAPERCLIP

Makeshift cocktail stick
slicer
keeps files in order
Use as magnet for small metal objects
art display
fridge magnet
fake braces
jacket fastener
Throw
used to make models
Draw lines
keep packets of food closed
Use it as a game piece
Analyze
selling in a stationary shop
one set
Kill an insect
open a disc drive with it
put notes together
Mock
to decide stuff
pointing device
Weight
painting tool
Clip it on anything you find
Symbolize
linking with other paperclips
make holes by digging into things
computer helper
Tie shoelaces
Scratch someone with
Wire for wrapping around something – closing it
Safety catch
papers
Brush
Archive
Use it to make a painting
Replacement earring
opening letterbox
electricity conductor
opening a letter
Construct
sewing needle
accessory
Necklace charm
Fixing a necklace or other chain
Poker for roll up cigarettes
Eject a disk from an apple mac with

Scratch a scratchie
Organize
Make a chain for a bag
Key
chain to form a necklace
Use it to scratch your head
to reach for something trapped in a narrow space
fixing broken bags
Hook something together. E.g. curtain
Mouse killer
Hurt someone
To hold things together
use to fiddle with
Challenge
belt, by linking paper clips together
Record
Throw at somebody
Use it to pin something to a notice board
Drink
Reset a phone or electronic device
bend out and use to get things out of grouting
Use it to deface a wall (scratch words with it).
Clip bits of plastic
Replacing short lengths of wire
hook to reach something
safe place for when you need them
repair tears
Scratch yourself
Flick it
Put in your hair
stretchable
to mark a book
Replace a wire in an electrical circuit
Scratch a car
Tricks
bracelet
the start to a rubber band ball
Coat hook
Fishing rod
Use it to hold your broken glasses
Electric contact
Calve your name
designing animals
Door stop
To unlock your house door when you've forgotten keys
Initiate
switch
push a small button
to scratch yourself
office

To open it all out to make a thin metal rod
use during magnet experiments
Come in different colours
closing your pants
Use it in a science experiment to investigate electromagnetism.
Scrape things with it
use as a pin
Open cd drawer
clipping wires together
something sharp to use as a tool
to hold paper together
documents
Hold fabric together
to keep paper looking neat
seperate one thing from another
memo
Pierce a can
getting something out of a hole by scooping with an end
fixing broken clothes
Submarine
Filling hook
Bend it into something else
Hold paper together
Use it to scratch your head if you got extensions in it
uncurl them to make a statue with some blue tack
Use it as solder
Tiny projectile
additional bit to aeriel on tv which doesnt work
used in schools
Closing packets
Key ring
break into a house
hook something out of a small gap
Put holes in a microwave meal lid
Dagger
A "poker"
Bend into shapes
make a paperclip chain
Split a banana into segments
To hold a dress up
Create a bed of nails
Punching small holes in paper
used as weight on paper aeroplane or helicopter blades
Twist
Bend it and use it to puncture holes in a piece of paper.
to collate
To break a shredder
Flick at someone
podger (technical term)
Use as a hairclip

to hold hair out your eyes
Make a catapult out of it
Clean nails
pop a blister
mobile
To scratch paint off
Broken zip replacement
To roll something along a bench
Make metal models
present
Blow up a microwave
attach lots of them together to make a chain
Straighten it
Chain
Art/design e.g. make a lampshade
to hand in assignments or a project
bottle opener
Make a collage
Shaping into a sculptor
storage
to tear something
Troubleshoot
Teaching material
card decoration
for organised files and documents
art and craft
keep stamps together
Prim
Wrap around finger
tidy up your nail polish (get excess polish off your hands)
Vandalizing generally
Reminder
Build
Stretch it out and get food out of your mouth
Stick figures
Use on a tie for flex or cable
create artwork
smalll key ring

Version F – PAPERCLIP

Fold out use to poke someone with
Fix broken zip fly
sharp edges
Lock opener
Colourful paperclips in a pot on office desk
Whisk
To put in your pocket for later
loose-able
Hole filler
decoration
in artwork
photo to a paper
To throw it in the bin
To throw at someone
kebab stick
cable tie
Tweezers
bending into shapes
use as counters
Use it for modeling clay
Key a car
convienence
attath photographs to cvs etc etc
hold money together
Get cockles out of a shell
Scratch something with
Attaching - as wire.
Rust
Put it onto clothing
artist might like to treat it as an object to be painted
People pincher
Coiling into a spring
Making a worm
Navigate
Hole punch
Novel nose ring
pen
ring
electrical wire
If your in need of a hole puncher use it
metal
Pick it
cufflinks
To “undo” the paper clip’s shape to reform into a hook and grab items faraway or unreachable
Bracelet chain of paperclips
tightrope for a mouse
Shoe decoration

clipping decorations up
Melt
Use as a magnet
Nose clip
Bend it out and use it to tweeze it out
fishing hook
Bend it
pick you nose
keep work tidy
to vandalise a desk
Scratching words into something
To break a photo copier
people who work in offices use them
Stop a fan
use to hold christmas cards
teachers use them
coursework
Fix a faulty door catch
Spike
Making wire
Shoelace – to small shoes
door wedge
Pick something small clean
door pick
pin
Poke people with
hold objects together
scrape a small surface clean
Splinter remover
Ruler
maintain
clip paper together
Melt into a ball bearing
children can use them as things to make models and creative things out of
to throw
hang pictures
Opening plastic containers
Pierce things with it
bookmark
Play with magnet
keep items of clothing together
make statues
to keep work together
bend into useful shape
Tie a knot
Collect
Clip on baby strap
sketch
can be used as a good luck charm
to stand on

cuticle remover
wire arts
Use as a paperclip! J
Scratch graffiti
keyboard cleaner
Make a spring
removable
Cleaning
clipping things to walls
Play with
schoolery object
make a mast for car radio
wind chimes
Artistic tool for creating scratches in surfaces
to undo hand cuffs
make into the shape of a snail
Make a hole in something
small
necklace pendant
Make a little man
push something out of small space
if pulled apart, it can be used as a sharp object to presss the reset button for example
hang things from
Wire
magnet
closing a bag
Break into car
To fill in a gap in a scratch on car paintwork
to use
teasing someone
Pierce a hole
Modern art
so nothing gets lost
To scoop tiny items into a lump
use-maker for idle hands
Button hole holder
Use it to join a ripped piece of clothing back together
crankshaft
belt
reshape to hand childrens mobiles on
Scratch an itch
Hold things together
Control
fixing your shoe laces
Reset button activator
Cleaning tiny holes
decoration on clothes
Strong bendy material to hold things together (like cable tie)
guess how many in jar
scratch something-

Trouble
Fold out use as a key
Hook
Generate electricity
separate
Bend it and use it as stress relief
Unblocker
Jewellery
Safety pin
customise clothes
Nail file
Draw into (i.e. wood)
Broach
Make a picture with loads
pinned
to decorate
Projectile
Picking up little bits of paper
Pierce your body
Object used for art and craft
Toggle for a zip
Make a sound (noise)
Connect an electrical board thing
keep things in place
Clothes decoration
toys
Book incert
room decoration
Measure the distance of something
to sell
To pierce lips
To make something e.g. stick on paper with something else to create a design
Fixing electrical break
exams
use them in schools and college and university and home
Spring

Version G – REMOTE CONTROL

Medallion
Push something with it
Put it to bed
Plane ticket
Trip someone up
Recycle it
Operate remote controlled toy
Air conditioning control
Use toilet cistern to displace water and use less water when flushing
Propping up window
Play space games
See how far you can throw it
Itch your back
Garden fork
Weight
Smash it
Take all the batteries
Window blinds
Put under table leg to make it steady
Hot air
Object for hide and seek
Mark the centre point between two piles of videos
Bat
Hat
Fix wonky table
Control radio
To hold something up
Phallic measuring device
Fetch with a dog
Take out batteries for another use
Imaginary controller for mass machine
Bash someone
Throw at someone
Off TV
Weapon
Open it up
Decorate as an ornament
Kick it
Stop
Dig a hole with
Baby toy
Laptop
Start a dvd
Painter
Control light
Jump on it
Turn on TV
Source of light

Steer toy car/boat/plane
Add to headband as a new accessory
Vase
Down
Break a window
Find it
Put on a table
Phone
Emergency battery holder
Cooling between legs (as a propping out device)
See if it floats in a pond
Switch to keep your hands busy
Cold air
Use as a prop in a play
Use the batteries
To mute my sister
Remover of things when not able to reach
Control amplifier
Paperweight
Store it
Learning/teaching to calculate
Gates
Excuse not to turn the telly off – as in "this remote control ain't working"
Take to the shop to remember it and buy a new one
Prop something up
To wear as shows – with elastic bands
Radio
Decoration
Play duration
Car alarm
Projector
Control curtains
Play phone
Ipod
Play catch
Break it when you are angry
Use the parts to make something else
Pretend play with e.g. use buttons as zapping
Cup holder or glass
Garage opener
Take apart and use the batteries
Throw it for a game
Swat flies with
Throw to a dog!
Decorate it
Microwave it
Break an egg
Play a tune – bang on table
Gear knob
Pretend it has magical powers

Book-end
Sculpture
Take to the remote control repair shop
Wedge a door open
Weighing something down with it
Toy aeroplane
Throw it
Use the batteries for something else
Electronics – take it apart, put it back together
Control DVD
Lights
Stand on for height
Teach it to ride a bike
Stress pad
Put spiky objects in buttons
Propping up door
Let your dog chew it
Disguise it
Wrap it up
Throw it in a lake
Sprinklers
Use parts to replace parts of another remote control
Eat it
Throw during fights
Block the view of a flashing light (video…)
Footrest
Throw it at a ball, that is stuck in the tree
Something to fiddle with
Make a hole in something
Transport food on
Throwing it at someone
Steal batteries from
Use as a support for something
Build with it
Close garage
Stir a broth/soup
Sell it
Pretend it's a remote for something else
Burn it
Games console
Teach a child numbers
Calculator
Percussion instrument
Batteries used for control
Throw at TV
Pretend to type on buttons
Have it by your side
With two remote controls: add straps and wear as fancy shoes
Get something from behind a radiator
Control car keys/lock

Hit it against something to make music
Hurting someone
Doorstop
Tray
Pretend to control someone
Pretend it is a weapon e.g. put in carrier bag to scare people?
Pretend it's a phone
Change channel
Put in under a wonky chair leg so it doesn't move
Treasure it
Bookmark
Toy light beam
Do an experiment using remote controls
Take it back to the shop
Break something with
Detonator
Fast forward
Dog toy
Bury it
Throw to get someone's attention
Pendant on a necklace
Knee rest
Ballast
Draw on

Version H – REMOTE CONTROL

Cook it
For a child's toy
Weigh down a tent with it
Building block
Smash a window
Microphone
Cooling armpits (propping out arms with remote control)
Put it in your pocket
Store batteries
House hold appliance
Back scratcher
Point at people with
Jar opener i.e. hit jar to open.
Hold a door 'a jar'
Take off the batteries and chew them
Throwing object
Balance stuff on
Way of getting people's attention by banging on table
Bat and ball
Protect yourself with it! Protect part of the body
Hide it
Smacking tool
Slide on ground
Juggling
Change its colour
Make into a boat
Stepping stone
Take apart
Scratch your back
Take apart and put back together again
Toy
Stencil
Help calculate sums
Put a hat on it
Lose it
Alter colour contrast of the monitors
Flatten your hair
Control heater
Hide it to annoy someone
Door wedge
Hit someone on the head
Spinner (spin the bottle)
Control remote – controlled model car/objects – make them faster/slower/change direction
Change brightness/contrast on TV
Cover it up
Coaster
Breaking things up
Level out a table

Nick the batteries out of it
Toothbrush
Record something on TV
Attack someone with IR waves
Put in microwave and see what happens
Put batteries in it
Use the acid from batteries
Put it away
Eat with
Teach it to drive
Give it to the dog
Drawing implement
Balance on your shoulders
Stack up and build things
Place on a pile of papers so they don't fly away when there is a draft
Use to point to objects
Pillow
Stick to your face and look like a robot
Ingredient in soup
Hit someone
Play telephone (mobile) with a child
Wedge to raise item
Hi Fi system control
Use electronic circuit
Catapult
Open/close remote controlled doors e.g. garage doors
Catch
Shake it in improvisation (Maracas)
Change TV volume
Pause
Brick
Pretend wand
Plinth
Stick
Break windows
Projectile
Hold in both hands
Hammer
Take the batteries out
Control Video
Hold newspaper open
Clock
On TV
Teach it to swim
Remote for air condition
Coffee table ornament
Balance small objects on (pins etc)
Reassembled: Junk for display
Dismantled: shrapnel
Teach child how to insert batteries

Instrument
Turn off TV
Pass it to someone
Control wheelchair
Give it to dog as a toy
Tie it to a tree
Cut it in half
Bludgeon
Scratch it
Prop a book to make reading easier
Light dimming
Stir tool with
Rewind
Balancing it on your knee
Key
The point in a sundial
Remotely controlling things
Act with it
Balance on your head
Dildo
Pencil case
Song change
Exercise lips by pressing buttons with lips
Get money by selling it on ebay
Tool of somesort?
Use as a car
Spoon
Control robot toy
Dominoe falling
Bang a nail
Pretend microphone
Poke someone with
Prodding tool
Makeshift drumstick
Break it into pieces and make a model figure out of it
Use batteries from it or for something else
Speaking stick
Take out the buttons and chew them as gum
Console holder
Ruler
Temperature
Kick under the sofa
Pen
Front door bell by remote (Wireless)
Digital tuner (Listens when playing)
Control toy car
Give it away
Plant it in the ground
Kill a fly
Put in shoe to keep its shape

Hairbrush
Prop a photo against
Use the battery compartment as a box
Light saber
Keep as an ornament
Sing into
Up
Pretend it’s a sword
Close/open remote controlled curtains/window
Toy gun
Exercise chin by pressing buttons with chin
Break it
To hold a pen
Turn item on
Wallet
Give to someone as present
Stand on
Lock car
Ball
Ornament

Appendix H – Experiment Six – Individual scorings of the AUT

The five independent judges scores of whether AUTs were considered as valid alternative uses or not for each set of responses are presented across tables H-1 to H-8. Where there is not 100% agreement between raters, it is clear to see that it is not due to one particular judge's scores.

Table H-1: AUT ratings, Version A: Bricks (N=130)

Response	J1	J2	J3	J4	J5
Smooth mud	Yes	Yes	Yes	Yes	Yes
Build rockery	Yes	Yes	**No**	**No**	Yes
Shoes – heels	**No**	**No**	Yes	Yes	Yes
Mark out an area	Yes	Yes	**No**	**No**	Yes
Term for old phone	Yes	**No**	**No**	Yes	**No**
Prop up table	Yes	Yes	Yes	**No**	Yes
Put it in microwave	**No**	**No**	Yes	Yes	**No**
Throw through window	Yes	Yes	**No**	Yes	**No**
Weigh down objects	Yes	Yes	Yes	**No**	Yes
Increasing your weight!	**No**	Yes	Yes	Yes	Yes
Stand on to see over something slightly higher than you	Yes	Yes	Yes	Yes	Yes
Percussion instrument	**No**	**No**	Yes	Yes	Yes
Weight training	Yes	**No**	Yes	**No**	Yes
Mount car on it	Yes	Yes	**No**	Yes	Yes
Train arm muscles	Yes	**No**	Yes	Yes	Yes
Ashtray	Yes	**No**	Yes	Yes	Yes
Pile up	Yes	**No**	**No**	Yes	**No**
Heat up and put a potato on it	**No**	Yes	Yes	Yes	Yes
Play it with some drum sticks	Yes	**No**	Yes	Yes	Yes
Bat	**No**	Yes	Yes	Yes	Yes
Decoration	Yes	Yes	Yes	**No**	Yes
Stand for picture	**No**	Yes	Yes	Yes	Yes
Walking on	Yes	Yes	**No**	**No**	Yes
Cut it in two	Yes	**No**	Yes	**No**	**No**
Steal it	**No**	**No**	Yes	Yes	**No**
Build a fence	Yes	Yes	Yes	**No**	**No**
Prop up objects off the ground	Yes	**No**	Yes	**No**	Yes
Killing a chicken or other small animal	Yes	Yes	Yes	Yes	Yes
Sit on it	Yes	**No**	Yes	**No**	Yes
Lift it like weights	Yes	**No**	Yes	Yes	Yes
Give it to someone	Yes	**No**	Yes	**No**	**No**
Put it in a fire and wait for it to explode	**No**	**No**	Yes	Yes	**No**
Half brick in sock	**No**	**No**	**No**	Yes	**No**
Fix a computer	**No**	Yes	Yes	Yes	Yes
Paperclip holder	Yes	**No**	Yes	Yes	Yes
For drowning cats in a bag	Yes	**No**	Yes	Yes	Yes
Crunch into gravel	Yes	**No**	**No**	Yes	**No**
Weigh a fishing net down under water	Yes	Yes	Yes	Yes	Yes

Raise height of moveable objects	Yes	Yes	Yes	**No**	Yes
Carry it in your pocket	**No**	**No**	Yes	Yes	**No**
Building game	Yes	**No**	**No**	**No**	**No**
Feed it to an animal	**No**	**No**	Yes	Yes	Yes
Simple sculpture	Yes	**No**	Yes	Yes	Yes
Use it as a table	**No**	Yes	Yes	**No**	Yes
Try and cook it	**No**	**No**	Yes	Yes	**No**
Decoration in garden	Yes	**No**	Yes	**No**	Yes
As a counter weight on a market scales	Yes	Yes	Yes	Yes	Yes
Hold something together	**No**	Yes	Yes	**No**	Yes
Hold it	Yes	**No**	Yes	**No**	**No**
BBQ building material	**No**	**No**	**No**	**No**	**No**
Drop it	Yes	**No**	Yes	**No**	**No**
Working out too	Yes	Yes	Yes	Yes	Yes
Play painful football with it	**No**	**No**	Yes	Yes	Yes
Break windows	Yes	Yes	**No**	Yes	Yes
Throw it	Yes	**No**	Yes	Yes	**No**
Opening a door/window	Yes	Yes	Yes	Yes	Yes
Ornament	Yes	Yes	Yes	Yes	Yes
Weigh down dustbin	Yes	Yes	Yes	**No**	Yes
Drainage item – porous	**No**	**No**	Yes	Yes	**No**
Play catch with	**No**	Yes	Yes	Yes	Yes
Build a tower	**No**	**No**	**No**	**No**	**No**
Hurting someone's toe or finger or head	Yes	Yes	Yes	**No**	**No**
Make a table higher	Yes	**No**	Yes	**No**	Yes
Write on it	**No**	**No**	Yes	Yes	Yes
Stepping stones	Yes	Yes	Yes	Yes	**No**
Something to build stuff with	**No**	Yes	**No**	**No**	**No**
Roll it down a hill	**No**	Yes	Yes	**No**	**No**
Trip people up	Yes	Yes	Yes	Yes	Yes
Bookend	Yes	**No**	Yes	Yes	Yes
Tie to something – make it sink	Yes	**No**	**No**	Yes	Yes
Stand on it	Yes	Yes	Yes	Yes	**No**
Build patio	**No**	Yes	**No**	**No**	**No**
Build houses	**No**	**No**	**No**	**No**	**No**
Weigh down a balloon	Yes	Yes	Yes	**No**	Yes
Build a wall	**No**	**No**	**No**	**No**	**No**
Chop it in half use them as bookends	Yes	**No**	Yes	Yes	Yes
Flattening some pressed flowers	Yes	Yes	Yes	Yes	Yes
Weapon	Yes	**No**	**No**	Yes	Yes
Karate training (Japanese martial arts) – break into two with bare hands	Yes	**No**	**No**	**No**	Yes
Stroke it like a pet	**No**	**No**	Yes	Yes	**No**
Sculpt into shape	Yes	Yes	Yes	Yes	Yes
Put a hat on it.	Yes	**No**	Yes	Yes	**No**
Mark a boundary	Yes	**No**	**No**	**No**	Yes
Play with	Yes	**No**	Yes	Yes	**No**
Block holes	Yes	Yes	**No**	**No**	Yes
Jump over it	Yes	**No**	Yes	Yes	**No**

Weights	Yes	**No**	Yes	Yes	Yes
Hit someone with it	Yes	**No**	**No**	Yes	Yes
Digging a hole	Yes	**No**	Yes	Yes	Yes
Try and burn it	**No**	**No**	Yes	Yes	**No**
Use it as a chair	**No**	Yes	Yes	Yes	Yes
Build barriers	**No**	Yes	**No**	**No**	**No**
Border in a garden	**No**	**No**	**No**	**No**	Yes
Throw in a lake	Yes	**No**	Yes	Yes	**No**
Stop objects from rolling down a hill e.g. a car/wheeled object	Yes	Yes	Yes	**No**	Yes
Anchor objects that may fly away/float away	Yes	Yes	**No**	Yes	Yes
Put on see saw	Yes	**No**	Yes	Yes	**No**
Try and eat it	**No**	**No**	Yes	Yes	**No**
Object to pick up from the bottom of pools	Yes	**No**	Yes	Yes	Yes
Throw at someone/something	Yes	Yes	**No**	Yes	**No**
Hit on someone's head	Yes	**No**	**No**	Yes	Yes
Make a wonky table level	Yes	Yes	**No**	**No**	Yes
Use it as a pillow	**No**	Yes	Yes	Yes	Yes
Clap together	Yes	**No**	Yes	Yes	**No**
Cup holder	Yes	Yes	Yes	Yes	Yes
Build a fireplace	Yes	**No**	**No**	**No**	**No**
Heat it up for warmth during a night	**No**	**No**	Yes	Yes	Yes
Cook an egg on a hot one	**No**	Yes	Yes	Yes	Yes
Bang on a door	Yes	**No**	Yes	Yes	Yes
Footstool	Yes	Yes	Yes	Yes	Yes
Fire proofing	**No**	**No**	**No**	Yes	Yes
Put some string round it and take it for a walk	Yes	Yes	Yes	Yes	**No**
Make a path	Yes	Yes	**No**	**No**	**No**
Door stop	Yes	**No**	Yes	Yes	Yes
Balance on head (Deportment)	Yes	Yes	Yes	Yes	**No**
Hammer	Yes	Yes	Yes	Yes	Yes
Balance things on top of	Yes	Yes	Yes	Yes	Yes
Hide it	Yes	**No**	Yes	**No**	**No**
Break stones	Yes	Yes	Yes	**No**	Yes
Paperweight	Yes	**No**	Yes	Yes	Yes
Build a sculpture	Yes	Yes	Yes	**No**	Yes
For artistic purposes	Yes	**No**	**No**	Yes	Yes
Standing a coffee on	Yes	Yes	Yes	Yes	Yes
Pave driveway	**No**	Yes	**No**	**No**	**No**
Break glass	Yes	Yes	**No**	Yes	Yes
Weigh down a bag	Yes	Yes	Yes	Yes	Yes
Measure a right angle	Yes	**No**	Yes	Yes	Yes
Put a candle on	**No**	Yes	Yes	Yes	Yes
Paint it	Yes	**No**	**No**	**No**	**No**
Smash something with it	Yes	Yes	Yes	**No**	Yes

Table H-2: AUT ratings, Version B: Newspaper (N=247)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
research tool	**No**	**No**	**No**	**No**	**No**
floor mats	Yes	Yes	Yes	Yes	Yes
carrying	Yes	Yes	**No**	**No**	**No**
triangle	**No**	**No**	**No**	**No**	Yes
to wipe something with	Yes	Yes	Yes	Yes	Yes
trace over pictures in it	Yes	Yes	Yes	Yes	Yes
inspiration	**No**	**No**	**No**	**No**	Yes
throw	**No**	Yes	Yes	**No**	Yes
scrap paper	Yes	Yes	Yes	Yes	Yes
Walking stick	Yes	**No**	**No**	Yes	Yes
Burn it to make a fire	Yes	Yes	Yes	Yes	Yes
apply for jobs	**No**	Yes	**No**	**No**	**No**
packaging	Yes	Yes	Yes	Yes	Yes
providing football scores	**No**	**No**	**No**	**No**	**No**
cloth	Yes	Yes	Yes	**No**	Yes
carry fish and chips	Yes	Yes	Yes	Yes	Yes
Fill	**No**	Yes	**No**	**No**	**No**
Collage – pictures	Yes	Yes	Yes	Yes	**No**
Lay on the floor	Yes	**No**	**No**	Yes	Yes
check the people in power	**No**	**No**	**No**	**No**	**No**
recycle	**No**	Yes	Yes	**No**	**No**
roll up and hit someone with	Yes	Yes	Yes	Yes	Yes
Covering	**No**	Yes	Yes	**No**	Yes
dad	**No**	**No**	**No**	**No**	**No**
Photograph	**No**	**No**	**No**	**No**	**No**
to throw balls made from newspaper at someone	Yes	Yes	Yes	Yes	Yes
Use them for building a bridge in one of those team building exercises.	Yes	Yes	Yes	Yes	Yes
clean windows	Yes	Yes	Yes	Yes	Yes
Make a paper plane	Yes	Yes	Yes	Yes	Yes
Find ideas	**No**	Yes	**No**	**No**	Yes
Counting practice for kids	**No**	**No**	**No**	**No**	Yes
Ball	Yes	Yes	Yes	**No**	Yes
Megaphone	**No**	Yes	**No**	Yes	Yes
Scoop	**No**	**No**	Yes	**No**	**No**
house to rent	**No**	**No**	**No**	**No**	**No**
Access to overview of around the world	**No**	**No**	**No**	**No**	**No**
Cooking and eating with	**No**	Yes	**No**	**No**	**No**
doing puzzles in	**No**	**No**	**No**	**No**	**No**
Back brush	**No**	**No**	Yes	Yes	**No**
baseball bat	**No**	Yes	Yes	Yes	Yes
pick up dog poo	Yes	Yes	Yes	Yes	Yes
Dress	**No**	Yes	Yes	Yes	**No**

