The Relationship Between Distractibility, Insight Problem-Solving & Working Memory Capacity

by

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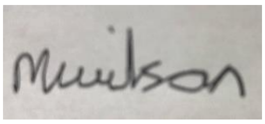
Signature of Candidate 

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Abstract

Thie current study was an exploratory piece of research to investigate the relationship between Distractibility, Working Memory Capacity (WMC) and insight problem-solving. There were three main aims of the study. Firstly, the present study aimed to determine

whether distractibility predicts insight problem-solving. Secondly, this research aimed to determine whether WMC predicts distractibility. Finally, to determine whether WMC predicts performance on insight problem-solving tasks. A total of 59 participants completed an online study deployed via Qualtrics experimental survey software and comprised of three parts. Firstly, a typical digit serial recall task was employed to test distractibility. Also, to test insight problem solving, the study employed both Compound Remote Associate Tasks (CRATs) and Rebus Puzzles. Finally, two working memory span tasks, Symmetry Span and Operation Span, were employed to measure visuo-spatial and verbal WMC.

The present study aimed to determine whether distractibility predicts insight problem-solving. A relationship was discovered between the number of correct answers given and time taken to solve visual and pictorial problem-solving tasks and distractibility by meaningless speech. Also, it was found distractibility by meaningless speech predicts the number of correct answers given to visual and pictorial problem-solving tasks, and the time taken to solve pictorial problem-solving tasks. Furthermore, a relationship was revealed between the number of correct answers given to visual and pictorial problem-solving tasks and distractibility for meaningful speech. Finally, it was shown that distractibility for meaningful speech predicts the number of correct answers given to visual problem-solving tasks.

Secondly, the current study aimed to determine whether WMC predicts distractibility. A relationship was discovered between a domain-general or domain-specific representational system of verbal and visuo-spatial WMC and one been less distracted by meaningful and meaningless speech.

Finally, the present study aimed to investigate whether WMC predicts insight problem-solving. It was discovered verbal WMC in a domain-specific representational system, and a combination of verbal and visuo-spatial WMC in a domain-general representational system predicts the time taken to solve difficult pictorial problem-solving tasks. Also, a relationship was revealed between verbal WMC been a domain-specific representational system and the time taken to solve visual pictorial problem-solving tasks. Additionally, a relationship was discovered between visuo-spatial WMC been a domain-specific representational system, and the time-taken to solve word pictorial problem-solving tasks. Furthermore, a relationship was shown between visuo-spatial WMC been a domain-specific representational system, and the number of correct answers given to easy word pictorial problem-solving tasks, and the time taken to solve difficult word pictorial problem-solving tasks. Finally, it was revealed verbal WMC in a domain-general representational system, and verbal and visuo-spatial WMC in a domain-specific representational system predicts the time taken to solve difficult word pictorial problem-solving tasks.

Chapter 1: Literature Review

1.1 Distraction

1.1.1 Introduction

The current study explored whether distractibility predicts insight problem-solving ability and whether working memory capacity (WMC) predicts distractibility. It is predicted that the higher one's distractibility, the more predictive it could be of performance on

Compound Remote Associate Tasks (CRATs) than Rebus Puzzles. Additionally, it is predicted that low WMC could predict high distractibility.

Within society, there is a high prevalence of sound and therefore, it is unlikely that one can escape the presence of background sound when doing mental work. Even when one's visual attention is focussed elsewhere, the auditory environment surrounding them is still processed. Although the eyelids act as shields to prevent the visual processing of unwanted material, there is not a mechanism that prevents the ears from receiving and processing unwelcome sounds. Prior research has endeavoured to understand how and why this processing of irrelevant and unwelcomed sound has an impact, which is usually negative, on a person's performance on a concurrent focal task (e.g., Marois, Marsh & Vachon, 2019).

Previous work has established that background sound does have a prominent disruptive effect on short-term memory tasks; specifically, those which involved covert serial rehearsal of visual-verbal material (for example, digits or letters), for instance, the serial recall task (see Colle & Welsh, 1976; Hughes, Vachon, & Jones, 2005; Jones & Macken, 1995; Lange, 2005; Sörqvist, 2010). In the main empirical platform where the impact of background sounds on task performance has been observed, research has involved the presentation, usually visual, of supra-span lists, containing seven to nine verbal items (for example, digits or letters) one at a time on a computer screen, whilst in the presence of a variety of background sound conditions. One of the conditions in the study is usually a quiet one, where the participant is not in the presence of background sound. The participants are required to recall the visually presented items in their original order of presentation. This is either after a short retention interval, which is typically between 7 and 10 seconds or immediately following the presentation of the last item in the sequence. The participants are informed of the presence of the background sound, which is usually delivered through headphones, and they are instructed to ignore the sounds because it is irrelevant to the serial recall task that should be their focus. This method is well-established and well-validated, and the oldest and best-known to measure distractibility and serial recall performance in experimental psychology. Therefore, it was used in the current study.

There is a consensus that certain types of auditory distracters elicit an orientating response (OR), which is an involuntary shift of one's attentional focus to the source of the distracter (Sokolov, 1990). Based on this, the current study used meaningful speech in the form of English Language, and meaningless speech in the form of Swedish Language, as distractors.

1.1.2 The Irrelevant Speech Effect

The presence of the irrelevant sound usually produces an increase in the number of errors made during serial recall, which happens regardless of whether the sound is presented to the participant, during the presentations of to-be-remembered (TBR) speech, retention, or both (Colle & Welsh, 1976; Jones, Madden, & Miles, 1992; Jones & Macken, 1993**;** LeCompte, 1996; Salamé & Baddeley, 1982, 1989; Tremblay & Jones, 1998). This is referred to as the Irrelevant Speech Effect (ISE) (Beaman & Jones, 1997). In the literature, it is widely known that background speech interferes with the short-term memory of visually presented items. Colle and Walsh (1976) investigated the effect of irrelevant speech sounds on a serial recall task and discovered that irrelevant speech does impair performance on the recall task. Furthermore, non-speech sounds can also cause interference to recall. Even though this effect occurs, the ISE is independent of the serial recall task because the participants are openly instructed to ignore the speech (Baddely, Gisselgard, Ingvar & Petersson, 2003). It has been suggested that the primary mechanism of interference is a competition of two streams of information, which contains cues to serial order. One mechanism is generated from the serial recall task and the other comes from the irrelevant auditory items (Gisselgard, Ingvar & Petersson, 2004). The main empirical signature of the ISE is the changing state (CS) effect. The CS effect suggests there is a series of sounds, in which there is physical change present between each successive item (CS sounds, for example, 'fsbxp') and this produces more of a disruption of serial recall than sounds that convey no physical changes between items (steady-state sound, for example, 'eeee'; Hughes, 2014). The CS effect has often been contrasted with the deviation effect, where performance on the focal task is impeded by the infrequent occurrence of an irrelevant item, which deviates from the others (for example, 'mmmym').

While several accounts have been offered to explain the ISE (Colle & Welsh, 1976; LeCompte, 1996; Neath, 2000; Page & Norris, 1998; Salamé & Baddeley, 1982), there is currently a debate over two of these accounts: the Unitary Account and the Duplex Mechanism Account. Firstly, the Unitary Account proposes that the CS effect and the deviation effect are produced by attentional capture **(**Bell, Röer, Marsh, Storch & Buchner 2017; Cowan, 1999). According to Ono and Tanigichi (2017), attentional capture is the phenomenon in which attention is directed towards a target stimulus, involuntarily, based on the stimulus' characteristics. Secondly, the Duplex Mechanism Account does not deny the role of attentional capture but instead proposes that the CS effect is not produced by attentional capture but by the interference by process approach (Hughes, 2014). This suggests that the semantic similarity between sequences will impair recall performance because of the disruption to the strategy or process underpinning the semantic focal task, rather than the similarity between the to-be-recalled content and the irrelevant category exemplars (Hughes, 2014). Specifically, the CS effect is argued to be driven by the pre-attentive processing of order cues yielded by the acoustical changes in the auditory sequence, which competes with the similar process of ordering the TBR items in the serial recall task, through rehearsal using covert speech (Hughes, Hurlstone, Marsh & Vachon, 2013).

1.1.3 The Unitary Account

According to the Unitary Account, all forms of auditory distraction in the short-term memory domain are a result of attentional capture. It has evolved from the embedded process model of memory (Cowan, 1995). The central tenet of the Unitary Account is that an OR is produced when there are unexpected changes between successive sounds (Sokolov, 1963). This reflexive response to unexpected stimuli results in semantic and cognitive orientation towards the stimulus. This is shown through disruption of the focal task performance. This account assumes that the OR to acoustically deviant sounds (for example, ‘eeeese’) arise because of a violation of an expectancy-based model of the physical invariance, which characterised the auditory stimulation been prevailed (for example a sequence of t’s). According to this account, the CS effect is a change in a sound stream that depletes attentional resources, which would otherwise be used to reflect to the focal task (Ohman, 1979). The account explains the CS effect by assuming that each sound in a CS sequence acts as an acoustical deviant and therefore, this produces a repetitive capture of attention (Bell, Roer, Dentale & Buchner, 2012). This is because each new sound in a CS draws one’s attention to the new stimulus, which causes a disruption to the attentional focal task (Ohman, 1979).

1.1.4 The Duplex Mechanism

Within the context of short-term memory, the Duplex Mechanism Account suggests that the CS and deviation effects are different types of auditory distraction with different underlying mechanisms (Hughes, 2014). In contrast to the unitary account, the duplex mechanism account proposes that when there are unexpected changes to predictable auditory stimuli, this gives rise to attentional capture because attention is orientated towards the sound and away from the focal task (Hughes, Vachon & Jones, 2007). This results in an impairment in focal task performance. In contrast, the CS effect is argued to be produced by an interference-by-process approach. The Duplex Mechanism assumes that the CS effect cannot be explained by attentional capture and contradicts the idea that every change produces an OR, leading to repetitive attentional capture. According to this account, the CS effect occurs because of an interference between two sets of order processes. Firstly, the automatic processing of successive and perceptually discrete sounds. Secondly, the deliberate processing of the order of TBR items. Therefore, the CS effect only occurs when the primary task requires order processing (Alfred, Bridges, Tremblay, Macken & Jones, 1999). However, the deviation effect is attributed to attentional capture because this account suggests the sound directs the selective attention from the task to the irrelevant speech (Labonte, Marois, Parent & Vachon, 2018).

1.1.5 Working Memory Capacity

Individuals differ in their working memory capacity (WMC). WMC is associated with an increase in the ability to actively maintain task-goal representations in a high activated and therefore, an accessible state in the cognitive system, and a volitional control of attention and the amount of attentional resource (See, Conway, Cowan, & Bunting, 2001**;** Kane, Bleckley, Conway, & Engle, 2001; Kane & Engle, 2000; Rosen & Engle, 1997).

The Unitary Account appears to predict a relationship between the distraction, produced by the deviants, and the participant's WMC. If the assumption is made that active maintenance of task-goal representation and/or the capacity to voluntarily control attention can temper with attentional capture, then an overriding of ORs/attentional capture of auditory events could be facilitated. There is evidence that has associated high WMC with a reduced auditory attentional capture, which has been gathered from the 'own-name effect' (Wood & Cowan, 1995). Whilst repeating back a message in an attended channel, for example, the information presented to a to-be attended ear, participants with higher WMC are less likely to recognise their name in an unattended channel, for example, auditory information been presented to a to-be-ignored ear. The 'own-name effect' could be considered an indication of attentional recruitment. Given the assumption that in one instance of habituation to the OR, central processing is required, it could be expected that individuals with high WMC would show more habituation, throughout the experiment (Ohman, 1979). In line with this, Sorqvist, Nostl and Halin (2012) reported that in a cross-modal oddball, where participants were asked to categorise a visual target, individuals with high WMC showed faster habituation to deviant distracters. Even though this was observed, data related to other forms of auditory distraction paradigms is less clear. Sorqvist, Nostl and Marsh's (2013) Bayesian-meta-analysis concluded that, in the context of auditory distraction, data from different studies supported a relationship between WMC and the deviation effects, where participants with higher WMC showed smaller effects. However, this relationship was not found between WMC and CS effects. This finding supports the Duplex Mechanism over the Unitary Account because the Duplex Mechanism proposes that the deviants disrupt performance by capturing and redirecting the participant's attention. In contrast, CS distracters disrupt because of a conflict, which occurs between the voluntary processing of rehearsed digits and the involuntary processing of items in a CS sequence. Previously, it has been argued that the undesired switch in attention to the deviant can be overruled by individuals with high WMC because of a more steadfast locus of attention from their greater engagement in the task (Sorqvist, Nostl, & Marsh, 2013).