Edit	Yes	Yes	**No**	**No**	**No**
cross word	**No**	**No**	**No**	**No**	**No**
wallpaper	Yes	Yes	Yes	Yes	Yes
tear it	Yes	Yes	**No**	**No**	**No**
put inside your shoes to dry them	Yes	Yes	Yes	Yes	Yes
Fly	**No**	**No**	Yes	**No**	**No**
putting on car screen when cold	Yes	Yes	Yes	Yes	Yes
standing on with muddy shoes	Yes	Yes	Yes	Yes	Yes
see other peoples opinions	**No**	**No**	**No**	**No**	**No**
Child's stars	**No**	**No**	**No**	**No**	**No**
Hit people with	Yes	Yes	Yes	Yes	Yes
to make money	**No**	Yes	**No**	**No**	**No**
burry it	**No**	Yes	**No**	**No**	**No**
making visual art	Yes	Yes	Yes	Yes	Yes
used for crosswords	**No**	**No**	**No**	**No**	**No**
swat flies	Yes	Yes	Yes	Yes	Yes
Fan	Yes	Yes	Yes	Yes	Yes
to wrap up cutlery	Yes	Yes	Yes	Yes	Yes
cutting up for scrap paper	Yes	Yes	Yes	Yes	**No**
Cheap tablecloth	Yes	Yes	Yes	Yes	Yes
Protection	**No**	Yes	Yes	Yes	Yes
Hockey	**No**	**No**	Yes	**No**	**No**
look	**No**	**No**	**No**	**No**	**No**
Cover something	Yes	Yes	Yes	Yes	Yes
rope	**No**	Yes	Yes	**No**	Yes
sleep under (if you're a tramp)	Yes	Yes	Yes	Yes	Yes
Make a table (Rolled up)	Yes	Yes	Yes	Yes	Yes
Sun protection	**No**	Yes	Yes	Yes	Yes
Study	**No**	**No**	**No**	**No**	**No**
keep dry	Yes	Yes	Yes	Yes	Yes
damp proofing	Yes	Yes	Yes	Yes	Yes
Make it wet and put on a wall	Yes	Yes	Yes	Yes	Yes
Blow nose	Yes	Yes	Yes	Yes	Yes
boat	**No**	**No**	Yes	Yes	Yes
catch up on the gossip	**No**	**No**	**No**	**No**	**No**
Funnel	Yes	Yes	Yes	Yes	Yes
sudoku	**No**	**No**	**No**	**No**	**No**
cleaning floor	Yes	Yes	Yes	Yes	Yes
Read	**No**	**No**	**No**	**No**	**No**
line the litter tray for the cat	Yes	Yes	Yes	Yes	Yes
Build a bridge/rolled up	Yes	Yes	Yes	Yes	Yes
Make a collage out of	Yes	Yes	Yes	Yes	**No**
can be used to make your fingers dirty	Yes	Yes	Yes	Yes	**No**
food wrap	Yes	Yes	Yes	Yes	Yes
make clothes out of it	Yes	Yes	Yes	Yes	Yes
football	Yes	**No**	Yes	**No**	Yes
do the sudoku	**No**	**No**	**No**	**No**	**No**
Block sun from window	Yes	Yes	Yes	Yes	Yes
read horoscope	**No**	**No**	**No**	**No**	**No**

sit	**No**	**No**	**No**	**No**	Yes
Toilet roll	Yes	Yes	Yes	Yes	Yes
pointer	Yes	Yes	**No**	**No**	Yes
fire building	Yes	**No**	Yes	Yes	Yes
Lush	**No**	**No**	**No**	**No**	**No**
Hide behind	Yes	Yes	Yes	Yes	Yes
armour	**No**	Yes	Yes	Yes	Yes
show weather	**No**	**No**	**No**	**No**	**No**
confetti	Yes	Yes	Yes	Yes	Yes
fly splatter	Yes	Yes	Yes	Yes	Yes
Wedging – rolled up	Yes	Yes	Yes	Yes	Yes
see what's on locally, cinema etc.	**No**	**No**	**No**	**No**	**No**
find or sell a car	**No**	**No**	**No**	**No**	**No**
Drying a dog	Yes	Yes	Yes	Yes	Yes
to use as a papertowel	Yes	Yes	Yes	Yes	Yes
update	**No**	**No**	**No**	**No**	**No**
scribble on	Yes	Yes	Yes	Yes	Yes
paper	**No**	Yes	**No**	Yes	Yes
Make a ball	Yes	Yes	Yes	Yes	Yes
to look at	**No**	**No**	**No**	Yes	**No**
On stage	**No**	**No**	**No**	**No**	**No**
Xerox Collect	**No**	Yes	**No**	**No**	**No**
cook it	Yes	**No**	**No**	**No**	Yes
look up the travel section	**No**	Yes	**No**	**No**	**No**
work	**No**	**No**	**No**	**No**	**No**
mat	Yes	Yes	Yes	Yes	Yes
place for the dog to sit	Yes	Yes	Yes	Yes	Yes
blocking	Yes	Yes	Yes	**No**	**No**
Lining boxes	Yes	Yes	Yes	Yes	Yes
jobhunting	**No**	**No**	**No**	**No**	**No**
oven-glove	**No**	Yes	Yes	Yes	Yes
education	**No**	**No**	**No**	**No**	**No**
hamster bedding	Yes	Yes	Yes	Yes	Yes
hit someone over the head	Yes	Yes	Yes	Yes	Yes
Hiding your face	Yes	Yes	Yes	Yes	Yes
rubbish	**No**	**No**	**No**	**No**	**No**
Clean a spill	Yes	Yes	Yes	Yes	Yes
Use as a draught excluder	Yes	Yes	Yes	Yes	Yes
put a painted object on while drying	Yes	Yes	Yes	Yes	Yes
Record	**No**	**No**	**No**	**No**	**No**
word search	**No**	**No**	**No**	**No**	**No**
Cutting up – templates	Yes	Yes	Yes	Yes	Yes
material for team-building games	**No**	Yes	Yes	Yes	Yes
wrapping paper	Yes	Yes	Yes	Yes	Yes
kebab-wrapper	Yes	Yes	Yes	Yes	Yes
to stand on	Yes	Yes	Yes	Yes	Yes
reference	**No**	**No**	**No**	**No**	Yes
Anonymity letter	**No**	Yes	**No**	**No**	Yes
Boil	**No**	**No**	**No**	**No**	**No**

covering areas	Yes	Yes	Yes	Yes	Yes
cover windows	Yes	Yes	Yes	Yes	Yes
binliner	Yes	Yes	Yes	Yes	Yes
guidance	**No**	**No**	**No**	**No**	**No**
Foreign language practice	Yes	**No**	**No**	**No**	Yes
Probe	**No**	Yes	**No**	**No**	Yes
Wrap up bottles	Yes	Yes	Yes	Yes	Yes
Cover books with	Yes	Yes	Yes	Yes	Yes
Check reading age of	**No**	Yes	**No**	**No**	Yes
Steal	**No**	Yes	**No**	**No**	**No**
In piles – to raise height	Yes	Yes	Yes	Yes	Yes
Purse	**No**	**No**	Yes	**No**	Yes
Share	**No**	Yes	**No**	**No**	**No**
look busy	**No**	Yes	Yes	**No**	**No**
Underlay	Yes	Yes	Yes	Yes	Yes
metro, people read them to see what the latest news is.	**No**	**No**	**No**	**No**	**No**
put them on doorstep for muddy shoes	Yes	Yes	Yes	Yes	Yes
Burn	Yes	Yes	**No**	Yes	**No**
teach children to read	**No**	Yes	**No**	Yes	Yes
desk ornament	Yes	Yes	Yes	Yes	Yes
Inside wrapping for a parcel	Yes	Yes	Yes	Yes	Yes
advertise skills such as teaching	**No**	**No**	**No**	**No**	**No**
get news and articles from	**No**	**No**	**No**	**No**	**No**
Indicator of status/personality	**No**	**No**	**No**	**No**	**No**
clean muddy boots	Yes	Yes	Yes	Yes	Yes
for cutting	Yes	Yes	Yes	Yes	**No**
Paper mache	Yes	Yes	Yes	Yes	Yes
shelf lining	Yes	Yes	Yes	Yes	Yes
Telescope	**No**	Yes	Yes	Yes	Yes
Hold	**No**	Yes	**No**	Yes	**No**
Squash up to make briquettes	Yes	Yes	Yes	Yes	Yes
Eat	Yes	**No**	**No**	**No**	Yes
celebrity gossip/news	**No**	**No**	**No**	**No**	**No**
Musical instrument/effect	Yes	Yes	Yes	Yes	**No**
wipe feet	Yes	Yes	Yes	**No**	Yes
tray	**No**	Yes	Yes	Yes	Yes
cover ones face with	Yes	Yes	Yes	Yes	Yes
baton	Yes	Yes	Yes	Yes	Yes
Keep some entertained	**No**	**No**	**No**	**No**	**No**
cup of tea	**No**	**No**	**No**	**No**	**No**
read the problem page	**No**	**No**	**No**	**No**	**No**
old man	**No**	**No**	**No**	**No**	**No**
cutting out comic strips	**No**	Yes	**No**	**No**	**No**
Clean up dog/cat mess	Yes	Yes	Yes	Yes	Yes
Eggs	**No**	**No**	**No**	**No**	**No**
Draw on	Yes	Yes	Yes	Yes	Yes
Inner sole for shoe	Yes	Yes	Yes	Yes	Yes
tear it up	Yes	Yes	**No**	Yes	Yes
Cudgel	**No**	Yes	**No**	**No**	**No**

Stick	**No**	Yes	**No**	**No**	**No**
Game of hockey	**No**	Yes	Yes	**No**	**No**
measure	**No**	Yes	**No**	**No**	**No**
collect	Yes	Yes	**No**	**No**	Yes
throw balls of paper	Yes	Yes	Yes	Yes	Yes
Subscribe	**No**	**No**	**No**	**No**	**No**
free	**No**	Yes	**No**	**No**	**No**
Carpet	Yes	Yes	Yes	**No**	Yes
sport	**No**	**No**	**No**	**No**	**No**
Cover with	**No**	Yes	Yes	**No**	Yes
Fancy dress outfit	Yes	Yes	Yes	Yes	Yes
Mop	**No**	Yes	Yes	Yes	**No**
Cover over a window to block out light	Yes	Yes	Yes	Yes	Yes
cover floor so it doesnt get dirty when muddy footprints	Yes	Yes	Yes	Yes	Yes
cleaning wipe	Yes	Yes	Yes	**No**	Yes
box	**No**	Yes	Yes	Yes	Yes
making chairs even	Yes	Yes	Yes	Yes	Yes
messy	**No**	**No**	**No**	**No**	**No**
business man/woman	**No**	**No**	**No**	**No**	**No**
Check horoscopes	**No**	**No**	**No**	**No**	**No**
cleaning up liquid	Yes	Yes	Yes	Yes	Yes
soak up liquids	Yes	Yes	Yes	Yes	Yes
find a job	**No**	**No**	**No**	**No**	**No**
pile up and sit on (like a chair)	Yes	Yes	Yes	Yes	Yes
articles	**No**	**No**	**No**	**No**	**No**
Disguise	Yes	Yes	Yes	**No**	Yes
Cover head in rain	Yes	Yes	Yes	Yes	Yes
frisbee	Yes	Yes	**No**	Yes	Yes
Layering on a surface like a drawer	Yes	Yes	Yes	Yes	Yes
A pile of newspapers makes a good step	Yes	Yes	Yes	Yes	Yes
singles ads so to find a partner	**No**	**No**	**No**	**No**	**No**
make a boat with	Yes	Yes	Yes	Yes	Yes
press cuttings	**No**	**No**	**No**	**No**	**No**
bbc one	**No**	Yes	**No**	**No**	**No**
latest gossip	**No**	Yes	**No**	**No**	**No**
Make a hat	Yes	Yes	Yes	Yes	Yes
Start a fire	Yes	Yes	Yes	Yes	Yes
Collage	Yes	Yes	Yes	**No**	**No**
make origami	Yes	Yes	Yes	Yes	Yes
paper people	**No**	Yes	Yes	Yes	Yes
Pillow	Yes	Yes	Yes	**No**	Yes
Lighting a fire	Yes	Yes	Yes	Yes	Yes
stuffimg	Yes	Yes	Yes	Yes	Yes
Polish windows/mirrors with it	Yes	Yes	Yes	Yes	Yes
law	**No**	**No**	**No**	**No**	**No**
dry out wet shoes (put inside)	Yes	Yes	Yes	Yes	Yes
kindle	**No**	**No**	**No**	Yes	**No**
Filter	Yes	Yes	Yes	**No**	Yes
explain whats happening in the world	**No**	**No**	**No**	**No**	**No**

Sell	**No**	Yes	**No**	**No**	**No**
music	**No**	**No**	**No**	**No**	**No**
sales	**No**	**No**	**No**	**No**	**No**
Chip wrapper	Yes	Yes	Yes	Yes	Yes
post it	**No**	Yes	**No**	**No**	**No**
spitballs	Yes	Yes	Yes	Yes	Yes
Archive	**No**	Yes	**No**	**No**	Yes
roll it up	Yes	Yes	**No**	Yes	Yes
Aeroplane	Yes	Yes	Yes	Yes	Yes

Table H-3: AUT ratings, Version C: Newspaper (N=247)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
to understand	**No**	Yes	Yes	Yes	**No**
allows people to publicaly announce events or occasions	**No**	Yes	Yes	**No**	**No**
buy	**No**	Yes	**No**	**No**	**No**
crime	**No**	Yes	Yes	**No**	**No**
general knowledge quiz	**No**	Yes	Yes	Yes	**No**
Throw on to people	Yes	**No**	Yes	Yes	Yes
Cushion for falling object	Yes	**No**	**No**	Yes	Yes
to wipe	Yes	Yes	Yes	Yes	Yes
Christmas tree decoration	Yes	**No**	Yes	Yes	Yes
look up a cookery recipe	**No**	Yes	**No**	**No**	**No**
sledge	Yes	**No**	Yes	Yes	**No**
fake money	**No**	**No**	Yes	Yes	Yes
ingredients for a soup	**No**	**No**	**No**	**No**	**No**
storage	**No**	**No**	**No**	**No**	**No**
Draw liner	Yes	**No**	Yes	Yes	Yes
cut out	**No**	**No**	Yes	**No**	Yes
Cut out small hole, and pretend you are reading - in fact you are spying on somebody	Yes	Yes	Yes	Yes	Yes
Put in welly boots to keep shape	Yes	Yes	Yes	Yes	Yes
to put your feet up on	Yes	**No**	Yes	Yes	Yes
Line cupboards	Yes	**No**	Yes	Yes	Yes
make a mask	Yes	**No**	Yes	Yes	Yes
Paper soldiers	Yes	**No**	Yes	Yes	Yes
frying up a mess on the floor	Yes	Yes	Yes	**No**	**No**
Cover for painting	Yes	Yes	Yes	Yes	Yes
Umbrella	Yes	**No**	Yes	Yes	Yes
to rip	Yes	Yes	Yes	Yes	Yes
check tv listings	**No**	Yes	Yes	**No**	Yes
Weapon	Yes	**No**	Yes	Yes	Yes
find out the news	**No**	Yes	**No**	**No**	**No**
Discover	**No**	Yes	Yes	**No**	**No**
Deduct ink	Yes	Yes	**No**	**No**	Yes
gather information from	**No**	Yes	Yes	**No**	Yes
roll up and use as bat in a game	Yes	**No**	Yes	Yes	Yes
celebrities	**No**	Yes	Yes	**No**	**No**

throwing away	**No**	Yes	Yes	Yes	Yes
Stuffing bean bags	Yes	**No**	Yes	Yes	Yes
Shell	Yes	**No**	**No**	**No**	**No**
Make paper dollies with	Yes	**No**	Yes	Yes	Yes
build paper models	Yes	**No**	Yes	Yes	Yes
Clean	Yes	Yes	Yes	Yes	Yes
important	**No**	Yes	Yes	**No**	**No**
learning	**No**	Yes	**No**	**No**	**No**
Tissue	Yes	**No**	Yes	Yes	**No**
magic tricks - water	**No**	Yes	Yes	Yes	**No**
Keep a fire going (ie. Make a draft with).	Yes	Yes	Yes	Yes	Yes
politics	**No**	Yes	Yes	**No**	**No**
to stick to the windows, when refurbishing buildings	Yes	**No**	Yes	Yes	Yes
finding local events	**No**	Yes	Yes	**No**	**No**
subtitles	**No**	Yes	Yes	**No**	**No**
table-cloth	Yes	**No**	Yes	Yes	Yes
research	**No**	Yes	Yes	**No**	**No**
Fly swat	Yes	Yes	Yes	Yes	Yes
screw up to make something	Yes	Yes	Yes	Yes	Yes
Stuff a bra	Yes	**No**	Yes	Yes	Yes
Special effect (radio etc)	Yes	Yes	**No**	Yes	Yes
Keep an essay in to hide it	Yes	**No**	Yes	**No**	Yes
Use rolled up pieces as pellets in a catapult	Yes	**No**	Yes	Yes	Yes
Wrap around chicken and light and cook	Yes	**No**	2	Yes	Yes
Napkin	Yes	**No**	Yes	Yes	Yes
Swap	**No**	Yes	Yes	**No**	**No**
Find out todays date	Yes	Yes	Yes	**No**	Yes
Padding	Yes	**No**	Yes	Yes	**No**
make paper decorations	Yes	**No**	Yes	Yes	Yes
Parachute	Yes	**No**	Yes	**No**	Yes
roll up to hit with	Yes	Yes	Yes	Yes	Yes
blocking a hole	Yes	Yes	Yes	Yes	Yes
Thermal layer (stuffed under shirt)	Yes	**No**	**No**	Yes	Yes
buy from an adverisement	**No**	Yes	Yes	**No**	**No**
horoscopes	**No**	Yes	Yes	**No**	**No**
bags filler	Yes	**No**	Yes	Yes	Yes
Complete the gamed	**No**	Yes	**No**	**No**	**No**
keep things in it	Yes	Yes	**No**	**No**	Yes
Cut letters out of to make a threatening letter	Yes	**No**	Yes	Yes	Yes
Wrapping	Yes	Yes	Yes	Yes	Yes
Collect pictures from	Yes	Yes	Yes	**No**	Yes
hit someone with a rolled up one	Yes	Yes	Yes	Yes	Yes
Fill in a gap	Yes	Yes	Yes	Yes	Yes
Cat litter tray liner	Yes	Yes	Yes	Yes	Yes
Fill a bin	Yes	Yes	Yes	Yes	Yes
use to doodle on	Yes	Yes	Yes	Yes	Yes
Clip	**No**	**No**	Yes	**No**	**No**
Throw to	**No**	Yes	Yes	Yes	**No**
Bung up hole	Yes	Yes	Yes	Yes	Yes

Blanket	Yes	**No**	Yes	Yes	Yes
read gossip	**No**	Yes	Yes	**No**	**No**
available in local shops	**No**	Yes	**No**	**No**	**No**
make a house from it	Yes	**No**	**No**	Yes	Yes
get football scores from	**No**	Yes	**No**	**No**	**No**
Get dirty hands with	**No**	Yes	**No**	**No**	Yes
use it to stuff a teddy bear	Yes	**No**	Yes	Yes	Yes
see holiday offers	**No**	Yes	Yes	**No**	**No**
put in wet shoes	Yes	Yes	Yes	Yes	Yes
Eliminate	**No**	**No**	Yes	**No**	**No**
Keep warm	Yes	**No**	Yes	Yes	Yes
Games – stepping stones	Yes	Yes	Yes	Yes	Yes
what movies are on	**No**	Yes	**No**	**No**	**No**
Distribute	**No**	Yes	Yes	**No**	**No**
Wafer – for ice cream	Yes	**No**	**No**	Yes	**No**
White balance on camera	**No**	**No**	**No**	**No**	**No**
to rest on	Yes	Yes	**No**	Yes	Yes
read your star signs	**No**	Yes	Yes	**No**	**No**
placing in rabbit hutch	Yes	Yes	Yes	Yes	Yes
Paperchains	Yes	**No**	Yes	Yes	Yes
Wrap up fish & chips	Yes	Yes	Yes	Yes	Yes
Insulation	Yes	**No**	**No**	Yes	Yes
take quotes	**No**	Yes	Yes	**No**	**No**
spare time	**No**	Yes	Yes	**No**	**No**
gift wrapper	Yes	**No**	Yes	Yes	Yes
decoration	Yes	**No**	Yes	Yes	Yes
flag-pole	Yes	**No**	Yes	**No**	Yes
chew when I'm really bored	Yes	**No**	**No**	Yes	Yes
gossip	**No**	Yes	Yes	**No**	**No**
Groundsheet for a tent	Yes	**No**	Yes	Yes	Yes
ruler	**No**	**No**	Yes	Yes	Yes
Beat someone with	Yes	**No**	Yes	Yes	Yes
floor tiles	Yes	**No**	Yes	Yes	Yes
to wrap up rubbish in	Yes	Yes	Yes	Yes	Yes
crime stories	**No**	Yes	Yes	**No**	**No**
preserved as an artifact	**No**	**No**	Yes	Yes	**No**
Crop	**No**	**No**	**No**	**No**	**No**
titles	**No**	Yes	Yes	**No**	Yes
blocking light out	Yes	Yes	Yes	Yes	Yes
to play musical chairs with	**No**	**No**	**No**	Yes	Yes
bracelet paper jewellery	Yes	**No**	Yes	Yes	Yes
Prop a table leg up with it	Yes	Yes	**No**	Yes	Yes
Make noises	Yes	Yes	Yes	Yes	**No**
sculpturing	Yes	**No**	Yes	Yes	Yes
Cut letters from the titles	Yes	**No**	Yes	Yes	Yes
adverts	**No**	Yes	Yes	**No**	**No**
sleeping	**No**	**No**	**No**	Yes	**No**
Clothes	Yes	**No**	**No**	Yes	**No**
Cover up cracks in the walls	Yes	**No**	Yes	Yes	Yes

money	**No**	**No**	**No**	**No**	**No**
Throw at someone	Yes	**No**	Yes	Yes	Yes
horses bed	Yes	**No**	Yes	Yes	Yes
hair extensions for a party	Yes	**No**	**No**	Yes	Yes
to shred	Yes	Yes	Yes	**No**	Yes
Cricket	**No**	Yes	Yes	**No**	**No**
Dry something	Yes	Yes	Yes	Yes	Yes
read news	**No**	Yes	Yes	**No**	**No**
wrapping articles when moving house	Yes	Yes	Yes	Yes	Yes
to provide tips for horse racing	**No**	Yes	Yes	**No**	**No**
buying second-hand goods	**No**	Yes	**No**	**No**	**No**
make pass the parcel	Yes	Yes	Yes	Yes	Yes
cutting and sticking from	Yes	Yes	Yes	Yes	Yes
paperball	Yes	**No**	Yes	Yes	**No**
Art and craft	**No**	Yes	Yes	Yes	Yes
Lay down in dusty wardrobes/cupboards	Yes	Yes	Yes	Yes	Yes
feeding	**No**	**No**	Yes	**No**	**No**
Christmas cracker	Yes	**No**	Yes	Yes	Yes
to look educated	**No**	Yes	Yes	Yes	**No**
Cover himself	Yes	**No**	Yes	**No**	Yes
Hat	Yes	**No**	Yes	Yes	Yes
Paint on	Yes	Yes	Yes	Yes	Yes
Educate people	**No**	Yes	Yes	**No**	Yes
put inside shoes	**No**	**No**	Yes	Yes	Yes
toilet training dogs	Yes	Yes	Yes	Yes	Yes
Use as a pattern when cutting fabric	Yes	Yes	Yes	Yes	Yes
use it as a plate	Yes	**No**	Yes	Yes	Yes
Provide a journalist with work	**No**	Yes	Yes	**No**	**No**
Glued into T-shirt	Yes	**No**	Yes	Yes	Yes
Bat	Yes	Yes	Yes	Yes	Yes
decorate the walls of a room	Yes	**No**	Yes	Yes	Yes
Stuff in shoes	Yes	**No**	Yes	Yes	Yes
reminders	**No**	Yes	**No**	**No**	**No**
bug killer	Yes	Yes	Yes	Yes	Yes
car-boot protector	Yes	Yes	Yes	Yes	Yes
reading on trains,	**No**	Yes	Yes	**No**	Yes
holder for broken glass in the bin	Yes	Yes	Yes	Yes	Yes
stories	**No**	Yes	Yes	**No**	**No**
let your dog urinate on it	Yes	Yes	Yes	Yes	Yes
bet	**No**	Yes	**No**	**No**	**No**
comics	**No**	Yes	Yes	**No**	**No**
Cut into shapes like a magician	Yes	**No**	Yes	Yes	Yes
Make logs by compressing	**No**	Yes	**No**	Yes	Yes
reporting crime	**No**	Yes	**No**	**No**	**No**
rugby news	**No**	Yes	**No**	**No**	**No**
Fire lighter	Yes	Yes	Yes	Yes	Yes
Paddle	Yes	**No**	**No**	Yes	**No**
Write on	Yes	Yes	Yes	**No**	Yes
mould it into a fan	Yes	**No**	Yes	Yes	Yes

stepping-stone	**No**	**No**	Yes	Yes	Yes
selling second-hand items	**No**	Yes	Yes	**No**	**No**
Information	**No**	Yes	Yes	**No**	**No**
in games (pass the parcel)	Yes	Yes	Yes	Yes	Yes
cover from rain	Yes	**No**	Yes	Yes	Yes
read the obits	**No**	Yes	Yes	**No**	**No**
animal litter	Yes	Yes	Yes	Yes	Yes
Insulation from a cold seat	Yes	**No**	Yes	Yes	Yes
Light a BBQ	Yes	Yes	Yes	Yes	Yes
Pet bedding	Yes	Yes	Yes	Yes	Yes
wall decoration	Yes	**No**	Yes	Yes	Yes
Fertilize	**No**	Yes	**No**	Yes	**No**
roll it up and use in self defence	Yes	**No**	Yes	Yes	Yes
Print	**No**	Yes	**No**	**No**	**No**
Hold fish and chips in like a plate	Yes	Yes	Yes	Yes	Yes
to roll	Yes	Yes	Yes	Yes	Yes
relax	**No**	Yes	Yes	**No**	**No**
Rearing animals	**No**	Yes	**No**	Yes	**No**
find or sell other items	**No**	Yes	Yes	**No**	**No**
Stuff a duvet	Yes	**No**	Yes	Yes	Yes
Door stop	Yes	**No**	Yes	Yes	Yes
creative art	**No**	Yes	Yes	Yes	**No**
For warmth – fire	Yes	Yes	Yes	Yes	Yes
make slippers out of	Yes	**No**	Yes	Yes	Yes
Fuel	**No**	Yes	**No**	Yes	Yes
ear trumpet	Yes	**No**	Yes	Yes	Yes
paper boot	**No**	**No**	Yes	Yes	Yes
Erudicate	**No**	**No**	**No**	Yes	**No**
Line a trench in garden	Yes	Yes	Yes	Yes	Yes
schools, use for collage	**No**	Yes	Yes	Yes	Yes
Stuff a box with	Yes	Yes	Yes	Yes	Yes
Making new words – sentences	**No**	Yes	Yes	**No**	**No**
cut holes in and spy on people	Yes	Yes	Yes	Yes	Yes
blowpipe	Yes	Yes	Yes	Yes	Yes
argument	**No**	Yes	**No**	**No**	**No**
Protecting surfaces	Yes	Yes	Yes	Yes	Yes
wrap presents	Yes	**No**	Yes	Yes	Yes
entertainment	**No**	Yes	Yes	**No**	**No**
Block out draught by lining windows	Yes	Yes	Yes	Yes	Yes
old	**No**	**No**	**No**	**No**	**No**
Build a paper tower	Yes	**No**	Yes	Yes	Yes
time passer	**No**	Yes	Yes	**No**	**No**
blocking draft	Yes	Yes	Yes	Yes	Yes
Get your anger at it	**No**	Yes	**No**	**No**	Yes
agony aunt	**No**	Yes	**No**	**No**	**No**
advertising	**No**	Yes	Yes	**No**	**No**
Puppy house	Yes	Yes	**No**	Yes	Yes
doormat	Yes	**No**	Yes	Yes	Yes
Create a cipher/code from	Yes	**No**	**No**	Yes	Yes

houses	**No**	**No**	**No**	**No**	**No**
Cleaning up gunge	Yes	Yes	Yes	Yes	Yes
Ignore	**No**	Yes	Yes	**No**	**No**
Fence	Yes	**No**	Yes	**No**	**No**
do the newspaper from it	**No**	**No**	**No**	**No**	**No**
Adore	**No**	**No**	**No**	**No**	**No**
dry stuff with	Yes	**No**	Yes	Yes	Yes
in an animals cage/hut	Yes	Yes	Yes	Yes	Yes
tabloids	**No**	Yes	**No**	**No**	**No**
cover a surface	Yes	Yes	Yes	Yes	Yes
To wipe something up	Yes	Yes	Yes	Yes	Yes
protection of china in boxes	Yes	Yes	Yes	Yes	Yes
tablemat	Yes	Yes	Yes	Yes	Yes
fun	**No**	Yes	Yes	**No**	**No**
curtain	Yes	**No**	Yes	Yes	**No**
catch up on world events	**No**	Yes	Yes	**No**	**No**
deliver to people	**No**	Yes	Yes	**No**	**No**

Table H-4: AUT ratings, Version D: Paperclip (N=187)

Response	J1	J2	J3	J4	J5
Ridicule	**No**	**No**	**No**	Yes	**No**
Pick-up line: "Is this your paperclip I found?"	Yes	**No**	**No**	Yes	**No**
gift	**No**	Yes	Yes	Yes	**No**
Ear scratcher	Yes	Yes	Yes	Yes	**No**
Piercing	Yes	Yes	Yes	Yes	**No**
fasten papers	**No**	Yes	Yes	Yes	**No**
Hold	**No**	**No**	Yes	**No**	**No**
binding objects	Yes	Yes	Yes	Yes	**No**
Hang washing instead of clothes peg !?	**No**	Yes	Yes	Yes	**No**
secure	**No**	Yes	Yes	Yes	Yes
Executive toy	**No**	**No**	Yes	Yes	**No**
fasten loose papers	**No**	Yes	Yes	Yes	**No**
Chew on	**No**	Yes	**No**	Yes	**No**
zip	Yes	Yes	Yes	**No**	**No**
can be used to stick on to things	Yes	Yes	Yes	Yes	**No**
Hang something up with it	Yes	Yes	Yes	Yes	Yes
use in dressmaking	Yes	**No**	Yes	Yes	**No**
putting on a magnet	**No**	Yes	Yes	Yes	**No**
Hold cardigan together	**No**	Yes	Yes	Yes	**No**
Draw it	**No**	Yes	Yes	Yes	**No**
to clip	**No**	Yes	Yes	Yes	Yes
Pierce ears	Yes	Yes	Yes	Yes	**No**
ear bud	**No**	Yes	**No**	Yes	**No**
making holes in wall	Yes	Yes	Yes	Yes	**No**
Make some sort of accessory – head band	Yes	Yes	Yes	Yes	**No**
put on paper	**No**	**No**	Yes	Yes	**No**
Distribute	**No**	**No**	Yes	Yes	**No**

to cut something	**No**	Yes	Yes	Yes	**No**
Use it in an A level chemistry experiment to find the % Mn in it	**No**	**No**	Yes	Yes	**No**
Demonstration of magnetism	Yes	Yes	Yes	Yes	**No**
needle	Yes	Yes	Yes	Yes	**No**
Attaching to a magnet	**No**	**No**	Yes	Yes	**No**
Clip cardboard	**No**	Yes	Yes	Yes	Yes
art material	Yes	Yes	Yes	Yes	Yes
Make a chain	Yes	Yes	Yes	Yes	Yes
picking	**No**	Yes	Yes	Yes	**No**
Probe	**No**	**No**	Yes	Yes	**No**
for show	**No**	**No**	Yes	Yes	**No**
Toothpick	**No**	Yes	**No**	Yes	**No**
Attracts to magnet easily	**No**	Yes	Yes	Yes	**No**
easy to use	**No**	**No**	Yes	**No**	Yes
Stencil	Yes	Yes	Yes	Yes	**No**
piercer	Yes	Yes	Yes	Yes	**No**
grouping	**No**	Yes	Yes	**No**	**No**
electric cable	Yes	**No**	Yes	Yes	**No**
Melt it – then mold it into something else	Yes	Yes	Yes	Yes	Yes
magnet attracter	**No**	Yes	Yes	Yes	Yes
Sample	**No**	**No**	**No**	Yes	**No**
to bookmark a page	Yes	Yes	Yes	Yes	**No**
filing	**No**	Yes	Yes	Yes	**No**
fasten	**No**	**No**	Yes	**No**	**No**
Pick a lock	Yes	Yes	Yes	Yes	**No**
Dog collar – attach name	Yes	**No**	Yes	Yes	**No**
bendable art	Yes	Yes	Yes	Yes	Yes
Mend my bassoon!	Yes	**No**	**No**	Yes	**No**
Using to open tins	**No**	Yes	Yes	Yes	**No**
Christmas tree decoration	Yes	Yes	Yes	Yes	**No**
Play with when bored	**No**	Yes	Yes	Yes	**No**
decorative ornamen	**No**	Yes	Yes	Yes	**No**
back-scratcher	Yes	Yes	Yes	Yes	**No**
money' in poker	**No**	Yes	Yes	**No**	**No**
To mend clothes e.g. if there is a rip	Yes	Yes	Yes	Yes	**No**
Sculpture	Yes	Yes	Yes	Yes	**No**
Poke holes in it	Yes	Yes	Yes	**No**	Yes
Stab someone	Yes	Yes	Yes	Yes	**No**
Hold clothes together	Yes	Yes	Yes	Yes	**No**
making paperclip sculptures	Yes	**No**	Yes	Yes	Yes
Link together for decoration	Yes	**No**	Yes	Yes	**No**
Decoration around the house	Yes	Yes	Yes	Yes	**No**
To gain spare staples	**No**	Yes	Yes	**No**	**No**
badge	**No**	Yes	Yes	Yes	**No**
Bend it into a tiny wire coat hanger	Yes	**No**	Yes	Yes	**No**
paperclip thowing olympic sport	**No**	Yes	Yes	Yes	**No**
Shaping into a pincer for fine object control	Yes	Yes	Yes	Yes	**No**
Walking stick for a mouse	**No**	Yes	Yes	Yes	**No**