Since the Bayesian meta-analysis, the results of recent research investigating the relationship between the WMC and the magnitude of different forms of auditory distraction are mixed. Although Sorqvist, Vachon and Marsh (2017) did replicate the finding that there was an association between WMC and the deviation effect, there was not a comparison of WMC with the CS effect undertaken. A recent study did not replicate the finding that WMC detaches the CS effect and the deviation effect and reported that both effects were equally unrelated to WMC (Korner, Roer, Buchner & Bell, 2017). However, in this study, it is worth noting that the number of participants, who demonstrated a deviation effect, was low, which could have impeded the appearance of any potential relationship between the measures involved.

1.2 Creative Problem-Solving

1.2.1 Creative Problem-Solving

Creative problem-solving involves generating solutions with the presence of two attributes: originality and effectiveness. However, the presence of only one attribute is insufficient (Runco, 2018). Recently, research about creative problem-solving has increased and is based on two traditional assumptions on how one solves these problems. The first assumption is problems are solved through analytic processing, involving conscious and explicit thinking, using a step-by-step manner, which moves one closer to the solutions (Ball & Stevens, 2009). The second assumption is that problems are solved through insight processing, involving non-conscious and implicit thinking, which causes sudden and clear realisations on how to progress towards the solution (Jung-Beeman, Bowden, Haberman, Frymiare, Arambel-Liu, Greenblatt, Reber & Kounios, 2004). These realisations are characterised by involving a major change in how the problem is represented, arising from primarily tacit processes.

Based on prior research, the emerging consensus is that one may use a combination of analysis and insight. This shift from the polarised view that creative problem-solving only uses analytical or insight processing, marks an important change because previously narrow and esoteric debates were influential and focused on a limited set of tasks and paradigms (Barr, 2018). Arguably, the emergence of more nuanced and encompassing theories was caused by an improvement in theory-driven experimentation and the availability of a wider variety of tasks (Shen, Yuan, Liu & Luo, 2017).

1.2.2 Insight & Non-Insight Problem-Solving

Non-insightful solutions are obtained through conscious, methodical, goal-directed and analytical processing (Ohlsson, 2011). Analytical processing is the conscious and deliberate search for a solution to a problem in a problem space, which obtains results immediately because it is largely available in the conscious mind (Dehaene & Sergent, 2004). Additionally, solutions to analytic problems involve a smooth progression of steps and are often solved, based on prior knowledge.

Non-insightful solutions occur differently from insightful solutions. Insightful solutions often occur independently of prior knowledge and suddenly because a new interpretation of a situation or a solution appears into conscious awareness. The new interpretation seems correct, and it will be accompanied by a surprising and emotional experience, known as the “Aha” phenomenon (Kaplan & Simon, 1990).

1.2.3 The Special Process View & Business-As-Usual View

In the literature, there has been debate about the processes, underlying insight. There are two competing viewpoints: the Special Process and the Business-As-Usual (B-A-U) views (Weisberg, 2006; Aziz-Zadeh, Kaplan, & Iacoboni, 2009). Prior research has suggested that non-insight problems are solved by conscious and analytic processes, which are labelled as ‘B-A-U’. In contrast, insight problems require additional processes, and these are ‘special’ to the development of restructuring and the processes are unconscious and associative (Ball, Gilhooly & Macchi, 2015).

The Special Process view proposed that the initial features of problem-solving lead to an impasse, which is a situation in which one is unsure of how to proceed. The occurrence of this starts the restructuring process by spreading activation in semantic memory (Bowden &

Jung-Beeman, 2003). These processes are outside one's control and might cause restructuring of the problem, resulting in a solution being found and an aha! experience. This viewpoint suggests that insight occurs in response to an impasse, meaning the solution attempts from when the initial analysis has been exhausted. Therefore, insightful solutions arguably take longer to produce than non-insightful solutions (Chein & Weisberg, 2014). One study conducted by Chein, Kwok, Streeter and Weisberg (2010) offered support for this view by demonstrating verbal overshadowing of insight. They found that, when the participants were asked to think aloud, this interfered with finding the solution to analytical problems. These findings can be interpreted as evidence that processes underlying insight are not verbalizable and outside of one's conscious control, unlike the processes underlying non-insightful solutions.

The second viewpoint is the B-A-U view. This view proposes that one solves a problem through restructuring and suggests one may change the representation of the problem in response to new and available information because of failed attempts at solving (Fioratou, Gilhooly & Henretty, 2010). One study, which supports this viewpoint, was conducted by Fleck and Weisberg (2004). They used Duncker's (1945) candle problem, where participants are to stop a candle from dripping wax onto a table, only using a box of thumb tacks and a book of matches (Lubarsky & Thomas, 2020). They showed the box solution to the candle problem was caused by restructuring occurring when new information was presented during the solving process. For example, one participant attempted to put the candle on the wall, using pins. However, the participant realised the pins were not large enough. Therefore, the participant realised the shelf and the box were needed.

When these two viewpoints are compared, research appears to favour the B-A-U viewpoint. One study conducted by Gilhooly, Fioratou and Henretty (2010) had two groups of participants complete eight examples of four different problem-solving tasks, which were a combination of insight versus non-insight and verbal versus spatial factors. They were given different verbalisation instructions. They discovered a significant interaction, based on solution rates and latencies, between the verbal versus spatial factor and the verbalisation condition, which reflects a greater, negative effect of verbalisation on spatial problems, compared to verbal problems.

1.2.4 Solution Strategy

Previous research has shown that solutions to problems generated by insight, are more likely to be correct than solutions generated by analysis. When Threadgold, Marsh and Ball

(2018) researched solution strategies and solution correctness for Rebus Puzzles, they discovered that of the solution responses labelled insight, 65% were correct, compared to 54% for solution responses labelled analysis. Also, they conducted a secondary analysis of their dataset, with a narrower response window than the full 30 seconds available. They only included those responses within a 2-10 seconds time window. They discovered the presence of the predicted accuracy effect, with analytic responses being more likely to be incorrect than insight responses.

Previous research has investigated solution strategies and solution correctness, related to solution confidence. Danek and Salvi (2018) contemplated its feasibility because solvers may use their confidence in their accurate responses as a metacognitive cue when reporting solutions based on insight. They acknowledged that this could be supported by a correlation between confidence and insight ratings being observed because the feeling of insight is linked with the participant suddenly realising the solution, which appears to be correct (Kounios, Frymiare, Bowden, Fleck, Subramaniam, Parrish & Jung-Beeman, 2006). This is supported by Metcalfe (1986), who showed that participants would often present a wrong answer as correct, alongside a feeling of warmth.

There has also been research exploring solution strategies, solution correctness and response time. Kounios, Fleck, Green, Payne, Stevenson, Bowden and Beeman (2008) discovered, during solving, a pattern of errors that suggest there are different cognitive strategies for insight and analysis problem-solving. It was found that participants, who solve problem-solving tasks by insight usually make errors of omission. Whereas participants who solve by analysis make errors of commission. Therefore, it was proposed that an insight solver will timeout when presented with a deadline if the insight does not arrive in time. In contrast, an analytical solver will be able to make a guess, which is often incorrect because the solver can offer a potential solution to the problem.

1.2.5 Classic Insight Problems

Historically, classic insight problems have been used in creative problem-solving research. One example of a classic insight problem is:

"Waterlilies double in areas every 24h. At the beginning of summer, there is one water lily on the lake. It takes 60 days for the lake to become completely covered with water lilies. On which day is the lake half covered?" (Sternberg & Davidson, 1982).

The answer to this is 59. This may or may not be apparent to the solver straight away, depending on what the solvers perceive as the key information and choose to fixate on. This question only functions as an insight problem if the solver misconstrues the problem space at first. The sudden realisation of the answer is had, alongside a feeling of certainty because the answer is simple to check (Webb, Little & Cropper, 2016).

There are many methodological issues associated with classic insight problems (MacGregor & Cunningham, 2008). Firstly, there is a restricted pool of them for researchers to draw on. Therefore, the methodologies that included these problems, often only involve a small number of test items. Secondly, classic insight problems are usually complex, and few participants can achieve the correct solution, without a hint. Consequently, the participants are only able to attempt a few, and this reduces the reliability of the data obtained (Ball, Marsh, Litchfield, Cook & Booth, 2015). Based on this, the current study did not use classic insight problem-tasks. Instead, in the same way as more recent research, compound remote associate tasks (CRATs) and Rebus Puzzles have been used.

1.2.6 Compound Remote Associate Tasks

Compound Remote Associate Tasks (CRATs) are variants of Remote Associate Tasks (RATs) (Mednick & Andrews, 1967). RATs involve a solver being presented with one word and are required to discover a meaningful link and produce three unrelated words. In contrast, CRATs involve participants being presented with three cue words and are required to find a solution word to create three compound words or phrases (Ball, Marsh, McLatchie & Threadgold, 2019). For example, the three cue words ‘dress, dial, flower’ would be associated with the solution word ‘sun’, to create the compound words ‘sundress’, ‘sundial’ and ‘sunflower’. Since CRATs are solved by semantic association, the solution word is not always strongly associated with the three cue words. Therefore, the participants must search their memory to discover unusual or infrequent associations. The solving of CRATs requires the participant to detach from high-frequency associations produced by the three cue words (Mednick, 1968).

The use of CRATs can be critically evaluated. One advantage of CRATs is they allow stimulus presentation and response timing to be controlled. This allows for better control and measurements of variables and for CRATs to be used in a variety of different paradigms (Ball, Garner, Howe & Wilkinson, 2016). Also, an advantage of using CRATs is they are easier to score as the solutions are one-word and unambiguous (Bowden & Jung-Beeman, 2003). When compared to classic insight problem-solving tasks, the use of CRATs is more advantageous. Therefore, in the current study, CRATs were used instead of classic insight problem-solving tasks.

1.2.7 Rebus Puzzles

Rebus Puzzles involve a combination of visual, numerical and spatial cues, which one must view and identify a commonly used phrase or saying. For example, the solution 'BUSINES,' is 'Unfinished Business' (Threadgold, Marsh & Ball, 2018). Rebus Puzzles are an interesting to use to study insight because for one to solve them, it often requires overcoming grammar rules of word composition. Therefore, one must restructure their formal interpretation of reading by relaxing already ingrained constraints so they can shift to how the elements of the Rebus Puzzle are represented (MacGregor & Cunningham, 2008). A common way of solving Rebus Puzzles is to verbally interpret, the visual-spatial relationships of the problem components. For example, for 'BROTHER', with the solution 'Big Brother', one must verbally interpret the visual attribute of the font (Salvi, Constantini, Bricolo, Perugini & Beeman, 2015). When solving the Rebus Puzzles, participants cannot report the details of the processes used before finding the solution, which suggests the solutions were combined with an Aha! experience and solved with insight (MacGregor & Cunningham, 2008). The challenge comes from tacit and self-imposed assumptions in some of the Rebus Puzzles. Based upon this and the method to solving CRATs, there is a distinct difference between the solving of spatial Rebus Puzzles and CRATs. The present study will use 16 CRATs and 16 spatial and pictorial Rebus Puzzles.

Although Rebus Puzzles are widely used in problem-solving research, they can be critically evaluated. A positive aspect of Rebus Puzzles is there is only one correct answer and therefore, the scoring of responses is simple (Ball, Marsh & Threadgold, 2018). However, a negative aspect of Rebus Puzzles is they can become problematic because there are many ways to tackle the problem. Consequently, the problem information might misdirect one's efforts to solve the problem because one is using implicit assumptions, related to their experience of normal reading. This results in self-constraint, which might lead to an impasse and this will need to be changed by the process of problem restructuring (Cunningham, Gibb, Haar & MacGregor, 2009).