hook to put your keys on	Yes	Yes	Yes	Yes	**No**
to take apart and use the wire for something	Yes	Yes	Yes	Yes	**No**
inter-personal projectile	**No**	**No**	Yes	**No**	**No**
Stick things to a corkboard	**No**	**No**	Yes	Yes	**No**
To build a tunnel in a tiny model city	Yes	Yes	Yes	Yes	**No**
to design a card	**No**	Yes	Yes	Yes	**No**
to stab someone	Yes	**No**	Yes	Yes	**No**
Secure an elastic band	Yes	Yes	Yes	Yes	**No**
put in a stationary box	**No**	Yes	Yes	Yes	Yes
To put in the stationary drawer	**No**	Yes	Yes	Yes	**No**
so you dont lose anything	**No**	Yes	Yes	Yes	**No**
Pick your teeth with it	**No**	Yes	**No**	Yes	**No**
clip	**No**	**No**	Yes	**No**	**No**
Cosmic	**No**	**No**	**No**	**No**	**No**
Pick a door	Yes	Yes	Yes	Yes	**No**
Link lots together to make a bracelet	Yes	**No**	Yes	Yes	Yes
Paralyze	**No**	**No**	**No**	**No**	**No**
putting objects together	Yes	**No**	Yes	Yes	**No**
Straighten wonky table	**No**	**No**	**No**	Yes	**No**
Export	**No**	**No**	**No**	**No**	**No**
to clip imoportant sheets together	**No**	**No**	Yes	Yes	Yes
dangerous for little kids	**No**	**No**	Yes	**No**	Yes
Gardening – tiing up etc…	Yes	**No**	Yes	Yes	**No**
Differentiate	**No**	**No**	**No**	**No**	**No**
Sell on ebay	**No**	Yes	Yes	Yes	**No**
Wire for a circuit	Yes	Yes	Yes	Yes	**No**
Different sizes	**No**	Yes	Yes	**No**	Yes
to make little 3d designes	Yes	Yes	Yes	Yes	**No**
Clip metal	**No**	Yes	Yes	Yes	**No**
Deduct	**No**	**No**	**No**	**No**	**No**
stationary	**No**	**No**	Yes	Yes	Yes
paperclip together	**No**	**No**	Yes	Yes	Yes
chainlink	Yes	Yes	Yes	Yes	**No**
cleaning your teeth	**No**	**No**	**No**	Yes	**No**
Fix	**No**	Yes	Yes	Yes	**No**
button pusher	**No**	Yes	Yes	Yes	**No**
Make into a picture holder thing	Yes	Yes	Yes	Yes	**No**
Test a cake	**No**	**No**	**No**	Yes	**No**
Scalpel	Yes	**No**	Yes	Yes	**No**
magnetic	**No**	Yes	Yes	**No**	Yes
Use as a pen	**No**	**No**	**No**	**No**	**No**
be magnetic	**No**	Yes	Yes	Yes	Yes
put on the table	**No**	**No**	Yes	Yes	**No**
Down the drain	**No**	**No**	Yes	**No**	**No**
poky	**No**	Yes	Yes	**No**	**No**
TV aerial	**No**	**No**	Yes	Yes	**No**
To stick magnets on	**No**	Yes	Yes	Yes	**No**
push something out of small space	Yes	**No**	Yes	Yes	**No**
complete a cicuit	Yes	Yes	Yes	Yes	**No**

link together as piece of art or fashion	Yes	Yes	Yes	Yes	Yes
Perform	**No**	**No**	**No**	**No**	**No**
cheap to buy	**No**	**No**	Yes	**No**	Yes
Straighten out to make straight edge	**No**	Yes	Yes	Yes	Yes
links	**No**	**No**	Yes	Yes	Yes
Scratch a scratch card with	Yes	**No**	Yes	Yes	**No**
Attach	**No**	**No**	Yes	Yes	**No**
To dislodge small items fallen into cracks (floor…)	Yes	Yes	Yes	Yes	**No**
Instrument	**No**	Yes	Yes	**No**	**No**
Scratch/itch	Yes	Yes	Yes	Yes	**No**
to puncture something	Yes	Yes	Yes	Yes	**No**
Conduct electricity	Yes	Yes	Yes	Yes	**No**
S' shape	**No**	Yes	Yes	Yes	**No**
Pin back your hair	Yes	Yes	Yes	Yes	**No**
Making tiny hole in paper to use as sunglasses to see an eclipse	Yes	**No**	Yes	Yes	**No**
glued	**No**	**No**	**No**	**No**	**No**
bird “attractor”	Yes	**No**	**No**	Yes	**No**
Note holding	**No**	Yes	Yes	Yes	Yes
Unfold and use to hold items together	Yes	Yes	Yes	Yes	**No**
to make wholes with the ends	**No**	Yes	Yes	Yes	Yes
Put on a zip to make it easier to pull	Yes	Yes	Yes	Yes	**No**
fashion item	Yes	Yes	Yes	Yes	**No**
stress release	**No**	**No**	**No**	Yes	**No**
Cakes – for decoration – tying on flags etc…	Yes	Yes	**No**	Yes	**No**
String together shoe laces	Yes	Yes	**No**	**No**	**No**
can be used to fiddle with during a boring lecture!	Yes	**No**	Yes	Yes	**No**
Weapon	Yes	Yes	Yes	Yes	**No**
Lock pick	Yes	**No**	Yes	Yes	**No**
Aim and shoot	**No**	**No**	Yes	**No**	**No**
Strum a guitar	Yes	Yes	Yes	Yes	**No**
Unblocking a smoking pipe	Yes	**No**	**No**	Yes	**No**
piece of wire	Yes	**No**	Yes	**No**	**No**
pick things from small places	Yes	Yes	Yes	Yes	**No**
room decorations	**No**	Yes	Yes	Yes	**No**
Fiddle with	Yes	Yes	Yes	Yes	Yes
To make a dream catcher (hang off ceiling etc…)	Yes	Yes	Yes	Yes	**No**
bookmaker	**No**	Yes	Yes	**No**	**No**
to put together	**No**	**No**	Yes	**No**	**No**
back scratcher	Yes	Yes	**No**	Yes	**No**
paperweight	**No**	Yes	**No**	**No**	**No**
Antenna	**No**	Yes	Yes	Yes	**No**
Electrocuter device	**No**	**No**	Yes	Yes	**No**
Expand	**No**	**No**	Yes	**No**	**No**
ornaments	**No**	**No**	Yes	Yes	**No**
Balloon popper	Yes	Yes	Yes	Yes	Yes
missile	**No**	**No**	Yes	**No**	**No**
to assist getting something out of a small space	Yes	**No**	Yes	Yes	**No**
Demonstration of metal fatigue	**No**	**No**	Yes	Yes	**No**

Necklace	Yes	Yes	Yes	Yes	**No**
use as a screwdriver	Yes	Yes	Yes	Yes	**No**
Make alternative shapes with	Yes	Yes	Yes	Yes	**No**
Page finder	Yes	Yes	Yes	Yes	Yes
Can bend out into one single metal strip	**No**	Yes	Yes	Yes	Yes
mend a buckle	Yes	Yes	Yes	Yes	**No**
To fasten a button	Yes	**No**	Yes	**No**	**No**
plastic coating	**No**	**No**	**No**	Yes	**No**
Hair clip	Yes	Yes	Yes	Yes	**No**
Lock for steering wheel	**No**	Yes	**No**	Yes	**No**
test magnet strength	**No**	Yes	Yes	Yes	Yes
scratcher	Yes	Yes	Yes	Yes	**No**
to hold	**No**	**No**	Yes	**No**	**No**
Mend a bag handle	Yes	Yes	Yes	Yes	**No**
Earrings	Yes	Yes	**No**	Yes	**No**

Table H-5: AUT ratings, Version E: Paperclip (N=186)

Response	J1	J2	J3	J4	J5
Makeshift cocktail stick	**No**	Yes	**No**	Yes	Yes
slicer	**No**	**No**	**No**	Yes	Yes
keeps files in order	**No**	**No**	Yes	**No**	Yes
Use as magnet for small metal objects	**No**	Yes	**No**	Yes	Yes
art display	Yes	Yes	**No**	Yes	Yes
fridge magnet	Yes	Yes	**No**	Yes	Yes
fake braces	**No**	Yes	**No**	Yes	Yes
jacket fastener	Yes	Yes	**No**	Yes	Yes
Throw	Yes	**No**	**No**	Yes	Yes
used to make models	Yes	Yes	**No**	Yes	Yes
Draw lines	**No**	**No**	**No**	Yes	Yes
keep packets of food closed	Yes	Yes	Yes	Yes	Yes
Use it as a game piece	Yes	Yes	**No**	Yes	Yes
Analyze	Yes	**No**	**No**	**No**	**No**
selling in a stationary shop	**No**	**No**	Yes	Yes	Yes
one set	Yes	**No**	**No**	Yes	**No**
Kill an insect	**No**	Yes	**No**	Yes	Yes
open a disc drive with it	Yes	Yes	**No**	Yes	Yes
put notes together	**No**	**No**	Yes	Yes	Yes
Mock	**No**	**No**	**No**	**No**	**No**
to decide stuff	Yes	**No**	**No**	**No**	**No**
pointing device	Yes	Yes	**No**	Yes	Yes
Weight	**No**	**No**	**No**	**No**	**No**
painting tool	Yes	Yes	**No**	Yes	Yes
Clip it on anything you find	**No**	**No**	**No**	Yes	Yes
Symbolize	Yes	**No**	**No**	Yes	Yes
linking with other paperclips	**No**	Yes	Yes	Yes	Yes

make holes by digging into things	Yes	Yes	**No**	Yes	**No**
computer helper	Yes	**No**	**No**	**No**	**No**
Tie shoelaces	**No**	**No**	**No**	Yes	**No**
Scratch someone with	**No**	Yes	**No**	Yes	Yes
Wire for wrapping around something – closing it	**No**	Yes	**No**	Yes	Yes
Safety catch	**No**	**No**	**No**	**No**	**No**
papers	Yes	**No**	Yes	**No**	Yes
Brush	**No**	**No**	**No**	**No**	**No**
Archive	Yes	**No**	**No**	**No**	Yes
Use it to make a painting	Yes	Yes	**No**	**No**	**No**
Replacement earring	**No**	Yes	**No**	Yes	**No**
opening letterbox	**No**	Yes	**No**	**No**	**No**
electricity conductor	Yes	Yes	Yes	Yes	Yes
opening a letter	**No**	Yes	**No**	Yes	Yes
Construct	**No**	**No**	**No**	**No**	**No**
sewing needle	**No**	Yes	**No**	Yes	Yes
accessory	Yes	Yes	**No**	Yes	Yes
Necklace charm	Yes	Yes	**No**	Yes	Yes
Fixing a necklace or other chain	Yes	Yes	Yes	Yes	Yes
Poker for roll up cigarettes	Yes	Yes	**No**	**No**	**No**
Eject a disk from an apple mac with	Yes	Yes	**No**	Yes	**No**
Scratch a scratchie	Yes	Yes	**No**	Yes	Yes
Organize	**No**	**No**	Yes	**No**	Yes
Make a chain for a bag	Yes	Yes	**No**	Yes	Yes
Key	Yes	**No**	**No**	**No**	Yes
chain to form a necklace	Yes	Yes	Yes	Yes	Yes
Use it to scratch your head	**No**	Yes	Yes	Yes	Yes
to reach for something trapped in a narrow space	Yes	Yes	Yes	Yes	Yes
fixing broken bags	**No**	Yes	**No**	Yes	Yes
Hook something together. E.g. curtain	Yes	Yes	Yes	**No**	Yes
Mouse killer	**No**	Yes	**No**	Yes	**No**
Hurt someone	**No**	Yes	**No**	Yes	Yes
To hold things together	**No**	**No**	Yes	Yes	Yes
use to fiddle with	Yes	Yes	Yes	Yes	Yes
Challenge	**No**	**No**	**No**	**No**	**No**
belt, by linking paper clips together	Yes	Yes	**No**	Yes	Yes
Record	Yes	**No**	**No**	**No**	**No**
Throw at somebody	Yes	Yes	**No**	Yes	Yes
Use it to pin something to a notice board	Yes	Yes	**No**	Yes	Yes
Drink	**No**	**No**	**No**	**No**	**No**
Reset a phone or electronic device	Yes	Yes	Yes	Yes	Yes
bend out and use to get things out of grouting	Yes	Yes	**No**	Yes	Yes
Use it to deface a wall (scratch words with it).	Yes	Yes	Yes	Yes	Yes
Clip bits of plastic	Yes	**No**	**No**	Yes	Yes
Replacing short lengths of wire	Yes	Yes	Yes	Yes	Yes
hook to reach something	**No**	Yes	Yes	Yes	Yes
safe place for when you need them	**No**	**No**	Yes	**No**	**No**
repair tears	**No**	**No**	**No**	**No**	Yes
Scratch yourself	**No**	Yes	Yes	Yes	Yes

Flick it	Yes	Yes	**No**	Yes	Yes
Put in your hair	**No**	Yes	**No**	Yes	Yes
stretchable	Yes	**No**	**No**	Yes	**No**
to mark a book	**No**	Yes	Yes	Yes	Yes
Replace a wire in an electrical circuit	Yes	Yes	Yes	Yes	Yes
Scratch a car	**No**	Yes	**No**	Yes	Yes
Tricks	**No**	**No**	Yes	Yes	**No**
bracelet	Yes	Yes	**No**	Yes	Yes
the start to a rubber band ball	Yes	Yes	**No**	Yes	**No**
Coat hook	Yes	Yes	**No**	**No**	Yes
Fishing rod	**No**	**No**	**No**	**No**	Yes
Use it to hold your broken glasses	Yes	Yes	**No**	**No**	**No**
Electric contact	**No**	**No**	Yes	**No**	Yes
Calve your name	**No**	**No**	**No**	**No**	Yes
designing animals	**No**	**No**	**No**	Yes	Yes
Door stop	**No**	Yes	**No**	**No**	**No**
To unlock your house door when you've forgotten keys	Yes	Yes	**No**	Yes	Yes
Initiate	**No**	**No**	**No**	**No**	**No**
switch	Yes	**No**	**No**	**No**	**No**
push a small button	Yes	Yes	**No**	Yes	Yes
to scratch yourself	Yes	Yes	Yes	Yes	Yes
office	Yes	**No**	Yes	**No**	Yes
To open it all out to make a thin metal rod	**No**	Yes	**No**	Yes	Yes
use during magnet experiments	Yes	Yes	Yes	Yes	Yes
Come in different colours	**No**	**No**	Yes	Yes	Yes
closing your pants	**No**	Yes	**No**	Yes	Yes
Use it in a science experiment to investigate electromagnetism.	Yes	Yes	Yes	Yes	Yes
Scrape things with it	Yes	Yes	Yes	Yes	Yes
use as a pin	Yes	**No**	**No**	Yes	Yes
Open cd drawer	Yes	Yes	**No**	**No**	**No**
clipping wires together	Yes	**No**	**No**	Yes	Yes
something sharp to use as a tool	Yes	Yes	**No**	Yes	Yes
to hold paper together	**No**	**No**	Yes	Yes	Yes
documents	**No**	**No**	Yes	**No**	Yes
Hold fabric together	Yes	**No**	Yes	Yes	Yes
to keep paper looking neat	Yes	Yes	Yes	Yes	Yes
seperate one thing from another	**No**	**No**	Yes	Yes	Yes
memo	**No**	**No**	Yes	**No**	**No**
Pierce a can	**No**	Yes	Yes	Yes	Yes
getting something out of a hole by scooping with an end	**No**	Yes	Yes	Yes	Yes
fixing broken clothes	**No**	Yes	**No**	Yes	Yes
Submarine	**No**	**No**	**No**	**No**	**No**
Filling hook	Yes	**No**	**No**	Yes	Yes
Bend it into something else	Yes	Yes	Yes	Yes	Yes
Hold paper together	Yes	**No**	Yes	Yes	Yes
Use it to scratch your head if you got extensions in it	Yes	Yes	**No**	Yes	**No**
uncurl them to make a statue with some blue tack	Yes	Yes	**No**	Yes	**No**
Use it as solder	**No**	Yes	**No**	**No**	Yes

Tiny projectile	Yes	Yes	**No**	**No**	Yes
additional bit to aeriel on tv which doesnt work	Yes	Yes	**No**	Yes	Yes
used in schools	Yes	**No**	Yes	Yes	Yes
Closing packets	Yes	Yes	Yes	Yes	Yes
Key ring	Yes	Yes	**No**	Yes	Yes
break into a house	Yes	Yes	**No**	**No**	Yes
hook something out of a small gap	**No**	Yes	Yes	Yes	Yes
Put holes in a microwave meal lid	Yes	Yes	Yes	Yes	Yes
Dagger	**No**	**No**	**No**	Yes	Yes
A "poker"	**No**	Yes	**No**	Yes	Yes
Bend into shapes	Yes	Yes	Yes	Yes	Yes
make a paperclip chain	Yes	Yes	Yes	**No**	Yes
Split a banana into segments	**No**	Yes	**No**	Yes	**No**
To hold a dress up	Yes	Yes	**No**	Yes	Yes
Create a bed of nails	Yes	Yes	**No**	Yes	Yes
Punching small holes in paper	**No**	Yes	Yes	Yes	Yes
used as weight on paper aeroplane or helicopter blades	Yes	Yes	**No**	**No**	Yes
Twist	**No**	**No**	Yes	Yes	**No**
Bend it and use it to puncture holes in a piece of paper.	Yes	Yes	Yes	Yes	Yes
to collate	**No**	**No**	Yes	**No**	Yes
To break a shredder	Yes	Yes	Yes	**No**	Yes
Flick at someone	Yes	Yes	Yes	Yes	Yes
podger (technical term)	Yes	**No**	**No**	Yes	**No**
Use as a hairclip	**No**	Yes	**No**	Yes	Yes
to hold hair out your eyes	Yes	Yes	Yes	Yes	Yes
Make a catapult out of it	**No**	Yes	**No**	Yes	**No**
Clean nails	**No**	Yes	Yes	Yes	Yes
pop a blister	**No**	Yes	Yes	Yes	Yes
mobile	**No**	**No**	**No**	**No**	**No**
To scratch paint off	Yes	Yes	**No**	Yes	Yes
Broken zip replacement	Yes	Yes	Yes	Yes	Yes
To roll something along a bench	**No**	Yes	**No**	**No**	**No**
Make metal models	Yes	Yes	**No**	Yes	Yes
present	**No**	**No**	**No**	**No**	**No**
Blow up a microwave	Yes	Yes	**No**	Yes	**No**
attach lots of them together to make a chain	Yes	Yes	Yes	Yes	Yes
Straighten it	**No**	**No**	Yes	Yes	Yes
Chain	**No**	Yes	Yes	Yes	Yes
Art/design e.g. make a lampshade	Yes	Yes	**No**	Yes	Yes
to hand in assignments or a project	Yes	**No**	Yes	Yes	Yes
bottle opener	**No**	Yes	**No**	Yes	**No**
Make a collage	Yes	Yes	**No**	**No**	Yes
Shaping into a sculptor	Yes	Yes	**No**	Yes	Yes
storage	**No**	**No**	Yes	**No**	**No**
to tear something	**No**	**No**	**No**	Yes	Yes
Troubleshoot	**No**	**No**	**No**	**No**	**No**
Teaching material	Yes	**No**	**No**	Yes	Yes
card decoration	Yes	Yes	Yes	Yes	Yes
for organised files and documents	Yes	**No**	Yes	Yes	Yes

art and craft	**No**	Yes	Yes	Yes	Yes
keep stamps together	Yes	**No**	Yes	Yes	Yes
Prim	Yes	**No**	**No**	**No**	**No**
Wrap around finger	**No**	**No**	**No**	Yes	Yes
tidy up your nail polish (get excess polish off your hands)	**No**	Yes	**No**	Yes	Yes
Vandalizing generally	**No**	Yes	**No**	**No**	**No**
Reminder	**No**	**No**	**No**	**No**	**No**
Build	**No**	**No**	**No**	**No**	**No**
Stretch it out and get food out of your mouth	**No**	Yes	Yes	Yes	**No**
Stick figures	Yes	**No**	Yes	Yes	Yes
Use on a tie for flex or cable	**No**	Yes	**No**	Yes	**No**
create artwork	Yes	Yes	**No**	Yes	Yes
smalll key ring	Yes	Yes	**No**	Yes	Yes

Table H-6: AUT ratings, Version F: Paperclip (N=183)

Response	J1	J2	J3	J4	J5
Fold out use to poke someone with	Yes	**No**	Yes	Yes	Yes
Fix broken zip fly	**No**	Yes	Yes	Yes	Yes
sharp edges	Yes	Yes	Yes	**No**	Yes
Lock opener	Yes	**No**	Yes	Yes	Yes
Colourful paperclips in a pot on office desk	Yes	Yes	**No**	**No**	Yes
Whisk	**No**	**No**	Yes	Yes	**No**
To put in your pocket for later	**No**	Yes	Yes	**No**	Yes
loose-able	**No**	**No**	Yes	**No**	Yes
Hole filler	Yes	**No**	Yes	Yes	**No**
decoration	Yes	**No**	Yes	Yes	Yes
in artwork	Yes	**No**	**No**	Yes	Yes
photo to a paper	Yes	Yes	**No**	**No**	Yes
To throw it in the bin	**No**	Yes	Yes	**No**	Yes
To throw at someone	**No**	**No**	Yes	Yes	Yes
kebab stick	Yes	**No**	Yes	Yes	Yes
cable tie	Yes	**No**	Yes	Yes	Yes
Tweezers	Yes	**No**	Yes	Yes	**No**
bending into shapes	Yes	Yes	Yes	Yes	Yes
use as counters	Yes	Yes	Yes	Yes	Yes
Use it for modeling clay	**No**	**No**	Yes	Yes	Yes
Key a car	**No**	**No**	Yes	Yes	Yes
convienence	**No**	**No**	**No**	**No**	Yes
attath photographs to cvs etc etc	**No**	Yes	Yes	**No**	Yes
hold money together	**No**	Yes	**No**	**No**	Yes
Get cockles out of a shell	Yes	Yes	Yes	Yes	**No**
Scratch something with	Yes	Yes	Yes	Yes	**No**
Attaching - as wire.	**No**	**No**	Yes	Yes	Yes
Rust	**No**	**No**	Yes	**No**	Yes
Put it onto clothing	Yes	**No**	Yes	Yes	Yes
artist might like to treat it as an object to be painted	**No**	**No**	Yes	Yes	Yes
People pincher	Yes	**No**	Yes	Yes	Yes
Coiling into a spring	Yes	**No**	Yes	Yes	Yes

Making a worm	**No**	**No**	Yes	Yes	**No**
Navigate	**No**	**No**	Yes	**No**	**No**
Hole punch	Yes	**No**	**No**	Yes	Yes
Novel nose ring	Yes	**No**	Yes	Yes	Yes
pen	Yes	**No**	Yes	Yes	**No**
ring	Yes	**No**	Yes	Yes	Yes
electrical wire	**No**	**No**	Yes	Yes	Yes
If your in need of a hole puncher use it	**No**	Yes	**No**	Yes	Yes
metal	**No**	Yes	Yes	**No**	Yes
Pick it	**No**	**No**	**No**	**No**	Yes
cufflinks	Yes	**No**	Yes	Yes	**No**
To “undo” the paper clip’s shape to reform into a hook and grab items faraway or unreachable	**No**	**No**	Yes	Yes	Yes
Bracelet chain of paperclips	Yes	Yes	Yes	Yes	Yes
tightrope for a mouse	Yes	**No**	Yes	Yes	Yes
Shoe decoration	**No**	**No**	Yes	Yes	Yes
clipping decorations up	Yes	Yes	**No**	Yes	Yes
Melt	**No**	**No**	Yes	Yes	Yes
Use as a magnet	Yes	**No**	**No**	Yes	Yes
nose clip	Yes	**No**	Yes	Yes	Yes
Bend it out and use it to tweeze it out	**No**	**No**	Yes	Yes	**No**
fishing hook	Yes	**No**	Yes	Yes	Yes
Bend it	Yes	Yes	**No**	**No**	Yes
pick you nose	Yes	**No**	Yes	**No**	**No**
keep work tidy	Yes	Yes	**No**	**No**	Yes
to vandalise a desk	**No**	**No**	Yes	Yes	**No**
Scratching words into something	Yes	**No**	Yes	Yes	Yes
To break a photo copier	**No**	**No**	Yes	Yes	**No**
people who work in offices use them	Yes	Yes	**No**	**No**	Yes
Stop a fan	**No**	**No**	Yes	Yes	**No**
use to hold christmas cards	Yes	Yes	Yes	Yes	Yes
teachers use them	**No**	Yes	**No**	**No**	Yes
coursework	**No**	Yes	**No**	**No**	Yes
Fix a faulty door catch	**No**	**No**	Yes	Yes	Yes
Spike	**No**	**No**	Yes	**No**	Yes
Making wire	**No**	**No**	Yes	Yes	Yes
Shoelace – to small shoes	Yes	**No**	Yes	Yes	**No**
door wedge	**No**	**No**	Yes	Yes	**No**
Pick something small clean	**No**	Yes	Yes	Yes	Yes
door pick	**No**	**No**	Yes	Yes	Yes
pin	Yes	**No**	**No**	Yes	Yes
Poke people with	Yes	**No**	Yes	Yes	Yes
hold objects together	Yes	Yes	**No**	Yes	Yes
scrape a small surface clean	Yes	**No**	Yes	Yes	**No**
Splinter remover	Yes	Yes	Yes	Yes	**No**
Ruler	Yes	**No**	Yes	**No**	**No**
maintain	**No**	**No**	**No**	**No**	Yes
clip paper together	Yes	Yes	**No**	**No**	Yes
Melt into a ball bearing	Yes	**No**	Yes	Yes	Yes

children can use them as things to make models and creative things out of	**No**	Yes	**No**	Yes	Yes
to throw	**No**	**No**	Yes	**No**	Yes
hang pictures	Yes	**No**	Yes	Yes	Yes
Opening plastic containers	Yes	**No**	Yes	Yes	Yes
Pierce things with it	Yes	Yes	**No**	Yes	Yes
bookmark	**No**	Yes	Yes	Yes	Yes
Play with magnet	Yes	**No**	Yes	Yes	Yes
keep items of clothing together	Yes	Yes	Yes	Yes	Yes
make statues	Yes	**No**	Yes	Yes	Yes
to keep work together	Yes	Yes	**No**	**No**	Yes
bend into useful shape	Yes	**No**	Yes	Yes	Yes
Tie a knot	**No**	Yes	Yes	Yes	**No**
Collect	Yes	Yes	Yes	**No**	Yes
Clip on baby strap	Yes	**No**	Yes	**No**	**No**
sketch	**No**	**No**	Yes	Yes	**No**
can be used as a good luck charm	**No**	**No**	Yes	Yes	Yes
to stand on	**No**	**No**	Yes	Yes	**No**
cuticle remover	Yes	**No**	Yes	Yes	Yes
wire arts	**No**	**No**	Yes	Yes	Yes
Use as a paperclip! J	**No**	Yes	**No**	**No**	Yes
Scratch graffiti	Yes	**No**	Yes	Yes	Yes
keyboard cleaner	Yes	Yes	Yes	Yes	Yes
Make a spring	**No**	**No**	Yes	Yes	**No**
removable	**No**	Yes	Yes	**No**	Yes
Cleaning	**No**	Yes	Yes	Yes	**No**
clipping things to walls	Yes	**No**	**No**	Yes	Yes
Play with	**No**	**No**	Yes	Yes	Yes
schoolery object	**No**	Yes	Yes	**No**	Yes
make a mast for car radio	**No**	**No**	Yes	Yes	Yes
wind chimes	**No**	**No**	Yes	Yes	Yes
Artistic tool for creating scratches in surfaces	Yes	**No**	Yes	Yes	Yes
to undo hand cuffs	Yes	Yes	Yes	Yes	Yes
make into the shape of a snail	Yes	**No**	Yes	Yes	Yes
Make a hole in something	Yes	Yes	Yes	Yes	Yes
small	**No**	Yes	Yes	**No**	Yes
necklace pendant	Yes	**No**	Yes	Yes	Yes
Make a little man	Yes	**No**	Yes	Yes	Yes
push something out of small space	**No**	Yes	Yes	Yes	Yes
if pulled apart, it can be used as a sharp object to presss the reset button for example	Yes	Yes	Yes	Yes	Yes
hang things from	Yes	Yes	**No**	Yes	Yes
Wire	Yes	Yes	Yes	Yes	Yes
magnet	Yes	**No**	Yes	**No**	Yes
closing a bag	Yes	**No**	Yes	Yes	Yes
Break into car	**No**	**No**	Yes	Yes	Yes
To fill in a gap in a scratch on car paintwork	**No**	**No**	Yes	Yes	**No**
to use	**No**	Yes	**No**	**No**	Yes
teasing someone	**No**	**No**	Yes	**No**	Yes