Although the use of Rebus Puzzles in research has increased, there is a limited amount of normative data, relating to solution rates, solution times and phenomenological characteristics. Prior research was restricted to a set of Italian Rebus Puzzles. This is problematic because Rebus Puzzles are linguistically context dependent as they are related to common words, sayings and phrases, in a particular language. Therefore, language-specific normative data was vital for increasing the use of Rebus Puzzles because it allowed the researchers to be confident in the Rebus Puzzles selected (Salvi et al., 2015).

Based on the aforementioned advantages and disadvantages, it is better to use Rebus Puzzles, rather than classic insight-problem-solving tasks. Also, this will further the findings of prior research because previously, only CRATs were used to research whether there is a relationship between WMC and insight problem-solving.

1.2.8 Auditory Distraction & Insight Problem-Solving

Previous research has shown that auditory distraction is beneficial to insight problem-solving. A key piece of research was conducted by Ball, Marsh, Litchfield, Cook and Booth (2015). They highlighted that there might be a dissociation between the beneficial and disruptive effects of auditory distraction on insight problem-solving, as a product of the nature of the problems. There were two distraction conditions, which showed a significantly increased likelihood of insightful solutions being made, relative to the thinking aloud or silent working conditions. This could be argued to be because the inhibiting opportunities for any speech processing, when the problems are presented, facilitate the occurrence of insightful solutions. It is presumed that this occurs by allowing the successful operation of non-conscious and non-reportable processes in restructuring the problem. Additionally, similar benefits for insight problem-solving arise from articulatory suppression and irrelevant speech, implying there is a common factor that underpins the facilitation effect, which is assumed to be linked to the way articulatory suppression and irrelevant speech interfere with processes.

Prior research has shown the effect of auditory distraction on performance on CRATs. One piece of research was conducted by Threadgold, Marsh, McLatchie and Ball (2019), who investigated the impact of background music on the performance of CRATs. They discovered that CRAT performance was significantly impaired by background music with foreign (unfamiliar) lyrics, instrumental music without lyrics and music with familiar lyrics, compared to the quiet background conditions.

1.3 Working Memory Capacity

1.3.1 Human Working Memory

Working memory (WM) is often described as the ability to simultaneously store and process information (Gathercole & Alloway, 2008), which is essential for many everyday tasks, for example, reading (Waters & Caplan, 1996), problem-solving (Chein & Weisberg, 2014) and arithmetic (Gathercole, Alloway, Willis & Adams, 2006). It is generally recognised that WM is a specific type of short-term memory because it provides the ability to retain information and simultaneously manipulate and process information (Cowan, 2005).

WM was initially outlined as a construct in Baddeley and Hitch’s (1974) WM Model. According to this model, WM is comprised of an over-arching central executive, responsible for several functions including the coordination of resources from the two slave systems, and the ability to manage retrieval and switch strategies (Baddeley & Hitch, 1974). In addition to the central executive, there are two sub-systems primed to deal with visual information (visuospatial sketchpad) and auditory processing of verbal speech (phonological loop).

Over recent years, additional accounts of WM have been proposed. For example, the time-based resource-sharing account postulates that memory is subject to a time-based decay when attention is otherwise occupied by concurrent activities (Barrouillet, Bernardin & Camos, 2004). Despite the perceived differences in the nature of the construct of WM, there is one facet of this construct that is common across accounts – the nature of the limited capacity of WM. A distinction can be made between the concepts of 'WM' and 'Working Memory Capacity (WMC)'. The latter, according to Wilhelm, Hildebrandt and Oberauer (2013) represents the broad range of differences in the capacity of WM across individuals.

1.3.2 Measuring Working Memory Capacity

There are a plethora of tasks, including Symmetry Span (SSPan) and Operation Span (OSPan), that have been operationalised to explore the concept of WMC. By far the most widely known are those in the Complex Span Paradigm of WM (Conway, Kane, Bunting, Hambrick, Wilhelm & Engle., 2005). Therefore, these tasks were chosen to measure visuo-spatial WMC and verbal WMC. The complex span paradigm has been developed across a range of domains, including reading (reading span task), arithmetic (operation span task) and visuospatial processing (symmetry-span task).

SSPan and OSPan use Span Length to measure WMC. Span length is often taken as an index for WMC (Roman, Pisoni & Kronberger, 2014). For example, participants' reading span can be used as an index for WMC. The greater one's reading span, the fewer times one will stop, whilst reading a line of text. In a reading span WM task, participants are required to read sets of sentences, which get progressively longer, out loud (the processing requirement), whilst they try to remember the final word of each sentence for later recall (the storage requirement). At the end of the set, the participants would be required to recall the final words of two sentences (Daneman & Hannon, 2007).

In the original reading span task (Daneman & Carpenter,1980), there were 60 unrelated sentences, on 8x5 index cards, 13 to 16 words in length and each sentence ended with a different word. There were blank cards to mark the beginning and the end of each set. The cards were arranged into three sets of two, three, four, five and six sentences. The participants were presented with sets in each level until they failed all three sets at a level. This was when the experiment was terminated. The level, where a participant passed two out of three sets was taken as their reading span. It was found that participants did not recall any sets of cards at a higher level, than their spans. During the experiment, the experimenter showed the cards one at a time and the subject was asked to read the sentence aloud. Each time the sentence on the card was read, a new card was presented, and the participant was asked to read the next one. This continued until the blank card, signalling the end of the block of trials, was presented. After each block, the participant was asked to recall the last words of all sentences, in the order, they were presented. One explanation of why participants find this task progressively harder is that a task requiring heavy processing should decrease the amount of additional information, which can be maintained.

Since the creation of the reading span task, other complex span tasks have been created. One task is the Symmetry Span Task; a spatial complex span task. It uses locations of red squares in a 4x4 grid of potential locations as the to-be-remembered items and the distractor task is judging whether a shape is symmetrical along the vertical task. During the task, participants will judge whether a shape is symmetrical along the vertical axis, see a location on the 4x4 grid and then, judge whether another shape is symmetrical along the vertical axis and then, see another location on the 4x4 grid. For each trial, the symmetry-location sequence is repeated between 2 and 5 times. After each symmetry-location sequence, participants are asked to recall the locations of the 4x4 grid, in order of appearance. The participants' scores are calculated by adding the number of red square locations correctly recalled in the correct order (Foster, Shipstead, Harrison, Hicks, Redick & Engle, 2014).

Another task is the Operation Span Task, which is a verbal WM task. It uses letters as the to-be-remembered items and simple mathematics problems as the distractor task. During the task, the participants will solve a mathematics problem, see a letter, and then, solve another problem and then, see another letter. For each trial, the mathematic-letter sequence is repeated between 3 and 7 times. After each mathematic-letter sequence, participants are asked to recall the letters in the order they appeared. The participants' scores are worked out by calculating the number of letters correctly recalled in the correct order. This is known as partial scoring (Foster et al., 2014). There is a pictorial version of the Operation Span task, known as Picture Span.

1.3.3 Computerised Working Memory Span Tasks

In the current study, computerised versions of the Symmetry Span (SSPan) and Operation Span (OSPan) were used. In the computerised version of SSPan, participants view an 8x8 matrix of white and black squares and determine whether the pattern is symmetrical, along the vertical axis. After this judgement, participants are presented with a 4x4 matrix of squares in which one cell is highlighted in red. After the series of matrix presentations, participants must recall the serial order of positions of the red cells (Unsworth, 2009). A similar version will be utilised in the present study. However, the 8x8 matrix will have orange squares and the locations on the 4x4 matrix will be shown with a black marker.

In the computerised version of OSPan, participants are given a series of simple mathematical problems. For each mathematical problem, the participant indicates whether they are true or false. Then, the participant is presented with a to-be-recalled icon. After the trial is completed, participants are presented with a 4x3 matrix of icons and asked to select the icons in order of presentation. In this task, the processing, decision, storage and recall are presented on three different screens to minimise the rehearsal of the to-be-remembered elements (Unsworth, Heitz, Schrock & Engle, 2005).

In research, the experimenter and computerised administered versions of SSpan and OSpan. One advantage of using the computerised version is, based on the participants' performance, an upper bound on processing time during the processing and storage trials can be created. This allows the participant to work at their own pace on the task, whilst restricting them from rehearsal (Rednick, Broadway, Meier, Kuriakose, Kane & Engle, 2012). Research has shown that complex span tasks with unlimited processing times do not predict higher-order cognition compared to ones with constrained ones (St. Clair-Thompson, 2007).

Another advantage of using computerised versions is the automatic processing and scoring. The program can provide feedback based on the number of items recalled in each set as well as the accumulative accuracy of the maths operations (Rednick et al., 2012). After the experiment, the researchers will be given 2 span scores. The Absolute Span Score, which is the sum of all trials in which all items were recalled in the correct serial order and the Partial Storage Score, which is the sum of items recalled in the correct serial position, regardless of whether the entire trial was recalled correctly. In addition to this, the researchers will be given information about 3 different types of errors. Firstly, processing errors, which is the total number of errors made on the processing task. Secondly, speed errors, which is the number of processing problems that were not answered before the individualised time limit. Finally, accuracy errors, which is the number of processing problems that were answered incorrectly (Rednick et al., 2012). This offers more information to the researcher and as this is automatic, it will be more accurate, than an experiment only use partial scoring.

1.3.4 Predictive Value of Working Memory

WMC is highly predictive of different abilities, for example, General Fluid Intelligence (Kong, Chen, Song, Xu & Jia, 2015), Reasoning Ability (Necka, Zak & Gruszka, 2016), Reading Comprehension (Dumont, Willis & Walrath, 2016), and Arithmetic Ability (Mabbott & Bisanz, 2003). Critical to the present study, WMC has been demonstrated to be predictive of problem-solving ability.

Previous research has reported a null or negative correlation between WMC and insight problem-solving performance (Chuderski, 2014). When Wiley and Jarosz (2012) reviewed the evidence of this correlation, they suggested that insight problem-solving might be impaired by an over efficient WM. In contrast, other research has discovered a positive correlation between WMC and insight problem-solving performance (Ash & Wiley, 2006). Additionally, using Composite Scores created from the average performance on reading and Operation Span, Ash and Wiley (2006) discovered that WM was only positively associated with insight problem-solving for problems with solution paths.

Insight and incremental problem-solving require one to first represent the problem, by comprehending the task instructions and interpreting the problem statements. In the initial problem representation stage, a higher WMC may be beneficial to performance. Individuals with a higher WMC will be able to form an initial problem representation (Wiley & Jarosz, 2012). However, at the solution or restructuring phases, a higher WMC may hinder the process. Individuals with a higher WMC have been shown to select and persistently use complex hypothesis testing and solution processes. In contrast, individuals with lower WMC will quickly abandon the complex strategies (Beilock & DeCaro, 2007). In addition, individuals with low WMC will take less time in the initial process. Therefore, individuals with high WMC will move to the restricting phase slower (Wiley & Jarosz, 2012). Finally, individuals with higher WMC are more likely to attempt restructuring, using a search process, which is attention-demanding, which might hinder insight, depending on the extent the success of restructuring is reliant on more associative processes (Ash & Wiley, 2006).

Prior research has shown that WMC does impact non-insight problem-solving. Individuals with a higher WMC have higher attentional control, which leads to one's greater ability to utilise more difficult, multistep strategies. However, the ability for individuals with higher WMC to execute complex strategies might mean they select strategies in line with their ability when the task might not require a controlled processing approach. This was shown in research conducted by DeCaro, Thomas and Beilock's (2008). Using Luchin's water jug task, they examined, the strategy selection of individuals with high and low WMC. During the task, participants were given 3 jugs with different capacities and the participants were asked to measure out a certain amount of water using the jugs. The participants were told to obtain the answers, mentally, and use the simplest strategy. During the task, the participants could solve the first few problems by using a simple complex formula. Although the final few problems could be solved using the same formula, a simpler strategy could be used and individuals with higher WMC were more likely to still use the simple complex formula. In contrast, individuals with low WMC abandoned the algorithmic approach quicker to adopt a less demanding strategy. These findings demonstrate that individuals with a higher WMC are inclined to use more complex strategies, even when simpler ones are more efficient (DeCaro, Van Stockum Jr. & Weith, 2015).