Pierce a hole	Yes	Yes	Yes	Yes	Yes
Modern art	**No**	**No**	Yes	Yes	Yes
so nothing gets lost	**No**	Yes	**No**	**No**	Yes
To scoop tiny items into a lump	Yes	**No**	Yes	Yes	Yes
use-maker for idle hands	**No**	**No**	Yes	Yes	**No**
Button hole holder	**No**	**No**	Yes	Yes	Yes
Use it to join a ripped piece of clothing back together	Yes	Yes	Yes	**No**	Yes
crankshaft	**No**	**No**	Yes	**No**	**No**
belt	**No**	**No**	Yes	Yes	**No**
reshape to hand childrens mobiles on	Yes	**No**	Yes	Yes	**No**
Scratch an itch	Yes	**No**	Yes	Yes	Yes
Hold things together	Yes	Yes	**No**	**No**	Yes
Control	**No**	**No**	**No**	**No**	**No**
fixing your shoe laces	Yes	Yes	Yes	Yes	**No**
Reset button activator	Yes	Yes	Yes	Yes	Yes
Cleaning tiny holes	Yes	Yes	Yes	Yes	Yes
decoration on clothes	**No**	**No**	Yes	Yes	Yes
Strong bendy material to hold things together (like cable tie)	Yes	**No**	Yes	Yes	**No**
guess how many in jar	**No**	Yes	Yes	Yes	Yes
scratch something–	Yes	**No**	Yes	Yes	Yes
Trouble	**No**	**No**	Yes	**No**	**No**
Fold out use as a key	Yes	**No**	Yes	Yes	Yes
Hook	**No**	**No**	Yes	**No**	Yes
Generate electricity	Yes	**No**	Yes	Yes	Yes
separate	**No**	**No**	**No**	**No**	Yes
Bend it and use it as stress relief	Yes	**No**	Yes	Yes	**No**
Unblocker	**No**	Yes	Yes	Yes	Yes
Jewellery	Yes	**No**	Yes	**No**	Yes
Safety pin	Yes	**No**	**No**	**No**	Yes
customise clothes	**No**	**No**	Yes	Yes	Yes
Nail file	**No**	**No**	Yes	Yes	**No**
Draw into (i.e. wood)	Yes	Yes	Yes	Yes	Yes
Broach	Yes	**No**	Yes	Yes	Yes
Make a picture with loads	**No**	Yes	Yes	Yes	Yes
pinned	Yes	Yes	**No**	**No**	Yes
to decorate	Yes	**No**	Yes	Yes	Yes
Projectile	**No**	**No**	Yes	Yes	Yes
Picking up little bits of paper	**No**	**No**	Yes	Yes	Yes
Pierce your body	**No**	**No**	Yes	Yes	Yes
Object used for art and craft	Yes	**No**	Yes	Yes	Yes
Toggle for a zip	Yes	Yes	Yes	Yes	Yes
Make a sound (noise)	**No**	**No**	Yes	Yes	Yes
Connect an electrical board thing	Yes	**No**	Yes	Yes	Yes
keep things in place	Yes	Yes	**No**	Yes	Yes
Clothes decoration	**No**	**No**	Yes	Yes	Yes
toys	**No**	**No**	Yes	**No**	**No**
Book incert	Yes	Yes	Yes	Yes	Yes
room decoration	Yes	**No**	Yes	Yes	Yes
Measure the distance of something	**No**	**No**	Yes	Yes	**No**

to sell	Yes	**No**	Yes	**No**	Yes
To pierce lips	Yes	**No**	Yes	Yes	Yes
To make something e.g. stick on paper with something else to create a design	Yes	**No**	Yes	Yes	Yes
Fixing electrical break	**No**	**No**	Yes	Yes	Yes
exams	**No**	**No**	**No**	**No**	Yes
use them in schools and college and university and home	Yes	Yes	Yes	**No**	Yes
Spring	**No**	**No**	Yes	Yes	**No**

Table H-7: AUT ratings, Version G: Remote control (N=172)

Response	J1	J2	J3	J4	J5
Medallion	Yes	Yes	Yes	Yes	**No**
Push something with it	Yes	Yes	Yes	**No**	Yes
Put it to bed	Yes	**No**	**No**	Yes	**No**
Plane ticket	**No**	**No**	Yes	Yes	Yes
Trip someone up	Yes	Yes	Yes	**No**	Yes
Recycle it	Yes	**No**	**No**	**No**	Yes
Operate remote controlled toy	Yes	**No**	**No**	**No**	**No**
Air conditioning control	Yes	**No**	**No**	Yes	**No**
Use toilet cistern to displace water and use less water when flushing	**No**	Yes	**No**	**No**	Yes
Propping up window	**No**	Yes	Yes	**No**	Yes
Play space games	Yes	Yes	Yes	**No**	**No**
See how far you can throw it	**No**	Yes	**No**	**No**	Yes
Itch your back	Yes	Yes	Yes	**No**	Yes
Garden fork	**No**	Yes	Yes	Yes	Yes
Weight	Yes	Yes	Yes	**No**	Yes
Smash it	Yes	**No**	**No**	**No**	Yes
Take all the batteries	**No**	**No**	**No**	**No**	Yes
Window blinds	**No**	**No**	**No**	**No**	**No**
Put under table leg to make it steady	Yes	Yes	Yes	**No**	Yes
Hot air	**No**	**No**	**No**	**No**	**No**
Object for hide and seek	Yes	Yes	Yes	Yes	Yes
Mark the centre point between two piles of videos	Yes	Yes	**No**	**No**	Yes
Bat	Yes	Yes	Yes	**No**	Yes
Hat	Yes	Yes	Yes	Yes	Yes
Fix wonky table	Yes	Yes	Yes	**No**	Yes
Control radio	Yes	**No**	**No**	Yes	**No**
To hold something up	Yes	Yes	Yes	**No**	Yes
Phallic measuring device	**No**	Yes	Yes	Yes	Yes
Fetch with a dog	**No**	Yes	**No**	**No**	Yes
Take out batteries for another use	Yes	**No**	**No**	**No**	Yes
Imaginary controller for mass machine	Yes	Yes	Yes	Yes	Yes
Bash someone	**No**	Yes	Yes	**No**	Yes
Throw at someone	Yes	Yes	Yes	**No**	Yes
Off TV	Yes	**No**	**No**	**No**	**No**

Weapon	**No**	Yes	Yes	Yes	Yes
Open it up	Yes	**No**	**No**	**No**	Yes
Decorate as an ornament	Yes	Yes	**No**	**No**	Yes
Kick it	Yes	**No**	**No**	**No**	Yes
Stop	**No**	**No**	**No**	**No**	Yes
Dig a hole with	**No**	Yes	Yes	**No**	Yes
Baby toy	Yes	Yes	Yes	Yes	Yes
Laptop	Yes	**No**	**No**	**No**	**No**
Start a dvd	Yes	**No**	**No**	**No**	**No**
Painter	Yes	**No**	Yes	Yes	Yes
Control light	Yes	**No**	**No**	Yes	**No**
Jump on it	Yes	**No**	**No**	**No**	Yes
Turn on TV	Yes	**No**	**No**	**No**	**No**
Source of light	Yes	**No**	Yes	Yes	**No**
Steer toy car/boat/plane	Yes	Yes	**No**	Yes	**No**
Add to headband as a new accessory	Yes	Yes	Yes	**No**	Yes
Vase	Yes	**No**	Yes	Yes	**No**
Down	Yes	**No**	**No**	**No**	**No**
Break a window	Yes	Yes	Yes	**No**	Yes
Find it	Yes	**No**	**No**	**No**	Yes
Put on a table	Yes	**No**	**No**	**No**	Yes
Phone	Yes	Yes	Yes	Yes	**No**
Emergency battery holder	Yes	**No**	**No**	Yes	Yes
Cooling between legs (as a propping out device)	**No**	Yes	Yes	**No**	Yes
See if it floats in a pond	Yes	Yes	**No**	Yes	Yes
Switch to keep your hands busy	Yes	**No**	**No**	**No**	Yes
Cold air	Yes	**No**	**No**	**No**	**No**
Use as a prop in a play	Yes	Yes	Yes	**No**	Yes
Use the batteries	Yes	**No**	**No**	**No**	Yes
To mute my sister	Yes	**No**	Yes	Yes	**No**
Remover of things when not able to reach	Yes	Yes	Yes	Yes	Yes
Control amplifier	Yes	**No**	**No**	Yes	**No**
Paperweight	Yes	Yes	Yes	Yes	Yes
Store it	Yes	**No**	**No**	**No**	Yes
Learning/teaching to calculate	Yes	Yes	Yes	**No**	Yes
Gates	Yes	**No**	**No**	**No**	**No**
Excuse not to turn the telly off – as in "this remote control ain't working"	Yes	**No**	**No**	**No**	**No**
Take to the shop to remember it and buy a new one	**No**	Yes	**No**	**No**	Yes
Prop something up	**No**	Yes	Yes	**No**	Yes
To wear as shows – with elastic bands	**No**	Yes	Yes	**No**	Yes
Radio	Yes	**No**	Yes	Yes	**No**
Decoration	Yes	Yes	Yes	Yes	Yes
Play duration	Yes	**No**	Yes	**No**	Yes
Car alarm	Yes	**No**	**No**	Yes	**No**
Projector	Yes	**No**	Yes	Yes	**No**
Control curtains	**No**	**No**	**No**	Yes	**No**
Play phone	**No**	Yes	Yes	Yes	Yes
Ipod	Yes	**No**	Yes	Yes	Yes

Play catch	Yes	Yes	Yes	**No**	Yes
Break it when you are angry	**No**	**No**	**No**	**No**	Yes
Use the parts to make something else	Yes	Yes	Yes	**No**	Yes
Pretend play with e.g. use buttons as zapping	**No**	Yes	Yes	Yes	**No**
Cup holder or glass	**No**	Yes	Yes	**No**	Yes
Garage opener	**No**	**No**	**No**	Yes	**No**
Take apart and use the batteries	Yes	**No**	**No**	**No**	Yes
Throw it for a game	**No**	Yes	Yes	**No**	Yes
Swat flies with	Yes	Yes	Yes	**No**	Yes
Throw to a dog!	**No**	Yes	**No**	**No**	Yes
Decorate it	**No**	**No**	**No**	**No**	Yes
Microwave it	Yes	**No**	**No**	**No**	Yes
Break an egg	Yes	Yes	Yes	Yes	Yes
Play a tune – bang on table	**No**	Yes	Yes	**No**	Yes
Gear knob	Yes	Yes	Yes	**No**	**No**
Pretend it has magical powers	Yes	Yes	Yes	**No**	Yes
Book-end	**No**	Yes	Yes	Yes	Yes
Sculpture	**No**	Yes	Yes	Yes	Yes
Take to the remote control repair shop	Yes	**No**	**No**	**No**	Yes
Wedge a door open	**No**	Yes	Yes	**No**	Yes
Weighing something down with it	Yes	Yes	Yes	**No**	Yes
Toy aeroplane	Yes	Yes	Yes	Yes	Yes
Throw it	Yes	**No**	**No**	**No**	Yes
Use the batteries for something else	Yes	**No**	**No**	**No**	Yes
Electronics – take it apart, put it back together	Yes	Yes	**No**	**No**	Yes
Control DVD	Yes	**No**	**No**	**No**	**No**
Lights	Yes	**No**	**No**	**No**	**No**
Stand on for height	**No**	Yes	Yes	**No**	Yes
Teach it to ride a bike	Yes	**No**	**No**	**No**	**No**
Stress pad	Yes	Yes	Yes	Yes	**No**
Put spiky objects in buttons	Yes	**No**	**No**	**No**	Yes
Propping up door	Yes	Yes	Yes	Yes	Yes
Let your dog chew it	**No**	Yes	**No**	**No**	Yes
Disguise it	Yes	**No**	**No**	**No**	Yes
Wrap it up	Yes	**No**	**No**	**No**	Yes
Throw it in a lake	Yes	**No**	**No**	**No**	Yes
Sprinklers	**No**	**No**	Yes	**No**	**No**
Use parts to replace parts of another remote control	Yes	**No**	**No**	**No**	Yes
Eat it	Yes	Yes	**No**	**No**	**No**
Throw during fights	Yes	Yes	Yes	**No**	Yes
Block the view of a flashing light (video…)	Yes	Yes	Yes	**No**	**No**
Footrest	Yes	Yes	Yes	Yes	Yes
Throw it at a ball, that is stuck in the tree	**No**	Yes	Yes	**No**	Yes
Something to fiddle with	Yes	Yes	**No**	**No**	Yes
Make a hole in something	Yes	Yes	Yes	**No**	Yes
Transport food on	Yes	Yes	Yes	**No**	Yes
Throwing it at someone	**No**	Yes	Yes	**No**	Yes
Steal batteries from	**No**	**No**	**No**	**No**	Yes
Use as a support for something	Yes	Yes	Yes	**No**	Yes

Build with it	Yes	Yes	Yes	**No**	Yes
Close garage	Yes	**No**	**No**	Yes	**No**
Stir a broth/soup	Yes	Yes	Yes	Yes	Yes
Sell it	Yes	**No**	**No**	**No**	Yes
Pretend it's a remote for something else	Yes	**No**	**No**	Yes	Yes
Burn it	Yes	**No**	**No**	**No**	Yes
Games console	Yes	**No**	**No**	Yes	**No**
Teach a child numbers	Yes	Yes	Yes	**No**	Yes
Calculator	**No**	**No**	Yes	Yes	Yes
Percussion instrument	Yes	Yes	Yes	Yes	Yes
Batteries used for control	Yes	**No**	**No**	**No**	**No**
Throw at TV	**No**	Yes	Yes	**No**	Yes
Pretend to type on buttons	**No**	Yes	Yes	**No**	Yes
Have it by your side	Yes	**No**	**No**	**No**	Yes
With two remote controls: add straps and wear as fancy shoes	**No**	Yes	Yes	Yes	Yes
Get something from behind a radiator	Yes	Yes	Yes	**No**	Yes
Control car keys/lock	Yes	**No**	**No**	**No**	Yes
Hit it against something to make music	**No**	Yes	Yes	**No**	Yes
Hurting someone	Yes	Yes	Yes	Yes	Yes
Doorstop	Yes	Yes	Yes	Yes	Yes
Tray	**No**	Yes	Yes	Yes	Yes
Pretend to control someone	**No**	Yes	Yes	**No**	Yes
Pretend it is a weapon e.g. put in carrier bag to scare people?	**No**	Yes	Yes	Yes	Yes
Pretend it's a phone	**No**	Yes	Yes	Yes	Yes
Change channel	Yes	**No**	**No**	**No**	**No**
Put in under a wonky chair leg so it doesn't move	**No**	Yes	Yes	**No**	Yes
Treasure it	**No**	**No**	**No**	**No**	Yes
Bookmark	Yes	Yes	Yes	Yes	Yes
Toy light beam	Yes	**No**	Yes	Yes	Yes
Do an experiment using remote controls	Yes	**No**	**No**	**No**	Yes
Take it back to the shop	Yes	**No**	**No**	**No**	Yes
Break something with	Yes	Yes	Yes	**No**	Yes
Detonator	Yes	Yes	Yes	Yes	Yes
Fast forward	Yes	**No**	**No**	**No**	**No**
Dog toy	**No**	Yes	Yes	Yes	Yes
Bury it	Yes	**No**	**No**	**No**	Yes
Throw to get someone's attention	**No**	Yes	Yes	**No**	Yes
Pendant on a necklace	Yes	Yes	Yes	Yes	**No**
Knee rest	Yes	Yes	Yes	Yes	Yes
Ballast	**No**	**No**	Yes	**No**	Yes
Draw on	Yes	Yes	**No**	**No**	Yes

Table H-8: AUT ratings, Version H: Remote control (N=168)

Response	J1	J2	J3	J4	J5
Cook it	Yes	**No**	Yes	Yes	**No**
For a child's toy	Yes	Yes	Yes	Yes	Yes
Weigh down a tent with it	Yes	Yes	**No**	Yes	Yes
Building block	Yes	Yes	Yes	Yes	Yes
Smash a window	Yes	Yes	Yes	Yes	Yes
Microphone	Yes	**No**	**No**	Yes	Yes
Cooling armpits (propping out arms with remote control)	Yes	Yes	Yes	Yes	Yes
Put it in your pocket	**No**	**No**	**No**	**No**	**No**
Store batteries	**No**	**No**	**No**	**No**	**No**
House hold appliance	**No**	**No**	**No**	**No**	**No**
Back scratcher	Yes	Yes	Yes	Yes	Yes
Point at people with	Yes	Yes	Yes	**No**	Yes
Jar opener i.e. hit jar to open.	Yes	Yes	**No**	Yes	Yes
Hold a door 'a jar'	Yes	Yes	Yes	Yes	Yes
Take off the batteries and chew them	**No**	**No**	**No**	**No**	**No**
Throwing object	Yes	Yes	Yes	Yes	Yes
Balance stuff on	Yes	Yes	Yes	Yes	Yes
Way of getting people's attention by banging on table	Yes	Yes	Yes	Yes	Yes
Bat and ball	Yes	**No**	Yes	Yes	Yes
Protect yourself with it! Protect part of the body	Yes	Yes	Yes	Yes	Yes
Hide it	**No**	**No**	**No**	**No**	**No**
Smacking tool	Yes	Yes	Yes	Yes	Yes
Slide on ground	**No**	**No**	Yes	**No**	Yes
Juggling	Yes	Yes	Yes	Yes	Yes
Change its colour	**No**	**No**	**No**	**No**	**No**
Make into a boat	Yes	Yes	Yes	Yes	Yes
Stepping stone	Yes	**No**	**No**	Yes	Yes
Take apart	**No**	**No**	**No**	**No**	**No**
Scratch your back	Yes	Yes	Yes	Yes	Yes
Take apart and put back together again	**No**	**No**	**No**	**No**	**No**
Toy	Yes	Yes	Yes	Yes	Yes
Stencil	Yes	Yes	Yes	Yes	Yes
Help calculate sums	**No**	**No**	**No**	Yes	**No**
Put a hat on it	Yes	**No**	**No**	Yes	**No**
Lose it	**No**	**No**	**No**	**No**	**No**
Alter colour contrast of the monitors	**No**	**No**	**No**	**No**	**No**
Flatten your hair	Yes	Yes	Yes	Yes	Yes
Control heater	**No**	**No**	**No**	**No**	**No**
Hide it to annoy someone	**No**	**No**	**No**	**No**	**No**
Door wedge	Yes	Yes	Yes	Yes	Yes
Hit someone on the head	Yes	Yes	Yes	Yes	Yes
Spinner (spin the bottle)	Yes	Yes	Yes	Yes	Yes
Control remote – controlled model car/objects – make them faster/slower/change direction	**No**	**No**	**No**	**No**	**No**
Change brightness/contrast on TV	**No**	**No**	**No**	**No**	**No**
Cover it up	**No**	**No**	**No**	**No**	**No**

Coaster	Yes	Yes	Yes	Yes	Yes
Breaking things up	**No**	Yes	Yes	Yes	Yes
Level out a table	Yes	Yes	Yes	Yes	Yes
Nick the batteries out of it	**No**	**No**	**No**	**No**	**No**
Toothbrush	Yes	Yes	Yes	Yes	Yes
Record something on TV	**No**	**No**	**No**	**No**	**No**
Attack someone with IR waves	Yes	Yes	Yes	Yes	**No**
Put in microwave and see what happens	**No**	**No**	**No**	**No**	**No**
Put batteries in it	**No**	**No**	**No**	**No**	**No**
Use the acid from batteries	**No**	**No**	**No**	Yes	**No**
Put it away	**No**	**No**	**No**	**No**	**No**
Eat with	Yes	Yes	Yes	Yes	**No**
Teach it to drive	**No**	**No**	**No**	**No**	**No**
Give it to the dog	**No**	Yes	Yes	**No**	**No**
Drawing implement	Yes	**No**	**No**	Yes	Yes
Balance on your shoulders	**No**	Yes	**No**	**No**	Yes
Stack up and build things	Yes	Yes	Yes	Yes	Yes
Place on a pile of papers so they don’t fly away when there is a draft	Yes	Yes	Yes	Yes	Yes
Use to point to objects	Yes	Yes	Yes	Yes	Yes
Pillow	Yes	Yes	Yes	Yes	Yes
Stick to your face and look like a robot	**No**	Yes	Yes	Yes	Yes
Ingredient in soup	**No**	**No**	Yes	Yes	**No**
Hit someone	**No**	Yes	Yes	Yes	Yes
Play telephone (mobile) with a child	Yes	**No**	Yes	Yes	Yes
Wedge to raise item	Yes	Yes	Yes	Yes	Yes
Hi Fi system control	**No**	**No**	**No**	**No**	**No**
Use electronic circuit	**No**	**No**	**No**	**No**	**No**
Catapult	Yes	Yes	**No**	Yes	Yes
Open/close remote controlled doors e.g. garage doors	**No**	**No**	**No**	**No**	**No**
Catch	**No**	**No**	Yes	**No**	Yes
Shake it in improvisation (Maracas)	Yes	Yes	Yes	**No**	Yes
Change TV volume	**No**	**No**	**No**	**No**	**No**
Pause	**No**	**No**	**No**	**No**	**No**
Brick	Yes	Yes	Yes	Yes	Yes
Pretend wand	Yes	Yes	Yes	Yes	Yes
Plinth	Yes	**No**	Yes	Yes	Yes
Stick	**No**	**No**	Yes	Yes	Yes
Break windows	Yes	Yes	Yes	Yes	Yes
Projectile	Yes	Yes	Yes	Yes	**No**
Hold in both hands	**No**	**No**	**No**	**No**	**No**
Hammer	Yes	Yes	Yes	Yes	Yes
Take the batteries out	**No**	**No**	**No**	**No**	**No**
Control Video	**No**	**No**	**No**	**No**	**No**
Hold newspaper open	Yes	**No**	Yes	Yes	Yes
Clock	**No**	**No**	**No**	Yes	**No**
On TV	**No**	**No**	**No**	**No**	**No**
Teach it to swim	**No**	**No**	**No**	Yes	**No**
Remote for air condition	**No**	**No**	**No**	**No**	**No**

Coffee table ornament	Yes	Yes	Yes	**No**	Yes
Balance small objects on (pins etc)	Yes	Yes	**No**	Yes	Yes
Reassembled: Junk for display	Yes	Yes	**No**	Yes	Yes
Dismantled: shrapnel	Yes	**No**	**No**	**No**	**No**
Teach child how to insert batteries	**No**	**No**	Yes	**No**	**No**
Instrument	Yes	Yes	Yes	**No**	Yes
Turn off TV	**No**	**No**	**No**	**No**	**No**
Pass it to someone	**No**	**No**	**No**	**No**	**No**
Control wheelchair	**No**	**No**	**No**	**No**	**No**
Give it to dog as a toy	Yes	Yes	Yes	Yes	Yes
Tie it to a tree	**No**	**No**	**No**	**No**	**No**
Cut it in half	**No**	**No**	**No**	**No**	**No**
Bludgeon	**No**	**No**	Yes	Yes	Yes
Scratch it	**No**	**No**	**No**	**No**	**No**
Prop a book to make reading easier	Yes	Yes	Yes	Yes	Yes
Light dimming	**No**	**No**	**No**	**No**	**No**
Stir tool with	Yes	Yes	Yes	**No**	Yes
Rewind	**No**	**No**	**No**	**No**	**No**
Balancing it on your knee	**No**	**No**	**No**	**No**	**No**
Key	**No**	**No**	**No**	Yes	**No**
The point in a sundial	Yes	Yes	Yes	Yes	Yes
Remotely controlling things	**No**	**No**	**No**	**No**	**No**
Act with it	**No**	Yes	Yes	Yes	Yes
Balance on your head	**No**	**No**	**No**	**No**	Yes
Dildo	Yes	Yes	Yes	Yes	Yes
Pencil case	**No**	Yes	**No**	Yes	Yes
Song change	**No**	**No**	**No**	**No**	**No**
Exercise lips by pressing buttons with lips	Yes	**No**	Yes	Yes	**No**
Get money by selling it on ebay	**No**	**No**	**No**	**No**	Yes
Tool of somesort?	Yes	Yes	Yes	Yes	Yes
Use as a car	**No**	**No**	Yes	Yes	Yes
Spoon	Yes	Yes	Yes	Yes	Yes
Control robot toy	**No**	**No**	**No**	Yes	**No**
Dominoe falling	Yes	Yes	Yes	Yes	Yes
Bang a nail	Yes	Yes	Yes	Yes	Yes
Pretend microphone	Yes	Yes	Yes	Yes	Yes
Poke someone with	Yes	Yes	Yes	**No**	Yes
Prodding tool	Yes	Yes	Yes	Yes	Yes
Makeshift drumstick	Yes	Yes	Yes	Yes	Yes
Break it into pieces and make a model figure out of it	Yes	Yes	Yes	Yes	Yes
Use batteries from it or for something else	**No**	**No**	**No**	**No**	**No**
Speaking stick	**No**	**No**	**No**	Yes	Yes
Take out the buttons and chew them as gum	Yes	Yes	Yes	Yes	**No**
Console holder	**No**	**No**	Yes	Yes	**No**
Ruler	Yes	Yes	Yes	Yes	Yes
Temperature	**No**	**No**	**No**	**No**	**No**
Kick under the sofa	**No**	**No**	**No**	**No**	**No**
Pen	Yes	Yes	**No**	Yes	**No**
Front door bell by remote (Wireless)	**No**	**No**	**No**	**No**	**No**

Digital tuner (Listens when playing)	**No**	**No**	**No**	**No**	**No**
Control toy car	**No**	**No**	**No**	Yes	Yes
Give it away	**No**	**No**	**No**	**No**	**No**
Plant it in the ground	**No**	Yes	**No**	**No**	**No**
Kill a fly	Yes	Yes	Yes	Yes	Yes
Put in shoe to keep its shape	Yes	Yes	Yes	Yes	Yes
Hairbrush	Yes	Yes	Yes	Yes	Yes
Prop a photo against	Yes	**No**	Yes	Yes	Yes
Use the battery compartment as a box	Yes	**No**	Yes	Yes	Yes
Light saber	Yes	**No**	Yes	Yes	Yes
Keep as an ornament	Yes	Yes	Yes	**No**	**No**
Sing into	Yes	Yes	Yes	Yes	Yes
Up	**No**	**No**	**No**	**No**	**No**
Pretend it's a sword	Yes	Yes	Yes	Yes	Yes
Close/open remote controlled curtains/window	**No**	**No**	**No**	**No**	**No**
Toy gun	Yes	Yes	Yes	Yes	Yes
Exercise chin by pressing buttons with chin	Yes	**No**	**No**	**No**	**No**
Break it	**No**	**No**	**No**	**No**	**No**
To hold a pen	Yes	Yes	**No**	Yes	Yes
Turn item on	**No**	**No**	**No**	**No**	**No**
Wallet	**No**	**No**	Yes	Yes	Yes
Give to someone as present	**No**	**No**	**No**	**No**	Yes
Stand on	Yes	Yes	Yes	Yes	Yes
Lock car	**No**	**No**	**No**	**No**	**No**
Ball	Yes	Yes	Yes	Yes	Yes
Ornament	Yes	Yes	Yes	Yes	Yes

Appendix I – Example sheet of 20-item AUT Scoring (Pilot Study Four)

Scoring the Alternative Uses Task

The Alternative Uses Task (AUT) asks people to list as many different answers as possible for a common object as possible that is not what the object was originally intended for.

Answers are then scored and any responses that include giving what the object is intended for OR the response not being an actual USE is eliminated.

The original use for a newspaper would include answers such as “to read” or “to gather information from.” However, sometimes answers are more ambiguous and people disagree on the answer.

In the table below are real answers from previous experiments. For the following items, please indicate whether you think the responses should be classed as an alternative use or not, the item being a NEWSPAPER.

Alternative Use	Yes	No
Carrying		
Throw		
A walking stick		
Lay on the floor		
Recycle		
Megaphone		
Find ideas		
A back brush		
A dress		
Edit		
Tear it		
Rope		
A boat		
Football		
A pointer		
Paper		
Cook it		
Anonymity letter		
Foreign language practice		
To probe		

Appendix J – Pilot Study Five – Individual AUT Scores

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Carrying	**No**	Yes	Yes	**No**	**No**
Throw	Yes	**No**	Yes	**No**	Yes
A walking stick	Yes	**No**	**No**	**No**	Yes
Lay on the floor	Yes	Yes	Yes	Yes	**No**
Recycle	**No**	Yes	Yes	Yes	**No**
Megaphone	Yes	Yes	Yes	Yes	Yes
Find ideas	**No**	Yes	Yes	Yes	**No**
A back brush	Yes	Yes	Yes	**No**	Yes
A dress	Yes	**No**	Yes	**No**	Yes
Edit	**No**	**No**	**No**	**No**	**No**
Tear it	**No**	Yes	Yes	**No**	**No**
Rope	Yes	**No**	**No**	**No**	Yes
A boat	Yes	**No**	**No**	**No**	Yes
Football	Yes	Yes	**No**	**No**	Yes
A pointer	Yes	Yes	Yes	Yes	Yes
Paper	**No**	Yes	Yes	Yes	**No**
Cook it	Yes	**No**	**No**	**No**	Yes
Anonymity letter	Yes	Yes	**No**	**No**	**No**
Foreign language practice	Yes	Yes	Yes	Yes	**No**
To probe	Yes	Yes	Yes	Yes	Yes

Appendix K: Experiment Seven; Individual Judges AUT Scoring

Table K-1: AUT ratings, Version A: Bricks (N=130)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Smooth mud	Yes	**No**	**No**	Yes	**No**
Build rockery	**No**	Yes	Yes	Yes	Yes
Shoes – heels	Yes	**No**	**No**	Yes	**No**
Mark out an area	Yes	**No**	Yes	**No**	**No**
Term for old phone	Yes	Yes	**No**	Yes	**No**
Prop up table	**No**	Yes	Yes	**No**	Yes
Put it in microwave	Yes	**No**	Yes	**No**	**No**
Throw through window	Yes	Yes	**No**	Yes	**No**
Weigh down objects	**No**	Yes	Yes	Yes	**No**
Increasing your weight!	Yes	Yes	Yes	Yes	**No**
Stand on to see over something slightly higher than you	**No**	Yes	Yes	Yes	Yes
Percussion instrument	Yes	Yes	**No**	Yes	**No**
Weight training	Yes	**No**	Yes	Yes	Yes
Mount car on it	Yes	Yes	Yes	Yes	**No**
Train arm muscles	Yes	Yes	Yes	Yes	Yes
Ashtray	Yes	**No**	Yes	**No**	**No**
Pile up	**No**	Yes	Yes	Yes	Yes
Heat up and put a potato on it	Yes	Yes	Yes	Yes	Yes
Play it with some drum sticks	**No**	Yes	Yes	Yes	**No**
Bat	Yes	Yes	**No**	Yes	**No**
Decoration	**No**	Yes	Yes	Yes	**No**
Stand for picture	Yes	**No**	**No**	Yes	Yes
Walking on	Yes	Yes	**No**	**No**	Yes
Cut it in two	**No**	Yes	Yes	**No**	**No**
Steal it	Yes	Yes	**No**	**No**	**No**
Build a fence	Yes	Yes	**No**	Yes	**No**
Prop up objects off the ground	Yes	Yes	Yes	Yes	**No**
Killing a chicken or other small animal	Yes	Yes	**No**	Yes	Yes
Sit on it	Yes	Yes	Yes	Yes	**No**
Lift it like weights	Yes	Yes	**No**	**No**	Yes
Give it to someone	**No**	Yes	Yes	**No**	**No**
Put it in a fire and wait for it to explode	**No**	**No**	Yes	**No**	Yes
Half brick in sock	**No**	Yes	Yes	Yes	Yes
Fix a computer	Yes	Yes	Yes	Yes	Yes
Paperclip holder	Yes	Yes	Yes	Yes	Yes
For drowning cats in a bag	Yes	**No**	Yes	**No**	**No**
Crunch into gravel	Yes	Yes	Yes	Yes	**No**
Weigh a fishing net down under water	Yes	Yes	**No**	Yes	Yes
Raise height of moveable objects	**No**	Yes	Yes	**No**	Yes
Carry it in your pocket	Yes	**No**	**No**	**No**	**No**
Building game	**No**	Yes	Yes	Yes	Yes
Feed it to an animal	Yes	Yes	Yes	Yes	Yes
Simple sculpture	**No**	Yes	**No**	Yes	Yes

Use it as a table	**No**	Yes	Yes	**No**	Yes
Try and cook it	Yes	Yes	**No**	Yes	**No**
Decoration in garden	Yes	Yes	Yes	Yes	**No**
As a counter weight on a market scales	**No**	Yes	**No**	Yes	**No**
Hold something together	Yes	Yes	**No**	**No**	**No**
Hold it	**No**	**No**	**No**	**No**	**No**
BBQ building material	Yes	Yes	**No**	**No**	**No**
Drop it	Yes	Yes	Yes	Yes	Yes
Working out too	**No**	Yes	Yes	Yes	Yes
Play painful football with it	Yes	**No**	Yes	Yes	**No**
Break windows	Yes	Yes	Yes	**No**	**No**
Throw it	Yes	Yes	Yes	Yes	Yes
Opening a door/window	Yes	Yes	Yes	Yes	Yes
Ornament	Yes	Yes	**No**	Yes	**No**
Weigh down dustbin	**No**	Yes	Yes	**No**	Yes
Drainage item – porous	**No**	Yes	Yes	Yes	Yes
Play catch with	**No**	**No**	**No**	**No**	**No**
Build a tower	Yes	Yes	**No**	**No**	**No**
Hurting someone's toe or finger or head	Yes	Yes	**No**	Yes	**No**
Make a table higher	**No**	Yes	Yes	Yes	Yes
Write on it	Yes	Yes	Yes	**No**	**No**
Stepping stones	**No**	**No**	**No**	**No**	**No**
Something to build stuff with	**No**	Yes	**No**	**No**	Yes
Roll it down a hill	Yes	Yes	Yes	Yes	**No**
Trip people up	Yes	Yes	Yes	Yes	Yes
Bookend	Yes	**No**	Yes	Yes	**No**
Tie to something – make it sink	Yes	Yes	Yes	**No**	**No**
Stand on it	**No**	**No**	**No**	**No**	**No**
Build patio	**No**	**No**	**No**	**No**	**No**
Build houses	Yes	Yes	**No**	Yes	**No**
Weigh down a balloon	**No**	**No**	**No**	**No**	**No**
Build a wall	Yes	Yes	Yes	Yes	Yes
Chop it in half use them as bookends	Yes	Yes	Yes	Yes	Yes
Flattening some pressed flowers	Yes	**No**	Yes	Yes	**No**
Weapon	Yes	**No**	**No**	Yes	**No**
Karate training (Japanese martial arts) – break into two with bare hands	**No**	Yes	Yes	**No**	Yes
Stroke it like a pet	Yes	Yes	Yes	Yes	Yes
Sculpt into shape	Yes	Yes	Yes	**No**	Yes
Put a hat on it.	Yes	**No**	**No**	Yes	**No**
Mark a boundary	Yes	Yes	Yes	**No**	**No**
Play with	Yes	**No**	**No**	Yes	**No**
Block holes	Yes	Yes	Yes	**No**	**No**
Jump over it	Yes	Yes	Yes	Yes	**No**
Weights	Yes	**No**	Yes	Yes	**No**
Hit someone with it	Yes	Yes	Yes	Yes	Yes
Digging a hole	**No**	Yes	Yes	**No**	Yes
Try and burn it	**No**	Yes	Yes	Yes	Yes
Use it as a chair	**No**	**No**	**No**	**No**	**No**

Build barriers	**No**	**No**	**No**	Yes	**No**
Border in a garden	Yes	Yes	Yes	**No**	**No**
Throw in a lake	Yes	Yes	**No**	Yes	**No**
Stop objects from rolling down a hill e.g. a car/wheeled object	Yes	**No**	Yes	Yes	**No**
Anchor objects that may fly away/float away	Yes	Yes	Yes	**No**	**No**
Put on see saw	**No**	Yes	Yes	**No**	Yes
Try and eat it	Yes	Yes	Yes	Yes	Yes
Object to pick up from the bottom of pools	Yes	**No**	Yes	**No**	**No**
Throw at someone/something	Yes	**No**	Yes	Yes	**No**
Hit on someone's head	Yes	**No**	**No**	Yes	**No**
Make a wonky table level	**No**	Yes	Yes	Yes	Yes
Use it as a pillow	Yes	Yes	Yes	**No**	Yes
Clap together	Yes	Yes	Yes	Yes	Yes
Cup holder	Yes	**No**	**No**	**No**	**No**
Build a fireplace	**No**	Yes	Yes	Yes	Yes
Heat it up for warmth during a night	**No**	Yes	Yes	Yes	Yes
Cook an egg on a hot one	Yes	Yes	Yes	Yes	**No**
Bang on a door	Yes	Yes	Yes	Yes	Yes
Footstool	**No**	**No**	Yes	Yes	**No**
Fire proofing	Yes	Yes	Yes	**No**	Yes
Put some string round it and take it for a walk	Yes	**No**	**No**	**No**	**No**
Make a path	Yes	Yes	Yes	Yes	**No**
Door stop	Yes	Yes	Yes	**No**	Yes
Balance on head (Deportment)	Yes	Yes	Yes	Yes	Yes
Hammer	Yes	Yes	Yes	Yes	**No**
Balance things on top of	Yes	Yes	**No**	**No**	**No**
Hide it	Yes	Yes	**No**	Yes	**No**
Break stones	Yes	Yes	Yes	Yes	**No**
Paperweight	Yes	Yes	**No**	Yes	Yes
Build a sculpture	Yes	**No**	Yes	Yes	**No**
For artistic purposes	Yes	Yes	Yes	Yes	Yes
Standing a coffee on	**No**	**No**	**No**	**No**	**No**
Pave driveway	Yes	**No**	Yes	Yes	**No**
Break glass	Yes	Yes	Yes	Yes	**No**
Weigh down a bag	Yes	Yes	Yes	Yes	Yes
Measure a right angle	**No**	Yes	Yes	Yes	**No**
Put a candle on	Yes	**No**	**No**	**No**	**No**
Paint it	Yes	Yes	**No**	Yes	**No**
Smash something with it	Yes	Yes	Yes	Yes	**No**

Table K-2: AUT ratings, Version B: Newspaper (N= 249)

Response	J1	J2	J3	J4	J5
research tool	**No**	**No**	**No**	**No**	**No**
floor mats	Yes	Yes	Yes	Yes	Yes
carrying	Yes	**No**	**No**	**No**	Yes
triangle	**No**	**No**	**No**	Yes	**No**
to wipe something with	Yes	Yes	Yes	Yes	Yes
trace over pictures in it	Yes	Yes	Yes	Yes	Yes
inspiration	**No**	**No**	**No**	Yes	**No**
throw	**No**	Yes	**No**	Yes	Yes
scrap paper	Yes	Yes	Yes	Yes	Yes
Walking stick	Yes	**No**	Yes	Yes	Yes
Burn it to make a fire	Yes	Yes	Yes	Yes	Yes
apply for jobs	**No**	**No**	**No**	**No**	**No**
packaging	Yes	Yes	Yes	Yes	Yes
providing football scores	**No**	**No**	**No**	**No**	**No**
cloth	Yes	Yes	**No**	Yes	Yes
carry fish and chips	Yes	Yes	Yes	Yes	Yes
Fill	**No**	**No**	**No**	**No**	**No**
Collage – pictures	Yes	Yes	Yes	**No**	Yes
Lay on the floor	Yes	**No**	Yes	Yes	Yes
check the people in power	**No**	**No**	**No**	**No**	**No**
recycle	**No**	Yes	**No**	**No**	Yes
roll up and hit someone with	Yes	Yes	Yes	Yes	Yes
Covering	**No**	Yes	**No**	Yes	Yes
dad	**No**	**No**	**No**	**No**	**No**
Photograph	**No**	**No**	**No**	**No**	**No**
to throw balls made from newspaper at someone	Yes	Yes	Yes	Yes	Yes
Use them for building a bridge in one of those team building exercises.	Yes	Yes	Yes	Yes	Yes
clean windows	Yes	Yes	Yes	Yes	Yes
Make a paper plane	Yes	Yes	Yes	Yes	Yes
Find ideas	**No**	**No**	**No**	Yes	**No**
Counting practice for kids	**No**	**No**	**No**	Yes	Yes
Ball	Yes	Yes	**No**	Yes	Yes
Megaphone	**No**	**No**	Yes	Yes	Yes
Scoop	**No**	Yes	**No**	**No**	Yes
house to rent	**No**	**No**	**No**	**No**	**No**
Access to overview of around the world	**No**	**No**	**No**	**No**	**No**
Cooking and eating with	**No**	**No**	**No**	**No**	Yes
doing puzzles in	**No**	**No**	**No**	**No**	**No**
Back brush	**No**	Yes	Yes	**No**	Yes
baseball bat	**No**	Yes	Yes	Yes	Yes
pick up dog poo	Yes	Yes	Yes	Yes	Yes
Dress	**No**	Yes	Yes	**No**	Yes
Edit	Yes	**No**	**No**	**No**	**No**
cross word	**No**	**No**	**No**	**No**	**No**
wallpaper	Yes	Yes	Yes	Yes	Yes

tear it	Yes	**No**	**No**	**No**	Yes
put inside your shoes to dry them	Yes	Yes	Yes	Yes	Yes
Fly	**No**	Yes	**No**	**No**	Yes
putting on car screen when cold	Yes	Yes	Yes	Yes	Yes
standing on with muddy shoes	Yes	Yes	Yes	Yes	Yes
see other peoples opinions	**No**	**No**	**No**	**No**	**No**
Child's stars	**No**	**No**	**No**	**No**	**No**
Hit people with	Yes	Yes	Yes	Yes	Yes
to make money	**No**	**No**	**No**	**No**	**No**
burry it	**No**	**No**	**No**	**No**	Yes
making visual art	Yes	Yes	Yes	Yes	Yes
used for crosswords	**No**	**No**	**No**	**No**	**No**
swat flies	Yes	Yes	Yes	Yes	Yes
Fan	Yes	Yes	Yes	Yes	Yes
to wrap up cutlery	Yes	Yes	Yes	Yes	Yes
cutting up for scrap paper	Yes	Yes	Yes	**No**	Yes
Cheap tablecloth	Yes	Yes	Yes	Yes	Yes
Protection	**No**	Yes	Yes	Yes	Yes
Hockey	**No**	Yes	**No**	**No**	Yes
look	**No**	**No**	**No**	**No**	**No**
Cover something	Yes	Yes	Yes	Yes	Yes
rope	**No**	Yes	**No**	Yes	Yes
sleep under (if you're a tramp)	Yes	Yes	Yes	Yes	Yes
Make a table (Rolled up)	Yes	Yes	Yes	Yes	Yes
Sun protection	**No**	Yes	Yes	Yes	Yes
Study	**No**	**No**	**No**	**No**	**No**
keep dry	Yes	Yes	Yes	Yes	Yes
damp proofing	Yes	Yes	Yes	Yes	Yes
Make it wet and put on a wall	Yes	Yes	Yes	Yes	Yes
Blow nose	Yes	Yes	Yes	Yes	Yes
boat	**No**	Yes	Yes	Yes	**No**
catch up on the gossip	**No**	**No**	**No**	**No**	**No**
Funnel	Yes	Yes	Yes	Yes	Yes
sudoku	**No**	**No**	**No**	**No**	**No**
cleaning floor	Yes	Yes	Yes	Yes	Yes
Read	**No**	**No**	**No**	**No**	**No**
line the litter tray for the cat	Yes	Yes	Yes	Yes	Yes
Build a bridge/rolled up	Yes	Yes	Yes	Yes	Yes
Make a collage out of	Yes	Yes	Yes	**No**	Yes
can be used to make your fingers dirty	Yes	Yes	Yes	**No**	Yes
food wrap	Yes	Yes	Yes	Yes	Yes
make clothes out of it	Yes	Yes	Yes	Yes	Yes
football	Yes	Yes	**No**	Yes	**No**
do the sudoku	**No**	**No**	**No**	**No**	**No**
Block sun from window	Yes	Yes	Yes	Yes	Yes
read horoscope	**No**	**No**	**No**	**No**	**No**
sit	**No**	**No**	**No**	Yes	Yes
Toilet roll	Yes	Yes	Yes	Yes	Yes
pointer	Yes	**No**	**No**	Yes	Yes

fire building	Yes	Yes	Yes	Yes	Yes
Lush	**No**	**No**	**No**	**No**	**No**
Hide behind	Yes	Yes	Yes	Yes	Yes
armour	**No**	Yes	Yes	Yes	Yes
show weather	**No**	**No**	**No**	**No**	**No**
confetti	Yes	Yes	Yes	Yes	Yes
fly splatter	Yes	Yes	Yes	Yes	Yes
Wedging – rolled up	Yes	Yes	Yes	Yes	Yes
see what's on locally, cinema etc.	**No**	**No**	**No**	**No**	**No**
find or sell a car	**No**	**No**	**No**	**No**	**No**
Drying a dog	Yes	Yes	Yes	Yes	Yes
to use as a papertowel	Yes	Yes	Yes	Yes	Yes
update	**No**	**No**	**No**	**No**	**No**
scribble on	Yes	Yes	Yes	Yes	Yes
paper	**No**	**No**	Yes	Yes	**No**
Make a ball	Yes	Yes	Yes	Yes	Yes
to look at	**No**	**No**	Yes	**No**	**No**
On stage	**No**	**No**	**No**	**No**	**No**
Xerox Collect	**No**	**No**	**No**	**No**	**No**
cook it	Yes	**No**	**No**	Yes	Yes
look up the travel section	**No**	**No**	**No**	**No**	**No**
work	**No**	**No**	**No**	**No**	**No**
mat	Yes	Yes	Yes	Yes	Yes
place for the dog to sit	Yes	Yes	Yes	Yes	Yes
blocking	Yes	Yes	**No**	**No**	Yes
Lining boxes	Yes	Yes	Yes	Yes	Yes
jobhunting	**No**	**No**	**No**	**No**	**No**
oven-glove	**No**	Yes	Yes	Yes	Yes
education	**No**	**No**	**No**	**No**	**No**
hamster bedding	Yes	Yes	Yes	Yes	Yes
hit someone over the head	Yes	Yes	Yes	Yes	Yes
Hiding your face	Yes	Yes	Yes	Yes	Yes
rubbish	**No**	**No**	**No**	**No**	Yes
Clean a spill	Yes	Yes	Yes	Yes	Yes
Use as a draught excluder	Yes	Yes	Yes	Yes	Yes
put a painted object on while drying	Yes	Yes	Yes	Yes	Yes
Record	**No**	**No**	**No**	**No**	**No**
word search	**No**	**No**	**No**	**No**	**No**
Cutting up – templates	Yes	Yes	Yes	Yes	Yes
material for team-building games	**No**	Yes	Yes	Yes	Yes
wrapping paper	Yes	Yes	Yes	Yes	Yes
kebab-wrapper	Yes	Yes	Yes	Yes	Yes
to stand on	Yes	Yes	Yes	Yes	Yes
reference	**No**	**No**	**No**	Yes	**No**
Anonymity letter	**No**	**No**	**No**	Yes	**No**
Boil	**No**	**No**	**No**	**No**	**No**
covering areas	Yes	Yes	Yes	Yes	Yes
cover windows	Yes	Yes	Yes	Yes	Yes
binliner	Yes	Yes	Yes	Yes	Yes

guidance	**No**	**No**	**No**	**No**	**No**
Foreign language practice	Yes	**No**	**No**	Yes	**No**
Probe	**No**	**No**	**No**	Yes	**No**
Wrap up bottles	Yes	Yes	Yes	Yes	Yes
Cover books with	Yes	Yes	Yes	Yes	Yes
Check reading age of	**No**	**No**	**No**	Yes	**No**
Steal	**No**	**No**	**No**	**No**	**No**
In piles – to raise height	Yes	Yes	Yes	Yes	Yes
Purse	**No**	Yes	**No**	Yes	Yes
Share	**No**	**No**	**No**	**No**	**No**
look busy	**No**	Yes	**No**	**No**	Yes
Underlay	Yes	Yes	Yes	Yes	Yes
metro, people read them to see what the latest news is.	**No**	**No**	**No**	**No**	**No**
put them on doorstep for muddy shoes	Yes	Yes	Yes	Yes	Yes
Burn	Yes	**No**	Yes	**No**	Yes
teach children to read	**No**	**No**	Yes	Yes	Yes
desk ornament	Yes	Yes	Yes	Yes	Yes
Inside wrapping for a parcel	Yes	Yes	Yes	Yes	Yes
advertise skills such as teaching	**No**	**No**	**No**	**No**	**No**
get news and articles from	**No**	**No**	**No**	**No**	**No**
Indicator of status/personality	**No**	**No**	**No**	**No**	**No**
clean muddy boots	Yes	Yes	Yes	Yes	Yes
for cutting	Yes	Yes	Yes	**No**	Yes
Paper mache	Yes	Yes	Yes	Yes	Yes
shelf lining	Yes	Yes	Yes	Yes	Yes
Telescope	**No**	Yes	Yes	Yes	Yes
Hold	**No**	**No**	Yes	**No**	**No**
Squash up to make briquettes	Yes	Yes	Yes	Yes	Yes
Eat	Yes	**No**	**No**	Yes	**No**
celebrity gossip/news	**No**	**No**	**No**	**No**	**No**
Musical instrument/effect	Yes	Yes	Yes	**No**	Yes
wipe feet	Yes	Yes	**No**	Yes	Yes
tray	**No**	Yes	Yes	Yes	Yes
cover ones face with	Yes	Yes	Yes	Yes	Yes
baton	Yes	Yes	Yes	Yes	Yes
Keep some entertained	**No**	**No**	**No**	**No**	**No**
cup of tea	**No**	**No**	**No**	**No**	**No**
read the problem page	**No**	**No**	**No**	**No**	**No**
old man	**No**	**No**	**No**	**No**	**No**
cutting out comic strips	**No**	**No**	**No**	**No**	**No**
Clean up dog/cat mess	Yes	Yes	Yes	Yes	Yes
Eggs	**No**	**No**	**No**	**No**	**No**
Draw on	Yes	Yes	Yes	Yes	Yes
Inner sole for shoe	Yes	Yes	Yes	Yes	Yes
tear it up	Yes	**No**	Yes	Yes	Yes
Cudgel	**No**	**No**	**No**	**No**	Yes
Stick	**No**	**No**	**No**	**No**	Yes
Game of hockey	**No**	Yes	**No**	**No**	Yes
measure	**No**	**No**	**No**	**No**	Yes

collect	Yes	**No**	**No**	Yes	Yes
throw balls of paper	Yes	Yes	Yes	Yes	Yes
Subscribe	**No**	**No**	**No**	**No**	**No**
free	**No**	**No**	**No**	**No**	**No**
Carpet	Yes	Yes	**No**	Yes	Yes
sport	**No**	**No**	**No**	**No**	**No**
Cover with	**No**	Yes	**No**	Yes	Yes
Fancy dress outfit	Yes	Yes	Yes	Yes	Yes
Mop	**No**	Yes	Yes	**No**	Yes
Cover over a window to block out light	Yes	Yes	Yes	Yes	Yes
cover floor so it doesnt get dirty when muddy footprints	Yes	Yes	Yes	Yes	Yes
cleaning wipe	Yes	Yes	**No**	Yes	Yes
box	**No**	Yes	Yes	Yes	Yes
making chairs even	Yes	Yes	Yes	Yes	Yes
messy	**No**	**No**	**No**	**No**	**No**
business man/woman	**No**	**No**	**No**	**No**	**No**
Check horoscopes	**No**	**No**	**No**	**No**	**No**
cleaning up liquid	Yes	Yes	Yes	Yes	Yes
soak up liquids	Yes	Yes	Yes	Yes	Yes
find a job	**No**	**No**	**No**	**No**	**No**
pile up and sit on (like a chair)	Yes	Yes	Yes	Yes	Yes
articles	**No**	**No**	**No**	**No**	**No**
Disguise	Yes	Yes	**No**	Yes	Yes
Cover head in rain	Yes	Yes	Yes	Yes	Yes
frisbee	Yes	**No**	Yes	Yes	**No**
Layering on a surface like a drawer	Yes	Yes	Yes	Yes	Yes
A pile of newspapers makes a good step	Yes	Yes	Yes	Yes	Yes
singles ads so to find a partner	**No**	**No**	**No**	**No**	**No**
make a boat with	Yes	Yes	Yes	Yes	Yes
press cuttings	**No**	**No**	**No**	**No**	**No**
bbc one	**No**	**No**	**No**	**No**	**No**
latest gossip	**No**	**No**	**No**	**No**	**No**
Make a hat	Yes	Yes	Yes	Yes	Yes
Start a fire	Yes	Yes	Yes	Yes	Yes
Collage	Yes	Yes	**No**	**No**	Yes
make origami	Yes	Yes	Yes	Yes	Yes
paper people	**No**	Yes	Yes	Yes	Yes
Pillow	Yes	Yes	**No**	Yes	Yes
Lighting a fire	Yes	Yes	Yes	Yes	Yes
stuffimg	Yes	Yes	Yes	Yes	**No**
Polish windows/mirrors with it	Yes	Yes	Yes	Yes	Yes
law	**No**	**No**	**No**	**No**	**No**
dry out wet shoes (put inside)	Yes	Yes	Yes	Yes	Yes
kindle	**No**	**No**	Yes	**No**	Yes
Filter	Yes	Yes	**No**	Yes	**No**
explain whats happening in the world	**No**	**No**	**No**	**No**	**No**
Sell	**No**	**No**	**No**	**No**	**No**
music	**No**	**No**	**No**	**No**	Yes
sales	**No**	**No**	**No**	**No**	**No**

Chip wrapper	Yes	Yes	Yes	Yes	Yes
post it	**No**	**No**	**No**	**No**	**No**
spitballs	Yes	Yes	Yes	Yes	**No**
Archive	**No**	**No**	**No**	Yes	**No**
roll it up	Yes	**No**	Yes	Yes	Yes
Aeroplane	Yes	Yes	Yes	Yes	Yes
cut out pictures for a scap book	Yes	Yes	Yes	Yes	**No**
Laugh at	**No**	**No**	**No**	**No**	**No**
put things on	Yes	Yes	Yes	Yes	Yes

Table K-3: AUT ratings, Version C: Newspaper (N= 252)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Learn	**No**	Yes	Yes	Yes	**No**
to understand	**No**	Yes	Yes	**No**	**No**
allows people to publicaly announce events or occasions	**No**	Yes	**No**	**No**	**No**
buy	**No**	Yes	Yes	**No**	**No**
crime	**No**	Yes	Yes	Yes	**No**
general knowledge quiz	Yes	**No**	Yes	Yes	Yes
Throw on to people	Yes	**No**	**No**	Yes	Yes
Cushion for falling object	Yes	Yes	Yes	Yes	Yes
to wipe	Yes	**No**	Yes	Yes	Yes
Christmas tree decoration	**No**	Yes	**No**	**No**	**No**
look up a cookery recipe	Yes	**No**	Yes	Yes	**No**
sledge	**No**	**No**	Yes	Yes	Yes
fake money	**No**	**No**	**No**	**No**	**No**
ingredients for a soup	**No**	**No**	**No**	**No**	**No**
storage	Yes	**No**	Yes	Yes	Yes
Draw liner	**No**	**No**	Yes	**No**	Yes
cut out	Yes	Yes	Yes	Yes	Yes
Cut out small hole, and pretend you are reading - in fact you are spying on somebody	Yes	Yes	Yes	Yes	Yes
Put in welly boots to keep shape	Yes	**No**	Yes	Yes	Yes
to put your feet up on	Yes	**No**	Yes	Yes	Yes
Line cupboards	Yes	**No**	Yes	Yes	Yes
make a mask	Yes	**No**	Yes	Yes	Yes
Paper soldiers	Yes	Yes	Yes	**No**	**No**
frying up a mess on the floor	Yes	Yes	Yes	Yes	Yes
Cover for painting	Yes	**No**	Yes	Yes	Yes
Umbrella	Yes	Yes	Yes	Yes	Yes
to rip	**No**	Yes	Yes	**No**	Yes
check tv listings	Yes	**No**	Yes	Yes	Yes
Weapon	**No**	Yes	**No**	**No**	**No**
find out the news	**No**	Yes	Yes	**No**	**No**
Discover	Yes	Yes	**No**	**No**	Yes
Deduct ink	**No**	Yes	Yes	**No**	Yes
gather information from	Yes	**No**	Yes	Yes	Yes
roll up and use as bat in a game	**No**	Yes	Yes	**No**	**No**

celebrities	**No**	Yes	Yes	Yes	Yes
throwing away	Yes	**No**	Yes	Yes	Yes
Stuffing bean bags	Yes	**No**	**No**	**No**	**No**
Shell	Yes	**No**	Yes	Yes	Yes
Make paper dollies with	Yes	**No**	Yes	Yes	Yes
build paper models	Yes	Yes	Yes	Yes	Yes
Clean	**No**	Yes	Yes	**No**	**No**
important	**No**	Yes	**No**	**No**	**No**
learning	Yes	**No**	Yes	Yes	**No**
Tissue	**No**	Yes	Yes	Yes	**No**
magic tricks - water	Yes	Yes	Yes	Yes	Yes
Keep a fire going (ie. Make a draft with).	**No**	Yes	Yes	**No**	**No**
politics	Yes	**No**	Yes	Yes	Yes
to stick to the windows, when refurbishing buildings	**No**	Yes	Yes	**No**	**No**
finding local events	**No**	Yes	Yes	**No**	**No**
subtitles	Yes	**No**	Yes	Yes	Yes
table-cloth	**No**	Yes	Yes	**No**	**No**
research	Yes	Yes	Yes	Yes	Yes
Fly swat	Yes	Yes	Yes	Yes	Yes
screw up to make something	Yes	**No**	Yes	Yes	Yes
Stuff a bra	Yes	Yes	**No**	Yes	Yes
Special effect (radio etc)	Yes	**No**	Yes	**No**	Yes
Keep an essay in to hide it	Yes	**No**	Yes	Yes	Yes
Use rolled up pieces as pellets in a catapult	Yes	**No**	**No**	Yes	Yes
Wrap around chicken and light and cook	Yes	**No**	Yes	Yes	Yes
Napkin	**No**	Yes	Yes	**No**	**No**
Swap	Yes	Yes	Yes	**No**	Yes
Find out todays date	Yes	**No**	Yes	Yes	**No**
Padding	Yes	**No**	Yes	Yes	Yes
make paper decorations	Yes	**No**	Yes	**No**	Yes
Parachute	Yes	Yes	Yes	Yes	Yes
roll up to hit with	Yes	Yes	Yes	Yes	Yes
blocking a hole	Yes	**No**	**No**	Yes	Yes
Thermal layer (stuffed under shirt)	**No**	Yes	Yes	**No**	**No**
buy from an adverisement	**No**	Yes	Yes	**No**	**No**
horoscopes	Yes	**No**	Yes	Yes	Yes
bags filler	**No**	Yes	**No**	**No**	**No**
Complete the gamed	Yes	Yes	**No**	**No**	Yes
keep things in it	Yes	**No**	Yes	Yes	Yes
Cut letters out of to make a threatening letter	Yes	Yes	Yes	Yes	Yes
Wrapping	Yes	Yes	Yes	**No**	Yes
Collect pictures from	Yes	Yes	Yes	Yes	Yes
hit someone with a rolled up one	Yes	Yes	Yes	Yes	Yes
Fill in a gap	Yes	Yes	Yes	Yes	Yes
Cat litter tray liner	Yes	Yes	Yes	Yes	Yes
Fill a bin	Yes	Yes	Yes	Yes	Yes
use to doodle on	**No**	**No**	Yes	**No**	**No**
Clip	**No**	Yes	Yes	Yes	**No**
Throw to	Yes	Yes	Yes	Yes	Yes

Bung up hole	Yes	**No**	Yes	Yes	Yes
Blanket	**No**	Yes	Yes	**No**	**No**
read gossip	**No**	Yes	**No**	**No**	**No**
available in local shops	Yes	**No**	**No**	Yes	Yes
make a house from it	**No**	Yes	**No**	**No**	**No**
get football scores from	**No**	Yes	**No**	**No**	Yes
Get dirty hands with	Yes	**No**	Yes	Yes	Yes
use it to stuff a teddy bear	**No**	Yes	Yes	**No**	**No**
see holiday offers	Yes	Yes	Yes	Yes	Yes
put in wet shoes	**No**	**No**	Yes	**No**	**No**
Eliminate	Yes	**No**	Yes	Yes	Yes
Keep warm	Yes	Yes	Yes	Yes	Yes
Games – stepping stones	**No**	Yes	**No**	**No**	**No**
what movies are on	**No**	Yes	Yes	**No**	**No**
Distribute	Yes	**No**	**No**	Yes	**No**
Wafer – for ice cream	**No**	**No**	**No**	**No**	**No**
White balance on camera	Yes	Yes	**No**	Yes	Yes
to rest on	**No**	Yes	Yes	**No**	**No**
read your star signs	Yes	Yes	Yes	Yes	Yes
placing in rabbit hutch	Yes	**No**	Yes	Yes	Yes
Paperchains	Yes	Yes	Yes	Yes	Yes
Wrap up fish & chips	Yes	**No**	**No**	Yes	Yes
Insulation	**No**	Yes	Yes	**No**	**No**
take quotes	**No**	Yes	Yes	**No**	**No**
spare time	Yes	**No**	Yes	Yes	Yes
gift wrapper	Yes	**No**	Yes	Yes	Yes
decoration	Yes	**No**	Yes	**No**	Yes
flag-pole	Yes	**No**	**No**	Yes	Yes
chew when I'm really bored	**No**	Yes	Yes	**No**	**No**
gossip	Yes	**No**	Yes	Yes	Yes
Groundsheet for a tent	**No**	**No**	Yes	Yes	Yes
ruler	Yes	**No**	Yes	Yes	Yes
Beat someone with	Yes	**No**	Yes	Yes	Yes
floor tiles	Yes	Yes	Yes	Yes	Yes
to wrap up rubbish in	**No**	Yes	Yes	**No**	**No**
crime stories	**No**	**No**	Yes	Yes	**No**
preserved as an artifact	**No**	**No**	**No**	**No**	**No**
Crop	**No**	Yes	Yes	**No**	Yes
titles	Yes	Yes	Yes	Yes	Yes
blocking light out	**No**	**No**	**No**	Yes	Yes
to play musical chairs with	Yes	**No**	Yes	Yes	Yes
bracelet paper jewellery	Yes	Yes	**No**	Yes	Yes
Prop a table leg up with it	Yes	Yes	Yes	Yes	**No**
Make noises	Yes	**No**	Yes	Yes	Yes
sculpturing	Yes	**No**	Yes	Yes	Yes
Cut letters from the titles	**No**	Yes	Yes	**No**	**No**
adverts	**No**	**No**	**No**	Yes	**No**
sleeping	Yes	**No**	**No**	Yes	**No**
Clothes	Yes	**No**	Yes	Yes	Yes