1.3.5 Domain Specific or Domain General Representational System

Within the literature, there has been a debate over whether WM is a domain-specific or domain-general representational system. Turner and Engle (1989) hypothesised that WMC and the specific processing component of a complex span task are independent, which suggests a domain-general representational system. Using an Operation Span task, they showed that a WM span task, which does not involve reading sentences, can predict reading ability.

In contradiction to Turner and Engle’s (1989) hypothesis, Jarrold and Towse (2006) suggested that WM is dependent on a combination of domain-general processing and control systems, and domain-specific representational systems. Research by Shah and Miyake (1996) contradicts this hypothesis. They presented adult participants with verbal or spatial storage tasks, which had verbal or spatial storage requirements. A factor analysis suggested that, along the storage line, these types of tasks grouped, which suggests a domain-general representational system. In contradiction to this finding and support of the hypothesis, Bayliss, Jarrold, Gunn and Baddeley (2003), using the same methodology but presenting the WM tasks to adults and children, discovered that a combination of measures was best described as a three-factor solution, comprising of one domain-general processing factor and two domain-specific storage factors.

Research conducted by Turner and Engle (1989) revealed that specific domains of ability correlate with WM tasks, even if the tasks did not engage the matching processing and storage domains. In support of this finding, Oberauer, SuB, Wilhelm and Wittman (2008) found that when a more theoretical principle set of WM tasks were employed, there was a distinction between the domains of ability. However, there was less strong evidence, when differentiating between tasks involving verbal and spatial storage. Instead, between all the WM measures, there was stronger evidence for a commonality. Contrary to these findings, Shah and Miyake (1996) discovered that there was a relationship between general verbal skills and WM tasks involving the storage of verbal information. However, this was not discovered for WM tasks involving the storage of spatial information.

1.3.6 The Relationship Between Verbal & Visuospatial Problem-Solving & Verbal & Visuospatial Working Memory

One's capacity of the phonological loop and visuospatial sketch pad are reflected by verbal and visuospatial WMC. Verbal WMC contains cognitive processes, where maintenance, retrieval, manipulation, and transformation of verbal information occurs (Pham & Ramzi, 2014). In contrast, visuospatial WMC contains cognitive processes for visual and spatial memory (Gathercole & Baddeley, 1993).

Prior research has discovered relationships between verbal problem-solving and verbal WMC. Hecht (2002) revealed a significant relationship between arithmetic problems, where verbal counting was used to solve the problems, and WMC. In addition to this, research has shown a relationship between verbal problem-solving and visuospatial WMC. Dehaene (1992) showed that mental arithmetic problem-solving was significantly predicted by the visual-spatial sketchpad. Alongside this, there is prior research showing a link between visuospatial problem-solving and visuospatial WMC. Gilhooly, Wynn Phillips, Logie and Sala (2002) concluded that there is a reliance on visuospatial, when using a predominant goal-selection strategy to solve the Tower of London task. This involves moving three coloured balls from one peg to another, when only two balls can be placed on the middle peg and only one can be placed on the smallest peg (Berg & Byrd, 2002). Despite the aforementioned links, no research has determined if there is a relationship between visuospatial problem-solving and verbal WMC.

1.3.7 Working Memory & Compound Remote Associate Problems

Prior research has also shown that there is a relationship between insight problem-solving and the verbal and visuospatial components of WM. Gilhooly and Murphy (2005) stated that verbal WM was positively related to verbal insight problem-solving rates. This was further supported by Chein, Weisberg, Streeter and Kwok (2010), who discovered that insight problem-solving was positively associated with verbal WM and not spatial WM.

In the present study, two types of insight problems are used: CRATs and Rebus puzzles. When one is solving CRATs, attentional control may prevent the solver from being influenced by irrelevant semantic information. Therefore, attentional control may guide a controlled search through memory and facilitate candidate solution words being identified (Unsworth, 2009). This was researched by Ricks, Turley-Ames and Wiley (2007), using verbal complex WM span tasks, and focusing on the interaction between problem performance and domain knowledge. There was a significant relationship revealed between problem performance and individual differences in WMC. Given that performance on the verbal complex WM span tasks is thought to measure executive aspects of WM, they suggested that WMC contributes to CRAT performance because of attentional control. However, this finding must be treated with caution because this study only used verbal complex WM span measures. Therefore, the findings may only reflect the involvement of WM in the problems solved by analysis and not those solved by insight. This was addressed by Chein and Weisberg (2014).

Chein and Weisberg (2014) used individual differences approach to explore the contributions made by WM and attention, to the solution of CRATs, accompanied by self-reported feelings of insight. It was suggested that the variation in overall CRAT problem-solving and the occurrence of solutions, which were accompanied by feelings of insight, were explained by individual differences in WM (Chein & Weisberg, 2014). This highlights the importance of insight vs analysis ratings in insight research. In the present study, insight vs analysis ratings is used for all CRATs and Rebus puzzles.

In the current study, the participants were asked to complete two complex WM span tasks, Operation Span (OSpan) and Symmetry Span (SSpan). Prior research has shown that CRAT problem-solving is related to OSpan and unrelated to SSpan. A key piece of research was conducted by Chein and Weisberg (2014). Firstly, they revealed that there was a weak correlation between overall CRAT solution rates and solution rates for CRATs solved correctly by insight, and SSpan. Secondly, they showed a moderate correlation between the number of problems solved correctly with insight and OSpan scores. Finally, they created a Composite WM span score, that was calculated as a mean of the OSpan and SSpan scores. There was a moderate correlation discovered between the composite scores and the number of problems solved correctly with insight. This is evidence that insight is a controlled process, which is dependent on WM resources.

1.4 Rationale For Study

The present study was an exploratory piece of research to investigate the relationship between distractibility, insight problem-solving, and working memory capacity (WMC). This research investigated three key research questions:

1. Does Distractibility Predict Insight Problem-Solving?

In the literature, there is research to suggest that solving CRATs is affected by background noise and auditory distraction. However, there is no research to determine whether high or low levels of distractibility predict insight problem-solving. Therefore, the present study aimed to determine whether distractibility predicts insight problem-solving. Based on the previous research, it was suggested that higher distractibility could have been more predictive of performance on CRATs.