Cover up cracks in the walls	**No**	**No**	**No**	**No**	**No**
money	Yes	**No**	Yes	Yes	Yes
Throw at someone	Yes	**No**	Yes	Yes	Yes
horses bed	Yes	**No**	**No**	Yes	Yes
hair extensions for a party	Yes	Yes	Yes	**No**	Yes
to shred	**No**	Yes	Yes	**No**	**No**
Cricket	Yes	Yes	Yes	Yes	Yes
Dry something	**No**	Yes	Yes	**No**	**No**
read news	Yes	Yes	Yes	Yes	Yes
wrapping articles when moving house	**No**	Yes	Yes	**No**	**No**
to provide tips for horse racing	**No**	Yes	**No**	**No**	**No**
buying second-hand goods	Yes	Yes	Yes	Yes	Yes
make pass the parcel	Yes	Yes	Yes	Yes	Yes
cutting and sticking from	Yes	**No**	Yes	Yes	**No**
paperball	**No**	Yes	Yes	Yes	Yes
Art and craft	Yes	Yes	Yes	Yes	Yes
Lay down in dusty wardrobes/cupboards	**No**	**No**	Yes	**No**	**No**
feeding	Yes	**No**	Yes	Yes	Yes
Christmas cracker	**No**	Yes	Yes	Yes	**No**
to look educated	Yes	**No**	Yes	**No**	Yes
Cover himself	Yes	**No**	Yes	Yes	Yes
Hat	Yes	Yes	Yes	Yes	Yes
Paint on	**No**	Yes	Yes	**No**	Yes
Educate people	**No**	**No**	Yes	Yes	Yes
put inside shoes	Yes	Yes	Yes	Yes	Yes
toilet training dogs	Yes	Yes	Yes	Yes	Yes
Use as a pattern when cutting fabric	Yes	**No**	Yes	Yes	Yes
use it as a plate	**No**	Yes	Yes	**No**	**No**
Provide a journalist with work	Yes	**No**	Yes	Yes	Yes
Glued into T-shirt	Yes	Yes	Yes	Yes	Yes
Bat	Yes	**No**	Yes	Yes	Yes
decorate the walls of a room	Yes	**No**	Yes	Yes	Yes
Stuff in shoes	**No**	Yes	**No**	**No**	**No**
reminders	Yes	Yes	Yes	Yes	Yes
bug killer	Yes	Yes	Yes	Yes	Yes
car-boot protector	**No**	Yes	Yes	**No**	Yes
reading on trains,	Yes	Yes	Yes	Yes	Yes
holder for broken glass in the bin	**No**	Yes	Yes	**No**	**No**
stories	Yes	Yes	Yes	Yes	Yes
let your dog urinate on it	**No**	Yes	**No**	**No**	**No**
bet	**No**	Yes	Yes	**No**	**No**
comics	Yes	**No**	Yes	Yes	Yes
Cut into shapes like a magician	**No**	Yes	**No**	Yes	Yes
Make logs by compressing	**No**	Yes	**No**	**No**	**No**
reporting crime	**No**	Yes	**No**	**No**	**No**
rugby news	Yes	Yes	Yes	Yes	Yes
Fire lighter	Yes	**No**	**No**	Yes	**No**
Paddle	Yes	Yes	Yes	**No**	Yes
Write on	Yes	**No**	Yes	Yes	Yes

mould it into a fan	**No**	**No**	Yes	Yes	Yes
stepping-stone	**No**	Yes	Yes	**No**	**No**
selling second-hand items	**No**	Yes	Yes	**No**	**No**
Information	Yes	Yes	Yes	Yes	Yes
in games (pass the parcel)	Yes	**No**	Yes	Yes	Yes
cover from rain	**No**	Yes	Yes	**No**	**No**
read the obits	Yes	Yes	Yes	Yes	Yes
animal litter	Yes	**No**	Yes	Yes	Yes
Insulation from a cold seat	Yes	Yes	Yes	Yes	Yes
Light a BBQ	Yes	Yes	Yes	Yes	Yes
Pet bedding	Yes	**No**	Yes	Yes	Yes
wall decoration	**No**	Yes	**No**	Yes	**No**
Fertilize	Yes	**No**	Yes	Yes	Yes
roll it up and use in self defence	**No**	Yes	**No**	**No**	**No**
Print	Yes	Yes	Yes	Yes	Yes
Hold fish and chips in like a plate	Yes	Yes	Yes	Yes	Yes
to roll	**No**	Yes	Yes	**No**	**No**
relax	**No**	Yes	**No**	Yes	**No**
Rearing animals	**No**	Yes	Yes	**No**	**No**
find or sell other items	Yes	**No**	Yes	Yes	Yes
Stuff a duvet	Yes	**No**	Yes	Yes	Yes
Door stop	**No**	Yes	Yes	Yes	**No**
creative art	Yes	Yes	Yes	Yes	Yes
For warmth – fire	Yes	**No**	Yes	Yes	Yes
make slippers out of	**No**	Yes	**No**	Yes	Yes
Fuel	Yes	**No**	Yes	Yes	Yes
ear trumpet	**No**	**No**	Yes	Yes	Yes
paper boot	**No**	**No**	**No**	Yes	**No**
Erudicate	Yes	Yes	Yes	Yes	Yes
Line a trench in garden	**No**	Yes	Yes	Yes	Yes
schools, use for collage	Yes	Yes	Yes	Yes	Yes
Stuff a box with	**No**	Yes	Yes	**No**	**No**
Making new words – sentences	Yes	Yes	Yes	Yes	Yes
cut holes in and spy on people	Yes	Yes	Yes	Yes	Yes
blowpipe	**No**	Yes	**No**	**No**	**No**
argument	Yes	Yes	Yes	Yes	Yes
Protecting surfaces	Yes	**No**	Yes	Yes	Yes
wrap presents	**No**	Yes	Yes	**No**	**No**
entertainment	Yes	Yes	Yes	Yes	Yes
Block out draught by lining windows	**No**	**No**	**No**	**No**	**No**
old	Yes	**No**	Yes	Yes	Yes
Build a paper tower	**No**	Yes	Yes	**No**	**No**
time passer	Yes	Yes	Yes	Yes	Yes
blocking draft	**No**	Yes	**No**	**No**	Yes
Get your anger at it	**No**	Yes	**No**	**No**	**No**
agony aunt	**No**	Yes	Yes	**No**	**No**
advertising	Yes	Yes	**No**	Yes	Yes
Puppy house	Yes	**No**	Yes	Yes	Yes
doormat	Yes	**No**	**No**	Yes	Yes

Create a cipher/code from	**No**	**No**	**No**	**No**	**No**
houses	Yes	Yes	Yes	Yes	Yes
Cleaning up gunge	**No**	Yes	Yes	**No**	**No**
Ignore	Yes	**No**	Yes	**No**	**No**
Fence	**No**	**No**	**No**	**No**	**No**
do the newspaper from it	**No**	**No**	**No**	**No**	**No**
Adore	Yes	**No**	Yes	Yes	Yes
dry stuff with	Yes	Yes	Yes	Yes	Yes
in an animals cage/hut	**No**	Yes	**No**	**No**	**No**
tabloids	Yes	Yes	Yes	Yes	Yes
cover a surface	Yes	Yes	Yes	Yes	Yes
To wipe something up	Yes	Yes	Yes	Yes	Yes
protection of china in boxes	Yes	Yes	Yes	Yes	Yes
tablemat	**No**	Yes	Yes	**No**	**No**
fun	Yes	**No**	Yes	Yes	**No**
curtain	**No**	Yes	Yes	**No**	**No**
catch up on world events	**No**	Yes	Yes	**No**	**No**
deliver to people	Yes	**No**	Yes	**No**	**No**
poster	Yes	Yes	Yes	Yes	Yes
clean glass	**No**	**No**	**No**	Yes	Yes
headdress	**No**	**No**	Yes	**No**	Yes
Entertain people	**No**	Yes	Yes	**No**	**No**
Sun	**No**	Yes	Yes	Yes	**No**

Table K-4: AUT ratings, Version D: Paperclip (N=187)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Ridicule	**No**	**No**	Yes	Yes	Yes
Pick-up line: "Is this your paperclip I found?"	Yes	**No**	Yes	Yes	Yes
gift	**No**	Yes	Yes	Yes	Yes
Ear scratcher	Yes	Yes	Yes	Yes	Yes
Piercing	Yes	Yes	Yes	Yes	**No**
fasten papers	**No**	Yes	Yes	**No**	**No**
Hold	**No**	**No**	**No**	**No**	**No**
binding objects	Yes	Yes	Yes	**No**	**No**
Hang washing instead of clothes peg !?	**No**	Yes	Yes	Yes	Yes
secure	**No**	Yes	Yes	**No**	Yes
Executive toy	**No**	**No**	Yes	Yes	Yes
fasten loose papers	**No**	Yes	Yes	**No**	**No**
Chew on	**No**	Yes	Yes	Yes	Yes
zip	Yes	Yes	**No**	Yes	**No**
can be used to stick on to things	Yes	Yes	Yes	**No**	**No**
Hang something up with it	Yes	Yes	Yes	Yes	Yes
use in dressmaking	Yes	**No**	Yes	Yes	**No**
putting on a magnet	**No**	Yes	Yes	Yes	**No**
Hold cardigan together	**No**	Yes	Yes	**No**	Yes
Draw it	**No**	Yes	Yes	Yes	Yes
to clip	**No**	Yes	Yes	**No**	**No**

Pierce ears	Yes	Yes	Yes	Yes	Yes
ear bud	**No**	Yes	Yes	Yes	Yes
making holes in wall	Yes	Yes	Yes	Yes	Yes
Make some sort of accessory – head band	Yes	Yes	Yes	Yes	**No**
put on paper	**No**	**No**	Yes	**No**	**No**
Distribute	**No**	**No**	Yes	Yes	Yes
to cut something	**No**	Yes	Yes	Yes	Yes
Use it in an A level chemistry experiment to find the % Mn in it	**No**	**No**	Yes	Yes	**No**
Demonstration of magnetism	Yes	Yes	Yes	Yes	**No**
needle	Yes	Yes	Yes	Yes	Yes
Attaching to a magnet	**No**	**No**	Yes	Yes	**No**
Clip cardboard	**No**	Yes	Yes	**No**	Yes
art material	Yes	Yes	Yes	Yes	**No**
Make a chain	Yes	Yes	Yes	Yes	**No**
picking	**No**	Yes	Yes	Yes	**No**
Probe	**No**	**No**	Yes	Yes	Yes
for show	**No**	**No**	Yes	Yes	**No**
Toothpick	**No**	Yes	Yes	Yes	Yes
Attracts to magnet easily	**No**	Yes	Yes	**No**	**No**
easy to use	**No**	**No**	**No**	**No**	**No**
Stencil	Yes	Yes	Yes	Yes	**No**
piercer	Yes	Yes	Yes	Yes	**No**
grouping	**No**	Yes	**No**	Yes	**No**
electric cable	Yes	**No**	Yes	Yes	Yes
Melt it – then mold it into something else	Yes	Yes	Yes	Yes	Yes
magnet attracter	**No**	Yes	Yes	Yes	**No**
Sample	**No**	**No**	Yes	Yes	Yes
to bookmark a page	Yes	Yes	Yes	**No**	**No**
filing	**No**	Yes	Yes	**No**	**No**
fasten	**No**	**No**	**No**	Yes	Yes
Pick a lock	Yes	Yes	Yes	Yes	**No**
Dog collar – attach name	Yes	**No**	Yes	Yes	**No**
bendable art	Yes	Yes	Yes	Yes	Yes
Mend my bassoon!	Yes	**No**	Yes	Yes	Yes
Using to open tins	**No**	Yes	Yes	Yes	Yes
Christmas tree decoration	Yes	Yes	Yes	Yes	**No**
Play with when bored	**No**	Yes	Yes	Yes	Yes
decorative ornamen	**No**	Yes	Yes	Yes	Yes
back-scratcher	Yes	Yes	Yes	Yes	Yes
money' in poker	**No**	Yes	**No**	Yes	Yes
To mend clothes e.g. if there is a rip	Yes	Yes	Yes	Yes	**No**
Sculpture	Yes	Yes	Yes	Yes	Yes
Poke holes in it	Yes	Yes	**No**	Yes	**No**
Stab someone	Yes	Yes	Yes	Yes	Yes
Hold clothes together	Yes	Yes	Yes	**No**	Yes
making paperclip sculptures	Yes	**No**	Yes	Yes	**No**
Link together for decoration	Yes	**No**	Yes	Yes	**No**
Decoration around the house	Yes	Yes	Yes	Yes	**No**

To gain spare staples	**No**	Yes	**No**	Yes	Yes
badge	**No**	Yes	Yes	Yes	**No**
Bend it into a tiny wire coat hanger	Yes	**No**	Yes	Yes	Yes
paperclip thowing olympic sport	**No**	Yes	Yes	Yes	Yes
Shaping into a pincer for fine object control	Yes	Yes	Yes	Yes	Yes
Walking stick for a mouse	**No**	Yes	Yes	Yes	Yes
hook to put your keys on	Yes	Yes	Yes	Yes	Yes
to take apart and use the wire for something	Yes	Yes	Yes	Yes	**No**
inter-personal projectile	**No**	**No**	**No**	Yes	Yes
Stick things to a corkboard	**No**	**No**	Yes	Yes	Yes
To build a tunnel in a tiny model city	Yes	Yes	Yes	Yes	Yes
to design a card	**No**	Yes	Yes	Yes	Yes
to stab someone	Yes	**No**	Yes	Yes	Yes
Secure an elastic band	Yes	Yes	Yes	Yes	**No**
put in a stationary box	**No**	Yes	Yes	**No**	**No**
To put in the stationary drawer	**No**	Yes	Yes	**No**	**No**
so you dont lose anything	**No**	Yes	Yes	**No**	**No**
Pick your teeth with it	**No**	Yes	Yes	Yes	Yes
clip	**No**	**No**	**No**	**No**	**No**
Cosmic	**No**	**No**	**No**	Yes	Yes
Pick a door	Yes	Yes	Yes	Yes	**No**
Link lots together to make a bracelet	Yes	**No**	Yes	Yes	**No**
Paralyze	**No**	**No**	**No**	Yes	Yes
putting objects together	Yes	**No**	Yes	**No**	**No**
Straighten wonky table	**No**	**No**	Yes	Yes	Yes
Export	**No**	**No**	**No**	Yes	Yes
to clip imoportant sheets together	**No**	**No**	Yes	**No**	**No**
dangerous for little kids	**No**	**No**	**No**	**No**	Yes
Gardening – tiing up etc…	Yes	**No**	Yes	Yes	Yes
Differentiate	**No**	**No**	**No**	Yes	Yes
Sell on ebay	**No**	Yes	Yes	**No**	Yes
Wire for a circuit	Yes	Yes	Yes	Yes	Yes
Different sizes	**No**	Yes	**No**	**No**	Yes
to make little 3d designes	Yes	Yes	Yes	Yes	**No**
Clip metal	**No**	Yes	Yes	**No**	**No**
Deduct	**No**	**No**	**No**	Yes	Yes
stationary	**No**	**No**	Yes	**No**	**No**
paperclip together	**No**	**No**	Yes	**No**	**No**
chainlink	Yes	Yes	Yes	Yes	**No**
cleaning your teeth	**No**	**No**	Yes	Yes	Yes
Fix	**No**	Yes	Yes	**No**	Yes
button pusher	**No**	Yes	Yes	Yes	**No**
Make into a picture holder thing	Yes	Yes	Yes	**No**	Yes
Test a cake	**No**	**No**	Yes	Yes	Yes
Scalpel	Yes	**No**	Yes	Yes	Yes
magnetic	**No**	Yes	**No**	Yes	**No**
Use as a pen	**No**	**No**	**No**	Yes	Yes
be magnetic	**No**	Yes	Yes	Yes	**No**
put on the table	**No**	**No**	Yes	**No**	Yes

Down the drain	**No**	**No**	**No**	Yes	Yes
poky	**No**	Yes	**No**	Yes	Yes
TV aerial	**No**	**No**	Yes	Yes	**No**
To stick magnets on	**No**	Yes	Yes	Yes	**No**
push something out of small space	Yes	**No**	Yes	Yes	**No**
complete a cicuit	Yes	Yes	Yes	Yes	Yes
link together as piece of art or fashion	Yes	Yes	Yes	Yes	**No**
Perform	**No**	**No**	**No**	Yes	Yes
cheap to buy	**No**	**No**	**No**	**No**	**No**
Straighten out to make straight edge	**No**	Yes	Yes	Yes	**No**
links	**No**	**No**	Yes	**No**	**No**
Scratch a scratch card with	Yes	**No**	Yes	Yes	Yes
Attach	**No**	**No**	Yes	**No**	Yes
To dislodge small items fallen into cracks (floor…)	Yes	Yes	Yes	Yes	**No**
Instrument	**No**	Yes	**No**	Yes	Yes
Scratch/itch	Yes	Yes	Yes	Yes	Yes
to puncture something	Yes	Yes	Yes	Yes	**No**
Conduct electricity	Yes	Yes	Yes	Yes	**No**
S' shape	**No**	Yes	Yes	Yes	**No**
Pin back your hair	Yes	Yes	Yes	Yes	Yes
Making tiny hole in paper to use as sunglasses to see an eclipse	Yes	**No**	Yes	Yes	Yes
glued	**No**	**No**	**No**	**No**	**No**
bird "attractor"	Yes	**No**	Yes	Yes	Yes
Note holding	**No**	Yes	Yes	**No**	**No**
Unfold and use to hold items together	Yes	Yes	Yes	**No**	**No**
to make wholes with the ends	**No**	Yes	Yes	Yes	Yes
Put on a zip to make it easier to pull	Yes	Yes	Yes	Yes	**No**
fashion item	Yes	Yes	Yes	Yes	Yes
stress release	**No**	**No**	Yes	Yes	Yes
Cakes – for decoration – tying on flags etc…	Yes	Yes	Yes	Yes	Yes
String together shoe laces	Yes	Yes	**No**	Yes	Yes
can be used to fiddle with during a boring lecture!	Yes	**No**	Yes	Yes	**No**
Weapon	Yes	Yes	Yes	Yes	Yes
Lock pick	Yes	**No**	Yes	Yes	**No**
Aim and shoot	**No**	**No**	**No**	Yes	Yes
Strum a guitar	Yes	Yes	Yes	Yes	**No**
Unblocking a smoking pipe	Yes	**No**	Yes	Yes	**No**
piece of wire	Yes	**No**	**No**	Yes	**No**
pick things from small places	Yes	Yes	Yes	Yes	**No**
room decorations	**No**	Yes	Yes	Yes	**No**
Fiddle with	Yes	Yes	Yes	Yes	**No**
To make a dream catcher (hang off ceiling etc…)	Yes	Yes	Yes	Yes	Yes
bookmaker	**No**	Yes	**No**	Yes	Yes
to put together	**No**	**No**	**No**	**No**	**No**
back scratcher	Yes	Yes	Yes	Yes	Yes
paperweight	**No**	Yes	**No**	Yes	Yes
Antenna	**No**	Yes	Yes	Yes	Yes
Electrocuter device	**No**	**No**	Yes	Yes	Yes

Expand	**No**	**No**	**No**	Yes	**No**
ornaments	**No**	**No**	Yes	Yes	Yes
Balloon popper	Yes	Yes	Yes	Yes	Yes
missile	**No**	**No**	**No**	Yes	Yes
to assist getting something out of a small space	Yes	**No**	Yes	Yes	**No**
Demonstration of metal fatigue	**No**	**No**	Yes	Yes	Yes
Necklace	Yes	Yes	Yes	Yes	**No**
use as a screwdriver	Yes	Yes	Yes	Yes	Yes
Make alternative shapes with	Yes	Yes	Yes	Yes	**No**
Page finder	Yes	Yes	Yes	**No**	**No**
Can bend out into one single metal strip	**No**	Yes	Yes	Yes	**No**
mend a buckle	Yes	Yes	Yes	Yes	**No**
To fasten a button	Yes	**No**	**No**	Yes	**No**
plastic coating	**No**	**No**	Yes	**No**	Yes
Hair clip	Yes	Yes	Yes	Yes	**No**
Lock for steering wheel	**No**	Yes	Yes	Yes	Yes
test magnet strength	**No**	Yes	Yes	Yes	**No**
scratcher	Yes	Yes	Yes	Yes	Yes
to hold	**No**	**No**	**No**	**No**	**No**
Mend a bag handle	Yes	Yes	Yes	Yes	Yes
Earrings	Yes	Yes	Yes	Yes	**No**

Table K-5: AUT ratings, Version E: Paperclip (N=186)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Makeshift cocktail stick	**No**	Yes	Yes	Yes	Yes
slicer	**No**	**No**	Yes	Yes	Yes
keeps files in order	Yes	**No**	**No**	**No**	**No**
Use as magnet for small metal objects	**No**	Yes	Yes	**No**	Yes
art display	Yes	Yes	Yes	Yes	Yes
fridge magnet	Yes	Yes	Yes	**No**	Yes
fake braces	**No**	Yes	Yes	Yes	Yes
jacket fastener	Yes	Yes	Yes	Yes	**No**
Throw	Yes	**No**	Yes	**No**	Yes
used to make models	Yes	Yes	Yes	Yes	Yes
Draw lines	**No**	**No**	Yes	Yes	Yes
keep packets of food closed	Yes	Yes	Yes	Yes	Yes
Use it as a game piece	Yes	Yes	Yes	Yes	Yes
Analyze	Yes	**No**	Yes	**No**	Yes
selling in a stationary shop	**No**	**No**	**No**	**No**	**No**
one set	Yes	**No**	Yes	**No**	**No**
Kill an insect	**No**	Yes	Yes	Yes	Yes
open a disc drive with it	Yes	Yes	Yes	Yes	Yes
put notes together	**No**	**No**	**No**	**No**	**No**
Mock	**No**	**No**	Yes	**No**	Yes
to decide stuff	Yes	**No**	Yes	**No**	Yes
pointing device	Yes	Yes	Yes	Yes	Yes
Weight	**No**	**No**	Yes	**No**	Yes

painting tool	Yes	Yes	Yes	Yes	Yes
Clip it on anything you find	**No**	**No**	Yes	Yes	**No**
Symbolize	Yes	**No**	Yes	Yes	Yes
linking with other paperclips	**No**	Yes	**No**	Yes	Yes
make holes by digging into things	Yes	Yes	Yes	Yes	Yes
computer helper	Yes	**No**	Yes	Yes	Yes
Tie shoelaces	**No**	**No**	Yes	Yes	Yes
Scratch someone with	**No**	Yes	Yes	Yes	Yes
Wire for wrapping around something – closing it	**No**	Yes	Yes	Yes	Yes
Safety catch	**No**	**No**	Yes	Yes	Yes
papers	Yes	**No**	Yes	**No**	**No**
Brush	**No**	**No**	Yes	**No**	Yes
Archive	Yes	**No**	Yes	**No**	Yes
Use it to make a painting	Yes	Yes	Yes	Yes	Yes
Replacement earring	**No**	Yes	Yes	Yes	Yes
opening letterbox	**No**	Yes	Yes	Yes	Yes
electricity conductor	Yes	Yes	Yes	Yes	**No**
opening a letter	**No**	Yes	Yes	Yes	Yes
Construct	**No**	**No**	Yes	Yes	Yes
sewing needle	**No**	Yes	Yes	Yes	Yes
accessory	Yes	Yes	Yes	Yes	**No**
Necklace charm	Yes	Yes	Yes	Yes	Yes
Fixing a necklace or other chain	Yes	Yes	Yes	Yes	Yes
Poker for roll up cigarettes	Yes	Yes	Yes	Yes	Yes
Eject a disk from an apple mac with	Yes	Yes	Yes	Yes	Yes
Scratch a scratchie	Yes	Yes	Yes	Yes	Yes
Organize	**No**	**No**	**No**	**No**	**No**
Make a chain for a bag	Yes	Yes	Yes	Yes	Yes
Key	Yes	**No**	Yes	Yes	Yes
chain to form a necklace	Yes	Yes	Yes	Yes	Yes
Use it to scratch your head	**No**	Yes	Yes	Yes	Yes
to reach for something trapped in a narrow space	Yes	Yes	Yes	Yes	Yes
fixing broken bags	**No**	Yes	Yes	Yes	Yes
Hook something together. E.g. curtain	Yes	Yes	Yes	Yes	Yes
Mouse killer	**No**	Yes	Yes	Yes	Yes
Hurt someone	**No**	Yes	Yes	Yes	Yes
To hold things together	**No**	**No**	**No**	**No**	**No**
use to fiddle with	Yes	Yes	Yes	Yes	Yes
Challenge	**No**	**No**	Yes	Yes	Yes
belt, by linking paper clips together	Yes	Yes	Yes	Yes	Yes
Record	Yes	**No**	Yes	Yes	Yes
Throw at somebody	Yes	Yes	Yes	Yes	Yes
Use it to pin something to a notice board	Yes	Yes	Yes	Yes	Yes
Drink	**No**	**No**	Yes	**No**	Yes
Reset a phone or electronic device	Yes	Yes	Yes	Yes	Yes
bend out and use to get things out of grouting	Yes	Yes	Yes	Yes	Yes
Use it to deface a wall (scratch words with it).	Yes	Yes	Yes	Yes	Yes
Clip bits of plastic	Yes	**No**	Yes	Yes	**No**
Replacing short lengths of wire	Yes	Yes	Yes	Yes	Yes

hook to reach something	**No**	Yes	Yes	Yes	Yes
safe place for when you need them	**No**	**No**	Yes	**No**	**No**
repair tears	**No**	**No**	Yes	Yes	Yes
Scratch yourself	**No**	Yes	Yes	Yes	Yes
Flick it	Yes	Yes	Yes	Yes	Yes
Put in your hair	**No**	Yes	Yes	Yes	Yes
stretchable	Yes	**No**	Yes	**No**	**No**
to mark a book	**No**	Yes	**No**	Yes	Yes
Replace a wire in an electrical circuit	Yes	Yes	Yes	Yes	Yes
Scratch a car	**No**	Yes	Yes	Yes	Yes
Tricks	**No**	**No**	Yes	Yes	Yes
bracelet	Yes	Yes	Yes	Yes	Yes
the start to a rubber band ball	Yes	Yes	Yes	Yes	Yes
Coat hook	Yes	Yes	Yes	**No**	Yes
Fishing rod	**No**	**No**	Yes	**No**	Yes
Use it to hold your broken glasses	Yes	Yes	Yes	Yes	Yes
Electric contact	**No**	**No**	Yes	Yes	Yes
Calve your name	**No**	**No**	Yes	**No**	Yes
designing animals	**No**	**No**	Yes	Yes	Yes
Door stop	**No**	Yes	Yes	**No**	Yes
To unlock your house door when you've forgotten keys	Yes	Yes	Yes	Yes	Yes
Initiate	**No**	**No**	Yes	Yes	Yes
switch	Yes	**No**	Yes	Yes	Yes
push a small button	Yes	Yes	Yes	Yes	Yes
to scratch yourself	Yes	Yes	Yes	Yes	Yes
office	Yes	**No**	**No**	**No**	**No**
To open it all out to make a thin metal rod	**No**	Yes	Yes	Yes	Yes
use during magnet experiments	Yes	Yes	Yes	Yes	Yes
Come in different colours	**No**	**No**	Yes	**No**	**No**
closing your pants	**No**	Yes	Yes	Yes	Yes
Use it in a science experiment to investigate electromagnetism.	Yes	Yes	Yes	Yes	Yes
Scrape things with it	Yes	Yes	**No**	Yes	Yes
use as a pin	Yes	**No**	Yes	Yes	Yes
Open cd drawer	Yes	Yes	Yes	Yes	Yes
clipping wires together	Yes	**No**	Yes	Yes	Yes
something sharp to use as a tool	Yes	Yes	Yes	Yes	**No**
to hold paper together	**No**	**No**	**No**	**No**	**No**
documents	**No**	**No**	Yes	**No**	**No**
Hold fabric together	Yes	**No**	Yes	Yes	Yes
to keep paper looking neat	Yes	Yes	Yes	**No**	**No**
seperate one thing from another	**No**	**No**	Yes	**No**	Yes
memo	**No**	**No**	Yes	**No**	**No**
Pierce a can	**No**	Yes	Yes	Yes	Yes
getting something out of a hole by scooping with an end	**No**	Yes	Yes	Yes	Yes
fixing broken clothes	**No**	Yes	Yes	Yes	Yes
Submarine	**No**	**No**	Yes	**No**	Yes
Filling hook	Yes	**No**	Yes	**No**	Yes
Bend it into something else	Yes	Yes	Yes	Yes	Yes

Hold paper together	Yes	**No**	**No**	**No**	**No**
Use it to scratch your head if you got extensions in it	Yes	Yes	**No**	Yes	Yes
uncurl them to make a statue with some blue tack	Yes	Yes	Yes	Yes	Yes
Use it as solder	**No**	Yes	Yes	Yes	Yes
Tiny projectile	Yes	Yes	Yes	Yes	Yes
additional bit to aeriel on tv which doesnt work	Yes	Yes	Yes	Yes	Yes
used in schools	Yes	**No**	**No**	Yes	**No**
Closing packets	Yes	Yes	Yes	**No**	Yes
Key ring	Yes	Yes	Yes	Yes	Yes
break into a house	Yes	Yes	**No**	Yes	Yes
hook something out of a small gap	**No**	Yes	**No**	Yes	Yes
Put holes in a microwave meal lid	Yes	Yes	Yes	Yes	Yes
Dagger	**No**	**No**	Yes	Yes	Yes
A "poker"	**No**	Yes	Yes	Yes	Yes
Bend into shapes	Yes	Yes	**No**	Yes	Yes
make a paperclip chain	Yes	Yes	Yes	Yes	Yes
Split a banana into segments	**No**	Yes	Yes	Yes	Yes
To hold a dress up	Yes	Yes	Yes	Yes	Yes
Create a bed of nails	Yes	Yes	Yes	Yes	Yes
Punching small holes in paper	**No**	Yes	**No**	Yes	Yes
used as weight on paper aeroplane or helicopter blades	Yes	Yes	Yes	Yes	Yes
Twist	**No**	**No**	Yes	**No**	Yes
Bend it and use it to puncture holes in a piece of paper.	Yes	Yes	**No**	Yes	Yes
to collate	**No**	**No**	Yes	**No**	Yes
To break a shredder	Yes	Yes	Yes	Yes	Yes
Flick at someone	Yes	Yes	Yes	Yes	Yes
podger (technical term)	Yes	**No**	Yes	**No**	Yes
Use as a hairclip	**No**	Yes	Yes	Yes	Yes
to hold hair out your eyes	Yes	Yes	Yes	Yes	Yes
Make a catapult out of it	**No**	Yes	Yes	Yes	Yes
Clean nails	**No**	Yes	**No**	Yes	Yes
pop a blister	**No**	Yes	Yes	Yes	Yes
mobile	**No**	**No**	Yes	Yes	Yes
To scratch paint off	Yes	Yes	**No**	Yes	Yes
Broken zip replacement	Yes	Yes	Yes	Yes	Yes
To roll something along a bench	**No**	Yes	Yes	Yes	Yes
Make metal models	Yes	Yes	Yes	Yes	Yes
present	**No**	**No**	Yes	Yes	Yes
Blow up a microwave	Yes	Yes	Yes	Yes	Yes
attach lots of them together to make a chain	Yes	Yes	Yes	Yes	Yes
Straighten it	**No**	**No**	Yes	Yes	**No**
Chain	**No**	Yes	Yes	Yes	Yes
Art/design e.g. make a lampshade	Yes	Yes	Yes	Yes	Yes
to hand in assignments or a project	Yes	**No**	**No**	**No**	**No**
bottle opener	**No**	Yes	Yes	Yes	Yes
Make a collage	Yes	Yes	Yes	Yes	Yes
Shaping into a sculptor	Yes	Yes	Yes	Yes	Yes
storage	**No**	**No**	Yes	Yes	Yes
to tear something	**No**	**No**	Yes	Yes	Yes

Troubleshoot	**No**	**No**	Yes	Yes	Yes
Teaching material	Yes	**No**	**No**	Yes	Yes
card decoration	Yes	Yes	Yes	Yes	Yes
for organised files and documents	Yes	**No**	**No**	**No**	**No**
art and craft	**No**	Yes	**No**	Yes	**No**
keep stamps together	Yes	**No**	Yes	**No**	**No**
Prim	Yes	**No**	**No**	**No**	Yes
Wrap around finger	**No**	**No**	Yes	Yes	Yes
tidy up your nail polish (get excess polish off your hands)	**No**	Yes	Yes	Yes	Yes
Vandalizing generally	**No**	Yes	Yes	Yes	Yes
Reminder	**No**	**No**	Yes	Yes	Yes
Build	**No**	**No**	Yes	Yes	Yes
Stretch it out and get food out of your mouth	**No**	Yes	Yes	Yes	Yes
Stick figures	Yes	**No**	Yes	Yes	Yes
Use on a tie for flex or cable	**No**	Yes	Yes	Yes	Yes
create artwork	Yes	Yes	Yes	Yes	Yes
smalll key ring	Yes	Yes	Yes	Yes	Yes

Table K-6: AUT ratings, Version F: Paperclip (N=183)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Fold out use to poke someone with	Yes	Yes	Yes	Yes	Yes
Fix broken zip fly	Yes	Yes	Yes	Yes	Yes
sharp edges	Yes	**No**	**No**	**No**	Yes
Lock opener	Yes	Yes	Yes	Yes	Yes
Colourful paperclips in a pot on office desk	**No**	**No**	**No**	**No**	**No**
Whisk	Yes	Yes	**No**	**No**	Yes
To put in your pocket for later	Yes	**No**	**No**	Yes	Yes
loose-able	Yes	**No**	**No**	**No**	Yes
Hole filler	Yes	Yes	Yes	**No**	Yes
decoration	Yes	Yes	Yes	**No**	Yes
in artwork	**No**	Yes	Yes	Yes	Yes
photo to a paper	**No**	**No**	**No**	**No**	**No**
To throw it in the bin	Yes	**No**	**No**	Yes	Yes
To throw at someone	Yes	Yes	**No**	Yes	Yes
kebab stick	Yes	Yes	Yes	Yes	Yes
cable tie	Yes	Yes	Yes	Yes	Yes
Tweezers	Yes	Yes	Yes	**No**	Yes
bending into shapes	Yes	Yes	**No**	Yes	Yes
use as counters	Yes	Yes	Yes	Yes	Yes
Use it for modeling clay	Yes	Yes	**No**	Yes	Yes
Key a car	Yes	Yes	Yes	Yes	Yes
convienence	**No**	**No**	**No**	**No**	**No**
attath photographs to cvs etc etc	Yes	**No**	**No**	Yes	**No**
hold money together	**No**	**No**	**No**	**No**	**No**
Get cockles out of a shell	Yes	Yes	Yes	Yes	Yes
Scratch something with	Yes	Yes	Yes	Yes	Yes
Attaching - as wire.	Yes	Yes	Yes	Yes	Yes

Rust	Yes	**No**	**No**	**No**	Yes
Put it onto clothing	Yes	Yes	Yes	Yes	Yes
artist might like to treat it as an object to be painted	Yes	Yes	Yes	Yes	**No**
People pincher	Yes	Yes	Yes	**No**	Yes
Coiling into a spring	Yes	Yes	Yes	Yes	Yes
Making a worm	Yes	Yes	**No**	**No**	Yes
Navigate	Yes	**No**	**No**	**No**	Yes
Hole punch	**No**	Yes	Yes	**No**	Yes
Novel nose ring	Yes	Yes	Yes	**No**	Yes
pen	Yes	Yes	**No**	Yes	Yes
ring	Yes	Yes	Yes	**No**	Yes
electrical wire	Yes	Yes	Yes	Yes	Yes
If your in need of a hole puncher use it	**No**	Yes	Yes	**No**	Yes
metal	Yes	**No**	**No**	**No**	**No**
Pick it	**No**	**No**	**No**	Yes	Yes
cufflinks	Yes	Yes	Yes	**No**	Yes
To “undo” the paper clip’s shape to reform into a hook and grab items faraway or unreachable	Yes	Yes	Yes	Yes	Yes
Bracelet chain of paperclips	Yes	Yes	Yes	Yes	Yes
tightrope for a mouse	Yes	Yes	Yes	Yes	Yes
Shoe decoration	Yes	Yes	Yes	**No**	Yes
clipping decorations up	**No**	Yes	**No**	**No**	**No**
Melt	Yes	Yes	**No**	Yes	Yes
Use as a magnet	**No**	Yes	**No**	Yes	Yes
nose clip	Yes	Yes	Yes	**No**	Yes
Bend it out and use it to tweeze it out	Yes	Yes	Yes	Yes	Yes
fishing hook	Yes	Yes	Yes	Yes	Yes
Bend it	**No**	**No**	**No**	Yes	**No**
pick you nose	Yes	**No**	Yes	Yes	Yes
keep work tidy	**No**	**No**	**No**	**No**	**No**
to vandalise a desk	Yes	Yes	Yes	Yes	Yes
Scratching words into something	Yes	Yes	Yes	Yes	Yes
To break a photo copier	Yes	Yes	**No**	Yes	Yes
people who work in offices use them	**No**	**No**	**No**	**No**	**No**
Stop a fan	Yes	Yes	**No**	Yes	Yes
use to hold christmas cards	Yes	Yes	**No**	Yes	**No**
teachers use them	**No**	**No**	**No**	**No**	**No**
coursework	**No**	**No**	**No**	**No**	**No**
Fix a faulty door catch	Yes	Yes	Yes	Yes	Yes
Spike	Yes	**No**	Yes	**No**	Yes
Making wire	Yes	Yes	Yes	Yes	Yes
Shoelace – to small shoes	Yes	Yes	Yes	**No**	Yes
door wedge	Yes	Yes	Yes	**No**	Yes
Pick something small clean	Yes	Yes	Yes	**No**	Yes
door pick	Yes	Yes	Yes	Yes	Yes
pin	**No**	Yes	Yes	**No**	**No**
Poke people with	Yes	Yes	Yes	Yes	**No**
hold objects together	**No**	Yes	**No**	Yes	**No**
scrape a small surface clean	Yes	Yes	Yes	Yes	Yes

Splinter remover	Yes	Yes	Yes	Yes	Yes
Ruler	Yes	**No**	Yes	**No**	Yes
maintain	**No**	**No**	**No**	**No**	Yes
clip paper together	**No**	**No**	**No**	**No**	**No**
Melt into a ball bearing	Yes	Yes	**No**	Yes	Yes
children can use them as things to make models and creative things out of	**No**	Yes	Yes	Yes	Yes
to throw	Yes	**No**	**No**	Yes	Yes
hang pictures	Yes	Yes	Yes	**No**	**No**
Opening plastic containers	Yes	Yes	Yes	Yes	Yes
Pierce things with it	**No**	Yes	Yes	Yes	Yes
bookmark	Yes	Yes	Yes	**No**	Yes
Play with magnet	Yes	Yes	**No**	Yes	Yes
keep items of clothing together	Yes	Yes	Yes	Yes	**No**
make statues	Yes	Yes	**No**	Yes	Yes
to keep work together	**No**	**No**	**No**	**No**	**No**
bend into useful shape	Yes	Yes	**No**	Yes	**No**
Tie a knot	Yes	Yes	**No**	Yes	Yes
Collect	Yes	**No**	**No**	**No**	**No**
Clip on baby strap	Yes	**No**	**No**	Yes	Yes
sketch	Yes	Yes	Yes	**No**	Yes
can be used as a good luck charm	Yes	Yes	**No**	Yes	Yes
to stand on	Yes	Yes	**No**	Yes	Yes
cuticle remover	Yes	Yes	Yes	Yes	Yes
wire arts	Yes	Yes	Yes	**No**	Yes
Use as a paperclip! J	**No**	**No**	**No**	**No**	**No**
Scratch graffiti	Yes	Yes	Yes	Yes	Yes
keyboard cleaner	Yes	Yes	Yes	Yes	Yes
Make a spring	Yes	Yes	Yes	Yes	Yes
removable	Yes	**No**	**No**	**No**	**No**
Cleaning	Yes	Yes	**No**	**No**	Yes
clipping things to walls	**No**	Yes	Yes	Yes	**No**
Play with	Yes	Yes	**No**	Yes	Yes
schoolery object	Yes	**No**	**No**	**No**	**No**
make a mast for car radio	Yes	Yes	Yes	Yes	Yes
wind chimes	Yes	Yes	Yes	Yes	Yes
Artistic tool for creating scratches in surfaces	Yes	Yes	Yes	Yes	Yes
to undo hand cuffs	Yes	Yes	Yes	Yes	Yes
make into the shape of a snail	Yes	Yes	**No**	Yes	Yes
Make a hole in something	Yes	Yes	Yes	Yes	Yes
small	Yes	**No**	**No**	**No**	Yes
necklace pendant	Yes	Yes	Yes	Yes	Yes
Make a little man	Yes	Yes	**No**	Yes	Yes
push something out of small space	Yes	Yes	Yes	Yes	Yes
if pulled apart, it can be used as a sharp object to presss the reset button for example	Yes	Yes	Yes	Yes	Yes
hang things from	**No**	Yes	Yes	Yes	**No**
Wire	Yes	Yes	**No**	**No**	**No**
magnet	Yes	**No**	**No**	**No**	Yes

closing a bag	Yes	Yes	Yes	Yes	**No**
Break into car	Yes	Yes	Yes	Yes	Yes
To fill in a gap in a scratch on car paintwork	Yes	Yes	Yes	Yes	Yes
to use	**No**	**No**	**No**	Yes	**No**
teasing someone	Yes	**No**	Yes	Yes	Yes
Pierce a hole	Yes	Yes	Yes	Yes	Yes
Modern art	Yes	Yes	**No**	**No**	**No**
so nothing gets lost	**No**	**No**	**No**	**No**	**No**
To scoop tiny items into a lump	Yes	Yes	Yes	Yes	Yes
use-maker for idle hands	Yes	Yes	**No**	**No**	Yes
Button hole holder	Yes	Yes	**No**	Yes	Yes
Use it to join a ripped piece of clothing back together	Yes	**No**	**No**	Yes	**No**
crankshaft	Yes	**No**	**No**	**No**	Yes
belt	Yes	Yes	Yes	**No**	Yes
reshape to hand childrens mobiles on	Yes	Yes	Yes	Yes	Yes
Scratch an itch	Yes	Yes	Yes	Yes	Yes
Hold things together	**No**	**No**	**No**	**No**	**No**
Control	**No**	**No**	**No**	**No**	Yes
fixing your shoe laces	Yes	Yes	Yes	Yes	Yes
Reset button activator	Yes	Yes	Yes	Yes	Yes
Cleaning tiny holes	Yes	Yes	Yes	Yes	Yes
decoration on clothes	Yes	Yes	Yes	Yes	Yes
Strong bendy material to hold things together (like cable tie)	Yes	Yes	Yes	Yes	**No**
guess how many in jar	Yes	Yes	**No**	**No**	Yes
scratch something–	Yes	Yes	Yes	**No**	Yes
Trouble	Yes	**No**	**No**	**No**	Yes
Fold out use as a key	Yes	Yes	Yes	Yes	Yes
Hook	Yes	**No**	Yes	Yes	Yes
Generate electricity	Yes	Yes	**No**	Yes	Yes
separate	**No**	**No**	**No**	**No**	Yes
Bend it and use it as stress relief	Yes	Yes	Yes	Yes	Yes
Unblocker	Yes	Yes	**No**	Yes	Yes
Jewellery	Yes	**No**	Yes	Yes	Yes
Safety pin	**No**	**No**	**No**	Yes	**No**
customise clothes	Yes	Yes	Yes	Yes	Yes
Nail file	Yes	Yes	**No**	**No**	Yes
Draw into (i.e. wood)	Yes	Yes	Yes	Yes	Yes
Broach	Yes	Yes	Yes	Yes	Yes
Make a picture with loads	Yes	Yes	Yes	Yes	Yes
pinned	**No**	**No**	**No**	**No**	Yes
to decorate	Yes	Yes	Yes	Yes	Yes
Projectile	Yes	Yes	**No**	**No**	Yes
Picking up little bits of paper	Yes	Yes	**No**	Yes	Yes
Pierce your body	Yes	Yes	Yes	Yes	Yes
Object used for art and craft	Yes	Yes	Yes	Yes	Yes
Toggle for a zip	Yes	Yes	Yes	Yes	Yes
Make a sound (noise)	Yes	Yes	**No**	Yes	Yes
Connect an electrical board thing	Yes	Yes	Yes	Yes	Yes
keep things in place	**No**	Yes	**No**	**No**	**No**

Clothes decoration	Yes	Yes	Yes	Yes	Yes
toys	Yes	**No**	**No**	Yes	Yes
Book incert	Yes	Yes	Yes	**No**	Yes
room decoration	Yes	Yes	**No**	**No**	Yes
Measure the distance of something	Yes	Yes	Yes	Yes	Yes
to sell	Yes	**No**	**No**	Yes	**No**
To pierce lips	Yes	Yes	Yes	Yes	Yes
To make something e.g. stick on paper with something else to create a design	Yes	Yes	**No**	**No**	Yes
Fixing electrical break	Yes	Yes	Yes	Yes	Yes
exams	**No**	**No**	**No**	**No**	**No**
use them in schools and college and university and home	Yes	**No**	**No**	**No**	**No**
Spring	Yes	Yes	Yes	**No**	Yes

Table K-7: AUT ratings, Version G: Remote Control (N=172)

Response	**J1**	**J2**	**J3**	**J4**	**J5**
Medallion	Yes	Yes	**No**	Yes	**No**
Push something with it	Yes	Yes	Yes	Yes	Yes
Put it to bed	**No**	**No**	**No**	Yes	**No**
Plane ticket	**No**	Yes	Yes	Yes	**No**
Trip someone up	Yes	Yes	Yes	Yes	Yes
Recycle it	**No**	**No**	Yes	Yes	**No**
Operate remote controlled toy	**No**	**No**	**No**	**No**	**No**
Air conditioning control	**No**	**No**	**No**	**No**	**No**
Use toilet cistern to displace water and use less water when flushing	Yes	**No**	Yes	Yes	**No**
Propping up window	Yes	Yes	Yes	Yes	**No**
Play space games	Yes	Yes	**No**	Yes	Yes
See how far you can throw it	Yes	**No**	Yes	Yes	Yes
Itch your back	Yes	Yes	Yes	Yes	Yes
Garden fork	Yes	Yes	Yes	Yes	**No**
Weight	Yes	Yes	Yes	Yes	**No**
Smash it	**No**	**No**	Yes	Yes	Yes
Take all the batteries	**No**	**No**	Yes	Yes	Yes
Window blinds	**No**	**No**	**No**	**No**	**No**
Put under table leg to make it steady	Yes	Yes	Yes	Yes	**No**
Hot air	**No**	**No**	**No**	**No**	**No**
Object for hide and seek	Yes	Yes	Yes	Yes	Yes
Mark the centre point between two piles of videos	Yes	**No**	Yes	Yes	Yes
Bat	Yes	Yes	Yes	Yes	Yes
Hat	Yes	Yes	Yes	Yes	**No**
Fix wonky table	Yes	Yes	Yes	Yes	**No**
Control radio	**No**	**No**	**No**	**No**	**No**
To hold something up	Yes	Yes	Yes	Yes	**No**
Phallic measuring device	Yes	Yes	Yes	Yes	**No**
Fetch with a dog	Yes	**No**	Yes	Yes	**No**
Take out batteries for another use	**No**	**No**	Yes	Yes	Yes

Imaginary controller for mass machine	Yes	Yes	Yes	Yes	Yes
Bash someone	Yes	Yes	Yes	Yes	**No**
Throw at someone	Yes	Yes	Yes	Yes	Yes
Off TV	**No**	**No**	**No**	**No**	**No**
Weapon	Yes	Yes	Yes	Yes	**No**
Open it up	**No**	**No**	Yes	Yes	**No**
Decorate as an ornament	Yes	**No**	Yes	Yes	**No**
Kick it	**No**	**No**	Yes	Yes	**No**
Stop	**No**	**No**	Yes	**No**	**No**
Dig a hole with	Yes	Yes	Yes	Yes	**No**
Baby toy	Yes	Yes	Yes	Yes	**No**
Laptop	**No**	**No**	**No**	**No**	**No**
Start a dvd	**No**	**No**	**No**	**No**	**No**
Painter	**No**	Yes	Yes	Yes	**No**
Control light	**No**	**No**	**No**	**No**	**No**
Jump on it	**No**	**No**	Yes	Yes	**No**
Turn on TV	**No**	**No**	**No**	**No**	**No**
Source of light	**No**	Yes	**No**	Yes	**No**
Steer toy car/boat/plane	Yes	**No**	**No**	**No**	**No**
Add to headband as a new accessory	Yes	Yes	Yes	Yes	**No**
Vase	**No**	Yes	**No**	Yes	**No**
Down	**No**	**No**	**No**	Yes	**No**
Break a window	Yes	Yes	Yes	Yes	Yes
Find it	**No**	**No**	Yes	Yes	**No**
Put on a table	**No**	**No**	Yes	Yes	**No**
Phone	Yes	Yes	**No**	Yes	Yes
Emergency battery holder	**No**	**No**	Yes	Yes	**No**
Cooling between legs (as a propping out device)	Yes	Yes	Yes	Yes	**No**
See if it floats in a pond	Yes	**No**	Yes	Yes	**No**
Switch to keep your hands busy	**No**	**No**	Yes	Yes	Yes
Cold air	**No**	**No**	**No**	**No**	**No**
Use as a prop in a play	Yes	Yes	Yes	Yes	Yes
Use the batteries	**No**	**No**	Yes	Yes	Yes
To mute my sister	**No**	Yes	**No**	Yes	**No**
Remover of things when not able to reach	Yes	Yes	Yes	Yes	**No**
Control amplifier	**No**	**No**	**No**	**No**	Yes
Paperweight	Yes	Yes	Yes	Yes	**No**
Store it	**No**	**No**	Yes	**No**	Yes
Learning/teaching to calculate	Yes	Yes	Yes	Yes	Yes
Gates	**No**	**No**	**No**	**No**	**No**
Excuse not to turn the telly off – as in "this remote control ain't working"	**No**	**No**	**No**	Yes	**No**
Take to the shop to remember it and buy a new one	Yes	**No**	Yes	Yes	**No**
Prop something up	Yes	Yes	Yes	Yes	Yes
To wear as shows – with elastic bands	Yes	Yes	Yes	Yes	**No**
Radio	**No**	Yes	**No**	**No**	**No**
Decoration	Yes	Yes	Yes	Yes	**No**
Play duration	**No**	Yes	Yes	Yes	Yes
Car alarm	**No**	**No**	**No**	**No**	**No**

Projector	**No**	Yes	**No**	**No**	**No**
Control curtains	**No**	**No**	**No**	**No**	**No**
Play phone	Yes	Yes	Yes	Yes	Yes
Ipod	**No**	Yes	Yes	Yes	**No**
Play catch	Yes	Yes	Yes	Yes	Yes
Break it when you are angry	**No**	**No**	Yes	Yes	Yes
Use the parts to make something else	Yes	Yes	Yes	Yes	**No**
Pretend play with e.g. use buttons as zapping	Yes	Yes	**No**	Yes	Yes
Cup holder or glass	Yes	Yes	Yes	Yes	**No**
Garage opener	**No**	**No**	**No**	**No**	**No**
Take apart and use the batteries	**No**	**No**	Yes	Yes	**No**
Throw it for a game	Yes	Yes	Yes	Yes	Yes
Swat flies with	Yes	Yes	Yes	Yes	Yes
Throw to a dog!	Yes	**No**	Yes	Yes	**No**
Decorate it	**No**	**No**	Yes	Yes	**No**
Microwave it	**No**	**No**	Yes	Yes	**No**
Break an egg	Yes	Yes	Yes	Yes	Yes
Play a tune – bang on table	Yes	Yes	Yes	Yes	Yes
Gear knob	Yes	Yes	**No**	Yes	**No**
Pretend it has magical powers	Yes	Yes	Yes	Yes	Yes
Book-end	Yes	Yes	Yes	Yes	**No**
Sculpture	Yes	Yes	Yes	Yes	**No**
Take to the remote control repair shop	**No**	**No**	Yes	Yes	**No**
Wedge a door open	Yes	Yes	Yes	Yes	**No**
Weighing something down with it	Yes	Yes	Yes	Yes	**No**
Toy aeroplane	Yes	Yes	Yes	Yes	Yes
Throw it	**No**	**No**	Yes	Yes	Yes
Use the batteries for something else	**No**	**No**	Yes	Yes	Yes
Electronics – take it apart, put it back together	Yes	**No**	Yes	Yes	**No**
Control DVD	**No**	**No**	**No**	**No**	**No**
Lights	**No**	**No**	**No**	**No**	**No**
Stand on for height	Yes	Yes	Yes	Yes	**No**
Teach it to ride a bike	**No**	**No**	**No**	Yes	**No**
Stress pad	Yes	Yes	**No**	Yes	**No**
Put spiky objects in buttons	**No**	**No**	Yes	Yes	**No**
Propping up door	Yes	Yes	Yes	Yes	**No**
Let your dog chew it	Yes	**No**	Yes	Yes	**No**
Disguise it	**No**	**No**	Yes	Yes	Yes
Wrap it up	**No**	**No**	Yes	Yes	**No**
Throw it in a lake	**No**	**No**	Yes	Yes	**No**
Sprinklers	**No**	Yes	**No**	**No**	**No**
Use parts to replace parts of another remote control	**No**	**No**	Yes	Yes	**No**
Eat it	Yes	**No**	**No**	Yes	**No**
Throw during fights	Yes	Yes	Yes	Yes	Yes
Block the view of a flashing light (video…)	Yes	Yes	**No**	Yes	Yes
Footrest	Yes	Yes	Yes	Yes	**No**
Throw it at a ball, that is stuck in the tree	Yes	Yes	Yes	Yes	**No**
Something to fiddle with	Yes	**No**	Yes	Yes	Yes
Make a hole in something	Yes	Yes	Yes	Yes	**No**

Transport food on	Yes	Yes	Yes	Yes	**No**
Throwing it at someone	Yes	Yes	Yes	Yes	Yes
Steal batteries from	**No**	**No**	Yes	Yes	**No**
Use as a support for something	Yes	Yes	Yes	Yes	Yes
Build with it	Yes	Yes	Yes	Yes	**No**
Close garage	**No**	**No**	**No**	**No**	**No**
Stir a broth/soup	Yes	Yes	Yes	Yes	**No**
Sell it	**No**	**No**	Yes	Yes	**No**
Pretend it's a remote for something else	**No**	**No**	Yes	Yes	Yes
Burn it	**No**	**No**	Yes	Yes	**No**
Games console	**No**	**No**	**No**	**No**	**No**
Teach a child numbers	Yes	Yes	Yes	Yes	Yes
Calculator	**No**	Yes	Yes	Yes	Yes
Percussion instrument	Yes	Yes	Yes	Yes	**No**
Batteries used for control	**No**	**No**	**No**	Yes	**No**
Throw at TV	Yes	Yes	Yes	Yes	**No**
Pretend to type on buttons	Yes	Yes	Yes	Yes	Yes
Have it by your side	**No**	**No**	Yes	Yes	Yes
With two remote controls: add straps and wear as fancy shoes	Yes	Yes	Yes	Yes	**No**
Get something from behind a radiator	Yes	Yes	Yes	Yes	**No**
Control car keys/lock	**No**	**No**	Yes	**No**	**No**
Hit it against something to make music	Yes	Yes	Yes	Yes	Yes
Hurting someone	Yes	Yes	Yes	Yes	Yes
Doorstop	Yes	Yes	Yes	Yes	Yes
Tray	Yes	Yes	Yes	Yes	**No**
Pretend to control someone	Yes	Yes	Yes	Yes	Yes
Pretend it is a weapon e.g. put in carrier bag to scare people?	Yes	Yes	Yes	Yes	**No**
Pretend it's a phone	Yes	Yes	Yes	Yes	Yes
Change channel	**No**	**No**	**No**	**No**	**No**
Put in under a wonky chair leg so it doesn't move	Yes	Yes	Yes	Yes	**No**
Treasure it	**No**	**No**	Yes	Yes	**No**
Bookmark	Yes	Yes	Yes	Yes	**No**
Toy light beam	**No**	Yes	Yes	Yes	**No**
Do an experiment using remote controls	**No**	**No**	Yes	Yes	Yes
Take it back to the shop	**No**	**No**	Yes	Yes	**No**
Break something with	Yes	Yes	Yes	Yes	Yes
Detonator	Yes	Yes	Yes	**No**	**No**
Fast forward	**No**	**No**	**No**	**No**	**No**
Dog toy	Yes	Yes	Yes	Yes	**No**
Bury it	**No**	**No**	Yes	Yes	Yes
Throw to get someone's attention	Yes	Yes	Yes	Yes	Yes
Pendant on a necklace	Yes	Yes	**No**	Yes	**No**
Knee rest	Yes	Yes	Yes	Yes	**No**
Ballast	**No**	Yes	Yes	Yes	**No**
Draw on	Yes	**No**	Yes	Yes	Yes

No new data was collected for Remote control versions of the AUT as levels of reliability were already high.

Appendix L – Experiment Eight – Survey Lists (Versions 1 – 9)

Version 1 – BRICK

A bookholder
A tool to break things with
Abuse
Add weight to a handbag to use as a weapon
Analysing
Apply pressure to another object
Art work
Artistic purposes
As a door stop
As a nail file
As a nutcracker
As a paper weight
as a stool
As a weapon of defense
As rollerblades
As shoes
As weight for light objects like paper
Balance it on your head
Be a character in anchorman
Book stop
Bookshelves
Break a window
Break into a house
Break it into pieces
Break something
Break something with it
Break window or door
Break windows
Breaking & entering. Lol
Breaking things with
Breaking to sand
Build
Build a barbecue
Build a car
Build a conservatory
Build a fireplace
Build a house
Build a staircase
Build a tower
Build a wall
Build blocks
Build chimney
Build houses
Building
Building a fence
Building block

Burn it
Bury
Carving on a wall
Catch it
Chair
Children to walk straight on
Clean a car with
Climb on
Cook stool
Cover a small crevase
Crack open a nut
Create a mosaic
Crumble into pieces
Crush it to make powder
Cuddle it
Damage something
Dance on one
Dashing for a house
Decorate it using paint for example and have it as an ornament in the hosue
Decorate something with it?
Decorating the garden with
Decoration
Do a painting on it
Do step up exercises
Door stopping
Draw graffiti on
Draw on it
Dress it up
Dress it up as a baby
Drop on someone's foot
Eat off it
Eat on it
Eating
Even out an uneven table
Extreme juggling
File something with
File your nails
Fill a gap
Floor
Flower box (the holes in the brick)
Foot stool
Football/ball
For a flower pot
For painting
For throwing
For tracing a block
For use of punishment
For your dog to fetch
Give money to someone on it
Gym weights

Hammering in a nail
Heated up as a hot stone in bed
Hiding a key under
Hiding something under
Hit over the head
Hit people
Hit someone
Hit someone on the head
Hitting a car
Hitting people with
Hold a door open
Hold down things on the floor
Hold it in the air
Hold something down with
Hold the door
Holding
Holding something level
Hop on
Hot & cold game > hide it
House
Hurdles
Hurt overs with (weapon)
Hurt your ex boyfriend with it!
If you have fight with someones, you will get and hit them
In a game
Information scanning
Instrument (banging together)
Juggling
Jump on
Keep a window open
Keep a wobbly table level
Keep car on a council estate front drive
Keys holder
Kick it
Kill
Kill birds
Kill bugs with
Kill someone with it

Version 2 – BRICK

Killing a spider with
Knock someone out
Lay a floor
Laying down on the floor
Lean on
Leg of a sofa
Lego brick to play with
Lick it
Lifting weights
Looking at
Loving
Lug it
Make a box in your room so you can put your box in it
Make a den
Make a dent in something
Make a mark (permanent one)
Make a play course thingy
Make an artistic model
Make furniture such as table and chairs
Make one out of sand
Make oxo cubes
Making a noise with (banging together)
Making a pattern in a rockery
Making a wax rubbing on to get a pattern
Making friends with
Making something higher
Mark out a distance
Marrying (I'm sure its legal in some US states)
Mass producing
Melting
Mock how cultured someone is
Murder weapon
Muscle-builder
Open bottles with it
Opening something
Ornaments
Outline an area
Paint a brick
Paint it
Paint it and print rectangles
Phone holder
Photo project - take photos of it
Pick up and place on somewhere
Picking up
Pile on top of each other to make platform
Pile up to use as doorstop
Placed on top of sheets to stop them blowing away
Placing down

Plant seeds in it
Plate
Play catch with
Play with
Play with by building
Pot
Practising kung fu
Pretend it's a bar of chocolate
Pretend to be a turtoise
Pretend to skateboard
Probe people with
Prop a car up that doesn't have a wheel
Prop door open
Prop up a chair with one leg shorter
Propping up an object
Protection
Pump muscle
Punching
Push it down some stairs
Put behind car wheels to stop rolling backward
Put face paints on it
Put in the bath to stop water going down drain
Put it behind a car wheel
Put it in a bin
Put it in a sock to hit someone
Put it in my pocket
Put it in the garden for bugs to live under
Put it in your bag and carry it around
Put it on a table
Put it under an unstable piece of furniture
Put it under someones tyre to ruin their car
Put on head
Put on top of each other and use as stool
Put pens on it
Put them on top of each other and stand on them
Put under a table leg
Put under wheel of a car to stop it moving (when on a hill)
Putting in a football and asking someone else to header it
Rebuilding after destroying
Rest objects on it
Resting your drink on it
Resting your phone on it
Robbery
Rubbing you back
Run with it
Scrap
Scratching on concrete like chalk
Sculpture
Sharpen knife
Shelf

Short person to stand on when kissing a taller person
Shot put practice
Sit on it
Smash
Smash + grind it into sand
Smash a window
Smash it
Smashing a car
Smashing it through the car window
Smelling
Sniff (powder)
Socialising with (definitely funny)
Something to sit on
Spoon
Squash bugs
Stacking them up
Stand
Stand on (as a stool)
Stand on it
Stand on to be taller
Stand things on
Step
Step aerobic exercise
Stop a car from reversing down a hill when its broken down
Stop a car from rolling forwards/backwards
Stop a door from closing
Stop a piece of paper/door
Stop an uneven object wobbling
Stop something blowing away
Stop things from flying away
Stopping wheels moving
Swim down to the bottom of a swimming pool and get the brick
Table
Talking with
Threaten people with
Throw at a car

Version 3 – BRICK

Throw at a computer
Throw at a person
Throw at a window
Throw at someone
Throw at someone's face
Throw in the air
Throw in the bin
Throw it
Throw it at an object
Throw it at someone
Throw it at someones head
Throw it at someones head I hate
Throw it through a window
Throwing on the floor
To bait
To bang together to make a noise
To block an entrance or pathway for a dog/cat
To break a glass window in fire emergency
To break up
To build a door
To build a wall for your plants (brick layered one)
To camaflage
To colour on
To create a boundary
To crush things, e.g. food/garlic etc.
To dance on
To draw with
To flatten something
To get a colour match for paint
To get and hit an ant
To hide something under
To hit your wife with
To hold
To hold something up with
To hurt someone with
To injure a human/animal
To keep as a memory
To knock on someone's door
To lean against something
To light a match
To make big letters for the helicopters
To make brick print/indent
To make shapes with
To pick up
To play jenga with
To practice walking with a straight back
To print
To put your cigarettes out on

To raise something off the ground
To scratch a surface
To sculpt something with it
To sing to
To sink it in water
To smack someone with
To smash an item
To smash on someones head
To squash a bug
To squash something with
To stab into
To stand on to reach something
To stick together
To stop a person entering in a gate by placing it behind a door
To stop something rolling
To stump your foot on
To take out clubbing
To throw
To throw as a game
To try and balance on one leg sideways
To use a weight
To use as a hat
To use as a ruler
To use as shape to draw something
To use as weights in a gym
To use in a piece of artwork
To use to lean on
To wear as a shoe
To wedge open a door
To write on
Touching
Use as a bat to hit something else
Use as a hammer
Use as a hammer like object (heavy)
Use as a phone
Use as a piece of sports equipment (bat)
Use as a stop for car
Use as a stress ball
Use as a teddy bear at a tea party (fun)
Use as a toy
Use as an alternative to a hammer
Use as confetti
Use as mosaics
Use as platform shoes
Use as real-life lego
Use as replacements for conkers
Use as show n tell
use as stilts
Use for art sculptures
Use it as a height lifter

Use it as a rugby ball
Use it as a shot put
Use it as a stall - sit on it
Use it for a game e.g. who can balance on it for the longest time
Use to break glass
Use to break things such as window
Use to crush a spider
Use to draw on
Use to make dust if you rub two together
Use to make stairs
Use to make things
Use to stand on
Use to weigh someone/something down
Use under car with busted tyre
Use with scales (measuring weight)
Using as a counterweight on scales
Using as a prank
Using as a weight to exercise with
Using it to draw
Using them to block a leak up on the wall
Vandalise
Vandalize a shop
Violence
Wall - make it
Wall hangings/posters
Weapon
Weapon/assault item
Wear it as a hat
Wedge a door open
Wedge something into place
Weigh something down or make it heavy
Weight for measuring
Weight training
Weight your shoes down
Wrap it up in paper to make a fake present under the christmas tree
Write on it
You will get in and put in yout room to put your phone on top of it

Version 4 – REMOTE CONTROL

(Tennis) racket
A bat
A bat to hit stuff
A bookend
A gun for a kid to play with
A piece of art to be drawn
A pointing device
A poking device
A prop
A prop to do piggy in the middle
A ruler
A shoe horn to help you put your shoes on
A toy for a kid
A voice remoted device
A walking stick
A weapon
An instrument to tap on a table
An object to throw at someone
An object used to prop up a bookshelf
Artwork
As a book mark
As a dog toy
As a gun
As a pointer
As a teleport machine
As a tray
As an aid to get something from under the sofa
Baby pretends it's a mobile phone
Back scratcher
Balance it on your head
Bath toy
Battery storer
Batton
Book case divider
Boredom reliever
Build a remote control house, to keep tv in
Build train track
By having an emotion feeling device that sense you for what you feel
Childrens pretend phone
Childs toy
Chuck at someone
Cooking utensil
Could use it to eat
Decoration?
Dongle prop
Door opener
Door stop
Doorwedge

Draw around it
Drink coaster
Eat dinner with
Eat it
Eat off it
Fan
Fly swatter
Food/drink stirrer
Frame it and put it on the wall
Frisby
Golf club
Hair brush
Hair brush (buttons stick out)
Hammer
Head scratcher
Hide it + play a game to find it for someone else
Hit brother with it
Hit bug
Hit people
Hit people with
Hit people with it
Hit someone
Hit someone on their head
Hit someone who is naughty
Hit someone with it
Hit the dog or cat
Hitting people
Hold cups on
Hold papers down
Infra red device
Juggle it
Kitchen utensil ie. Flatten meat
Knock someone out
Laser beam (Infrared)
Learning about electronics
Make calls
Making noise by hitting it
Measure something
Melting
Microphone
Mobile phone
Mobile phone (toy)
Morris dancing stick
Move things arounf (push)
Ornament
Paperweight
Pick it up, wack the fire alarm button for emergency fire
Ping pong bat
Place it on a stand as a trophy
Place on top of t.v

Place to store batteries
Place under a short chair or table leg to prop it up
Play catch
Play catch with it
Play fetch with pet
Play football
Play football with it
Play spin the bottle with it
Play tennis with it
Play throwing & catching
Play toy car
Playing a game (if you have the control you can speak)
Playing football
Playing it like an air-guitar
Poke someone with it

Version 5 – REMOTE CONTROL

Poker
Practical joke
Press the buttons
Pretend it's a phone
Pretend keyboard
Pretend microphone
Pretend that it is a telephone
Propping up books
Pull of all the button no one can use it
Put in pocket
Put in someone's mouth to shut them up
Put it in a fish bowl to get your own back
Put it in between 2 double doors so they cannot open (lock)
Put it on a table, shelf, bed, pillow, bath tub.
Put under table for balance; if the table's wobbly
Racket
Racquet
Rattle
Scratch back
Sex toy
Shoe horn
Shoe stretcher
Sing into it
Sing to it
Sit on it
Sleep with it
Small storage space
Small training calculator
Something to bite
Something to hold a cupboard open with
Space ship key
Spin it around
Spoon
Squish something
Stamp on it for stress relief
Stand something up with
Steal batteries from
Stirring stuff
Switch people off
Table wedge
Take the batteries out the back and use it for something else
Tap it on hand for being naughty
Teaching numbers and or colours
Throw at cat
Throw at the TV
Throw it
Throw it at someone
Throw it out the window towards an annoying cat

Throw it to someone
Throw it up in the air and catch it
Throw out of a window, at a pidgeon
Throwing
Throwing object
Tie it up as a clip
Time machine
To break glass with
To break it
To dip the button side in painr and print on paper to make spotty patterns
To flip food in a pan
To get dry skin off feet
To hide it
To hit someone in the face with
To hit things
To hold the pages of a book open
To keep a door ajar
To keep the page in a book
To kick it like a football
To move something closer to you
To pretend it's a microphone when singing
To set fire to it
To smash things with
To stir food
To switch on the radio/computer
To test batteries
To throw is across the room
To use as a cricket bat
To use as a tool
To use in remote football (as a ball)
To use it as a phone when imitating someone
To use the back
To use the parts
To wedge a door open
To weight down paper
Torch?
Toy
Toy gun
Try to turn some 'off'
Use as a ball (catch + throw +kick)
Use as a bat (hitting a ball)
Use as a coaster
Use as a cuddly toy
Use as a drumstick
Use as a prop, e.g. plane
Use as decoration
Use batteries - steal them
Use for the microwave
Use it as a makeshift bludgeoning weapon
Use it as a satellite-ariel

Use it as a spoon
Use it as a toy car
Use it as a toy plane
Use it instead of a brick to break a window
Use it to hammer a nail into a wall
Use on a stack of paper
Use the numbers for help with maths
Use to hold up door
use to scratch back
Use to stop the door
Using it as part of a treasure hunt, hide and seek
Using it to reach for something you can't get
Weapon for bashing
Weapon to hit someone with
Weight lifting if your weak

Version 6 – PAPERCLIP

A hair piece
A tasty treat
Amunition for a slingshot
Art
As a decoration twirled around a pencil
As a peg for washing
As a piece of jewellery, i.e. necklace pendant
Babe top make
Badge
Belly bar
Bend it
Bending it to make shapes
Bracelet
Broach
Carrying into table etc.
Chain for neck
Clean fingernails
Clean your teeth with
Clip hair back
Clip on clothes
Clip together to make chains
Clip your finger
Clip your lip
Conductor - in a electric circuit
Create a game
Decoration
Earring
Fashion
Flick at someone
For decoration on painting (to glue them on)
Get something out of a small hole
Getting into small places i.e. taking out a phone sim card
Getting through doors
Hair band
Hair clip
Hair pin
Hair slide
Hair tie
Hold a rip in your trousers togeher
Hold back hair
Hold hair in place
Hold hair together
Hold things together
Hold two pieces material (clothes) together
Holding glasses together
I would use it to help me to find the page I stopped reading in my book
Instead of a safety pin
It can be used as a blunt needle (hospital)

Jewellery
Join a few of them to create something artistic
Keep cash together
Key
Key - to pick locks
Key (to open locks)
Kill someone
Made into chains
Magnet
Make a 'S' if you unfold it
Make a bracelet
Make a chain - necklace
Make abstract art
Make art craft
Make at class?
Make it straight
Make paperclip chains
Make paperclip models
Making a hole in something
Making jewellery i.e. chain
Making little ball type thing to throw into a river or something
Modern art
Mould into a sculpture
Nail cleaner
Necklace
Necklace (multi paper clips)
Nose clip
Open a difficult object (e.g. get the back off a phone)
Open a padlock
Open something that's difficult to open
Phone wand
Pick a lock
Pick your nails
Picking your teeth
Pierce an object
Pierce holes in object
Play with it
Poke someone with
Poking someones eye out
Pop balloons
Pull back your hair
Put clothes together
Put in your hair
Remodel & use as a piece of art
Removing tiny objects from under skirting board
Replacement zipper for a coat
Reset a watch
Reset something e.g.phone
Ring
Rope; attaching many together

Scrape off things
Scratch & graffiti on desks
Scratch something in to metal
Scratching
Self harm
Sexual pleasure
Shape in to pretty objects and hang up for decoration
Shape it into a stencil
Skipping rope (multiple paper clips)
Stab someone
Stab someone in the eye
Stick on a magnet
Straighten first and then to prick something (i.e. make a hole)
Stretch it out and poke someone
Stretch it out and use as a toothpick
Thread a needle
Throw at people
Throw at someone
To be used as a weapon - poke someone in the eye
To check magnetic fields
To chew
To conduct electricity
To do artwork - crayon + paint affect, i.e. scratch it in
To get dirt from fingernails
To get dirt from the bottom of your shoe
To get hair out of a plug hole
To hold clothes together
To hold things in place
To open and use as a thin pin
To open the sim card slot on the iphone 4
To pick up small objects
To pick your nose
To pierce your ears
To pinch things
To play with when bored
To press reset on digital devices
To reset something electronic e.g. a small toy (tamagotchi)
To reset things
To scratch a scratchcard
To scratch objects
To scratch someone
To scratch something
To scratch your body
To stick
To take dirt out of small spaces
To use as a spring as part of a funny toy
To use instead of a safety pin on clothes: to hold them together
To wear as an earring
Tongs for hair
Toothpick

Toy-bend it
Undo a lock
Unscrew something
Use as a fishing hook in magnet fishing
Use as an instrument
Use in your hair
Use to design a dress
Use with a magnet
Using a magnetic force to flow current through
Weapon
Weapon - go for the eyes
Weapon - poke someone in eye
Weapon (Sharp when unravelled)
Write messages in playdough, clay…
Write words on table
Zipper attachment

Version 7 – NEWSPAPER

A ball
A paper manual fan
A pulling toy for dog
Aeroplane
Art
Arts and crafts
Artwork
As a blanket
AS a curtain to block sunlight
As a mat to wipe your feet
As a paper plane
As a sheild
As stuffing for a doll
As wallpaper
As wrapping paper in pass the parcel
Basketball
Bin liner
Block your windows
Blow it
Blow your nose on it
Build a house
Burn it
Carry fish and chips
Castle
cat No1 area
Cheap reading material
Chip paper
Chips bag
Chuck it out a window
Clean laptop
Clean the floor
Cleaning windows
Clothing
Collage
Colour it
Confetti
Cool it
Cover
Cover adult material secretly
Cover head when raining
Cover your eyes from the sun
Cover your hair when it's raining
Covering floor to catch paint!
Covering hole in a window
Crosswords
Cut it
Cut out letters
Cut out letters to make notes

Cut pictures out
Cut to use letters as a ransom/anonymous note!!!
Decorate
Dog no1 area
Dog training mat
Doodle on
Door wedge
Doorstop
Draw faces on pictures
Draw it
Draw on
Dust bedroom
Dustbins
Eat fish + chips from
Eat it
Eat off of
Fan
Fan if hot
Fan yourself
Fire kindling
Fish & chip holder
Fish + chips
Flick it
Flower pot cover
Flush it
Folded as a door wedge
Football
For something to carry
For toilet paper
Get view on the difference between tabloid and journalism
Gift wrapping paper
Greaseproof paper
Hang it on the line
Hat
Hate mail
Hide behind
Hide it
Hit a fly
Hit annoying animals
Hit annoying people
Hit it
Hit on the head
Hit people with
Hit someone
Hit someone on the head
Hit someone with
Hit someone/something
Hit spiders
Hitting people
Hold chips

Hold objects
Imaginary sword fight
Insulation
Insulation from cold
Keep as a collection
Keep out of rain/use as umbrella
Kiling a fly/wasp/insect etc
Kill insect
Kill rats/pests
Lay down on floor to protect carpet from paint
Light a fire
Litter tray liner
Look for errors
Made into a kite
Make a collage
Make a fan out of it to cool yourself
Make a paper boat
Make a sword
Make funny objects
Make into a hat

Version 8 – NEWSPAPER

Make into hat for fancy dress
Make it as a mat for picnic
Make it into a boat/hat
Make paper aeroplanes
Make paper dolls
Make proper chain
Make swans
Makeshift cup
Making paper shapes/snowflakes + rows of people
Mask
Mat
News update
Open a window
Oregami material
Origami
Paper airplaine
Paper ball for the cat
Paper hat
Paper mache
Paperball fight
Paperchain
People's opinions on popular topics
Pet bedding
Pick up insect to throw out of room
Pictures of celebrities
Pillow
Plate
Play paper toss
Poke it
Protect carpet from paint
Protect glasses when moving
Protect the floor
Pull it
Punish the dog
Put arts + crafts on
Put food in it
Put it down to cover mess
Put on a damp chair to sit down
Put on spilt things/liquids
Put on table to stop mess
Put over head when raining
Read
Recycle
Recycle to save the planet
Replaces toilet paper
Research
Rip it
Rip it into tiny pieces and stick them on the pavement

Rip it up
Ripped and used a bookmark
Ripping
Roll it up
Roll up & throw at each other - children
Roll up and shout from
Roll up as a sword
Rugby ball
Sail boats
Scrap paper
Scrunch it up
Scrunched up as a ball
Send a threatening note
Set fire
Sex toy
Shield
Shoes
Shoot it
Shred into pieces and pick them back up again and try to put them together
Sit on
Sit on it
Slapping on someone's head
Sleep with it around you
Something to wrap things in
Something to write on
Sponge
Stack up as a step
Start a fire
Step on it
Stick it in your shoes to make yourself look taller
Stick on the wall
Stick one in a gap
Stock market shares
Stop staining
Stopping mud dripping
Student newspaper
Stuff down my shorts
Stuff it up my shirt
Support (a stack of papers)
Swat bugs away
Sword
Table
Table mat
Tablecloth
Tear into pieces
Tear up
Throw in the post
Throw it
Throw it in the air
To clean a window without creating streaks

To clean the glass table
To cover a table
To cover the ground
To create a lucky dip box
To crush up and make into a ball
To cut random items/shapes out of it
To draw on/make notes
To fill something out with (e.g.shoes)
To fold into origami
To generally play with, football etc…
To give to a cat to play with
To hide behind, so no one sits next to you on the train
To hide your face on the train while sleeping
To hit someone on the head
To keep warm
To kill a fly
To kill a spider ot another creepy crawly
To line a rabbit/guinea pig hutch
To make a paper airplaine out of it
To make clothes out of

Version 9 – NEWSPAPER

To make decorations
To make notes on if you run out of paper
To make paper shapes
To make yourself look smarter
To mix paint colours on
To mop up a spill
To mop up water
To pass a flame to another place
To pick up dog poo
To place shoes on
To play football once scrunched up
To polish dust off a mirror or a window
To protect a table from paint & stuff
To protect you from the rain
To put down for painting
To put down for pets
To put down in a bird cage
To put down on a bus seat before you sit down
To put fried stuff on, such as chips, somosas
To put on the floor and walk over with dirty shoes
To put up on a window
To roll up and hit things with
To roll up and hit with
To roll up and look through
To roll up and wach flies with
To shade you from the sun
To shred + put in a hamsters cage
To shred and insulate
To shred and use for animal bedding
To shred up
To sit on
To sleep on
To soak up water (clean with)
To spit chewing gum into
To stand on
To stop paint dropping on the floor
To throw away
To use as a placemat
To use as filling for shoes
To use as wrapping paper. As a parcel
To use to recycle vegetables in it
To use when making/using paper mache
To use when painting a picture (the base)
To use when painting to avoid spilling it on the carpet
To wash yourself
To wear as a hat
To wipe a surface down if you make a mess
To wipe feet on

To wipe something off of a surface
To wipe the floor
To wrap
To wrap a book
To wrap a present in if you are feeling cheap
To wrap and hit someone with it
To wrap fish + chips
To wrap up something that may cause smells before you put it in the rubbish
To write on
Toilet for dogs/cats
Tube
Turn into paper mache to make a mask
Umbrella/wind shield
Uni results
Use as a 'bat' to hit a ball
Use as a bed for pets e.g. rabbits
Use as a cricket bat
Use as a diary e.g. to do list
Use as a drumstick to make music
Use as a kite
Use as a microphone
Use as a prop in drama
Use as a tissue or towel
Use as a weight
Use as paper masheigh
Use as tennis ball
Use as wrapping paper
Use for a surface to cut nails
Use for information
Use for pet rabbits/hamsters
Use for protection when painting
Use instead of cat litter
Use it as a brush
Use it as decoration
Use it to sweep up rubbish onto
Use pictures
Use to cover things
Use to hide something/cover it up
Use to make dress
Use to protect hair from rain
Use to toll up and burn when starting BBQ's
Use to trap creepy crawlies/spiders
Use to wipe shows on
Use to wrap vergetable in
Used as a book
Used as a curtain
Used as a food table mat
Used as a mat to put on the floor
Used as protective padding for when moving items in boxes
Used to doodle when you are bored

Used to fold into a cylinder
Used to fold paper plane
Used to hit somebody
Used to kill insect
Used to sell and earn money
Used to shelter yourself from rain
Used to wipe stains away
Uses as a dust pan
Vandalise it
Wave it
Wear them
Welcome mat
Wet it
Wipe kitchen sides with
Wipe surfaces with
Wrap bottles
Wrap glass in it
Wrap things in when moving house
Wrap vegetables/foods
Wrapping things to protect them
Write with

Appendix M – Experiment Eight: Spearman Rank Order Correlation Coefficients

Table M-1: Spearman Rho Correlations for AUT, Experiment 8, Version 1; Brick

	Participant 2	Participant 3	Participant 4	Participant 5
Participant 1	.422 $p < .001$	.223 $p = .010$	.487 $p < .001$	.555 $p < .001$
Participant 2		-.079 $p > .05$	.278 $p = .001$	.428 $p < .001$
Participant 3			.325 $p < .001$	.011 $p > .05$
Participant 4				.270 $p = .002$

Table M-2: Spearman Rho Correlations for AUT, Experiment 8, Version 2; Brick

	Participant 2	Participant 3	Participant 4	Participant 5
Participant 1	.283 $p = .001$	.529 $p < .001$	.189 $p = .029$	.352 $p < .001$
Participant 2		.338 $p < .001$	.562 $p < .001$	.431 $p < .001$
Participant 3			.183 $p = .035$	.501 $p < .001$
Participant 4				.347 $p < .001$

Table M-3: Spearman Rho Correlations for AUT, Experiment 8, Version 3; Brick

	Participant 2	Participant 3	Participant 4	Participant 5
Participant 1	.494 $p < .001$	.094 $p > .05$	.483 $p < .001$	.391 $p < .001$
Participant 2		.253 $p = .003$	.657 $p < .001$	.389 $p < .001$
Participant 3			.244 $p = .004$	.171 $p = .047$
Participant 4				.370 $p < .001$

Table M-4: Spearman Rho Correlations for AUT, Experiment 8, Version 4; Remote control

	Participant 2	Participant 3	Participant 4	Participant 5
Participant 1	.328 *p* < .001	.042 *p* > .05	.573 *p* < .001	.419 *p* < .001
Participant 2		-.109 *p* > .05	.289 *p* = .002	.330 *p* < .001
Participant 3			-.095 *p* > .05	.049 *p* > .05
Participant 4				.301 *p* = .001

Table M-5: Spearman Rho Correlations for AUT, Experiment 8, Version 5; Remote control

	Participant 2	Participant 3	Participant 4	Participant 5
Participant 1	.249 *p* = .008	.023 *p* > .05	.144 *p* > .05	.310 *p* = .001
Participant 2		.268 *p* = .004	.262 *p* = .005	.314 *p* = .001
Participant 3			-.002 *p* > .05	.357 *p* < .001
Participant 4				-.030 *p* > .05

Table M-6: Spearman Rho Correlations for AUT, Experiment 8, Version 6; Paperclip

	Participant 2	Participant 3
Participant 1	.048 *p* > .05	.112 *p* > .05
Participant 2		-.076 *p* > .05

Table M-7: Spearman Rho Correlations for AUT, Experiment 8, Version 7; Newspaper

	Participant 2	Participant 3	Participant 4	Participant 5
Participant 1	.093 $p > .05$	-.209 $p = .023$	.036 $p > .05$	.022 $p > .05$
Participant 2		-.058 $p > .05$	-.029 $p > .05$	.169 $p > .05$
Participant 3			-.036 $p > .05$	-.115 $p > .05$
Participant 4				.173 $p > .05$

Table M-8: Spearman Rho Correlations for AUT, Experiment 8, Version 8; Newspaper

	Participant 2	Participant 3	Participant 4
Participant 1	.532 $p < .001$	.433 $p < .001$	.282 $p = .002$
Participant 2		.350 $p < .001$	.305 $p = .001$
Participant 3			.048 $p > .05$

Table M-9: Spearman Rho Correlations for AUT, Experiment 8, Version 9; Newspaper

	Participant 2	Participant 3
Participant 1	.000 $p > .05$	.079 $p > .05$
Participant 2		-.043 $p > .05$

Appendix N – Hoehn & Yahr (1967) Scale

Hoehn & Yahr staging

The simplest and most popular scale to establish the severity of PD is the Hoehn & Yahr Stage scale (source: Hoehn & Yahr, 1967) while this scale is useful for rough classification of the disease, it lacks sensitivity to changes in the patient's functional condition (source: Jankovic, 2003). The disease process is divided into the following stages: (source: Hoehn & Yahr, 1967; Jankovic, 2003)

- **Stage 0**: **No** signs of disease

- **Stage 1**: symptoms are very mild and appear only on one side of the body

- **Stage 1.5**: symptoms appear only on one side of the body but with axial involvement

- **Stage 2**: symptoms appear on both sides without impairment of balance

- **Stage 2.5**: symptoms appear on both sides and still mild, with recovery on pull test

- **Stage 3**: symptoms are mild to moderate, some postural instability occurs, but patients are physically independent

- **Stage 4**: symptoms are severe, the patient is severely debilitated and needs some assistance, but can still walk or stand unassisted

- **Stage 5**: symptoms are very severe, the patient is typically wheelchair-bound or confined to a bed, unless aided

Appendix Q – Parkinson's Disease Quality of Life (PDQoL) Questionnaire (39-item)

<u>Parkinson's Disease Quality of Life Questionnaire</u>

DUE TO HAVING PARKINSON'S DISEASE, how often have you experienced the following, **<u>during the last month</u>**?

Please tick one box for each question

Due to having Parkinson's disease, how often <u>during the last month</u> have you ….

	Never	Occasionally	Sometimes	Often	CanNot do at all
1. Had difficulty doing the leisure activities which you would like to do?					
2. Had difficulty looking after your home, e.g. DIY, housework, cooking?					
3. Had difficulty carrying bags of shopping?					
4. Had problems walking half a mile?					
5. Had problems walking 100 yards?					
6. Had problems getting around the house as easily as you would like?					
7. Had difficulty getting around in public?					
8. Needed someone else to accompany you when you went out?					
9. Felt frightened or worried about falling over in public?					
10. Been confined to the house more than you would like?					
11. Had difficulty washing yourself?					
12. Had difficulty dressing yourself?					
13. Had problems doing up buttons or shoe laces?					
14. Had problems writing clearly?					

	Never	Occasionally	Sometimes	Often	CanNot do at all
15. Had difficulty cutting up your food?					
16. Had difficulty holding a drink without spilling it?					
17. Felt depressed?					
18. Felt isolated and lonely?					
19. Felt weepy or tearful?					
20. Felt angry or bitter?					
21. Felt anxious?					
22. Felt worried about your future?					
23. Felt you had to conceal your Parkinson's from people?					
24. Avoided situations which involve eating or drinking in public?					
25. Felt embarrassed in public due to having Parkinson's disease?					
26. Felt worried by other people's reaction to you?					
27. Had problems with your close personal relationships?					
*If you do **No**t have a spouse or partner, please leave blank* 28. Lacked support in the ways you need from your spouse or partner?					
29. Lacked support in the ways you need from your family or close friends?					
30. Unexpectedly fallen asleep during the day?					
31. Had problems with your concentration, e.g. when reading or watching TV?					
32. Felt your memory was bad?					
33. Had distressing dreams or hallucinations?					

	Never	**Occasionally**	**Sometimes**	**Often**	**CanNot do at all**
34. Had difficulty with your speech?					
35. Felt unable to communicate with people properly?					
36. Felt ig**No**red by people?					
37. Had painful muscle cramps or spasms?					
38. Had aches and pains in your joints or body?					
39. Felt unpleasantly hot or cold?					

Please check that you have ticked one box for each question

Appendices O and P can be accessed via the attached CD.

Appendix O – Dance improvisation video
Appendix P – Dance control video