2. Does Working Memory Capacity Predict Distractibility?

Previous research exploring WMC and distractibility has investigated these factors concerning the Unitary Account and the Duplex Mechanisms. Additionally, prior research has shown that individuals with high-WMC are less likely to be affected by aircraft noise and back spend on memory and comprehension of written materials (Sorqvist, 2010). However, there is no research demonstrating that WMC predicts Distractibility. Therefore, the present study aimed to determine whether WMC predicts Distractibility. Based on the previous research, it was thought the current study might find that low WMC is predictive of high distractibility.

3. Does Working Memory Capacity Predict Insight Problem-Solving?

Previous research indicates that WMC is potentially critical in explaining individual differences in insight problem-solving ability, as measured by CRATs (Chein & Weisberg, 2014). However, to date no research has explored this relationship with a broader range of insight problem-solving tasks. Therefore, the aim of the current study was to explore if WMC is predictive of insight problem-solving ability, in tasks that are verbally based (CRATs), thus replicating previous research. In addition, the aim was to determine if WMC is predictive of insight problem-solving ability for an additional type of insight problem-solving task; Rebus Puzzles, which rely on a variety of spatial and visual cues. Thus, determining if WMC is predictive of additional insight based problem-solving tasks beyond the commonly used CRAT. Finally, through employing two different types of working memory span task; Symmetry Span and Operation Span, the aimed to determine if WMC is generally predictive of insight problem-solving, or if these tasks are differentially predictive of CRAT and Rebus Puzzle performance.

Chapter 2: Methodology

2.1 Participants

The G-Power programme was used to determine an appropriate a-priori sample. This indicated that a minimum sample size of 54 participants was required for a .4 Cohen's d with 95% power (Faul, Erdfelder, Lang & Buchner, 2007). There were 59 recruited (18 female, 41 Male) for this study. The participants were aged between 18 and 65 years (*M* = 31.49, *SD* = 13.41). Out of the 59 participants recruited, 52 participants completed all three tasks. Participants were recruited via the Prolific Academic participant sourcing site and were paid the standard department payment rate in exchange for 30 minutes of participation time. Ethical clearance was obtained from the Science Ethics Board at The University of Central Lancashire, UK (Approval Code: SCIENCE 0131).

2.2 Design

A 2 x 2 x 2 mixed design was employed. Distractibility was the between-participants factor with two levels (high vs. low). Problem-solving was a within-participants factor with two levels (verbal task [CRATs] vs. spatial task [Rebus Puzzles]). Working memory capacity was the final within-participants factor with two levels (Operation-Span vs. Symmetry-Span).

2.3 Materials

The Digit Serial Recall Task. Within the literature, this task is well-established and well-validated, and is the oldest and best-known method, in experimental psychology, to measure digit serial recall. In the present study, this task was employed online using JavaScript. This task involved the presentation of each of the single digits 1-9, in black, bold, Arial, font size 72, presented in the middle of the computer screen. Each digit was presented once, in a random order. Participants were presented with each digit on the screen for 800 ms with a 200 ms inter-stimulus interval. Participants were required to reproduce these digits in the order they were presented, by selecting the boxes on the screen (e.g. Murdock, 1962) (See Appendix 11). Participants were required to wear headphones and task-irrelevant auditory distractor sounds, in the form of Meaningless Speech (Swedish) and Meaningful Speech (English), were played during each trial. The participant's headphones and sound were checked in the sound calibration part of the study, consisting of 5 trials (See Appendix 9). Altogether, in the main body of the study, there were 3 practice trials and 36 test trials, split into three sound conditions. There were 12 quiet trials and therefore, no auditory distractors, 12 trials with Meaningful Speech as the auditory distractors, and 12 trials with Meaningless Speech as the auditory distractors. The Meaningful Speech will be commonly used words from the UK English Language, which the participants will recognise. Whereas, the Meaningless Speech consisted of a recording of a Swedish story, which the participants will not recognise. In the demographic form, the participants were asked if English was their first language (1 = yes; 2 = no) and if they could speak or comprehend Swedish (1 = yes; 2 = no) (See Appendix 7). These questions were important because the answers informed the researcher whether the Meaningless and Meaningful Speech assumption is accurate. For example, if a participant knows Swedish, then the Meaningless Speech is not meaningless. Within the study, there were three checks for the participants to take: sound calibration, the 'please type the last letter you heard in the box below' and the questionnaire at the end of the trials (See Appendices 9 & 14)

Problem-Solving Tasks. Two different types of problem-solving tasks were utilised, a verbal-based problem-solving task (CRATs; e.g. Bowden & Beeman, 1998) and picture-based problem-solving task (Rebus Puzzles; Threadgold, Marsh & Ball, 2018).

Compound Remote Associates Task (CRATs). A set of Compound Remote Associate Tasks (CRATs) were selected from the normative set presented in Bowden and Jung-Beeman (2003). CRATs are short verbal problems, involving the presentation of three cue words (for example: *'flower' / 'dial' / 'dress'*) from which the participant must identify a single word (e.g. 'sun'), that when combined with each cue word, forms a new compound word or phrase (e.g. *'sunflower' / 'sun dial' / sun dress'*) (Bowden & Beeman, 1998). A set of 16 CRATs were selected, of which 8 were classed as 'easy', and 8 'difficult' based on the percentage of participants solving the item, and the mean solution time (Bowden & Jung-Beeman, 2003) (See Appendix 19). For the easy CRATs, items with a 50-75% of participants solving, and a mean solution time between 0 and 15 seconds, were selected. For the hard CRATs, items with 25-35% of participants solving, and a mean solution time between 7 and 15 seconds, were selected. The mean percentage of participants solving the item and solution times for all the easy and hard CRAT set are shown in Table 1.

Table 1. Mean Percentage of Participants Solving the Item and Solution Times (Seconds) for Easy & Difficult CRATs.

	Mean Percentage of Participants Solving the Item (%)	**Mean Normative Solution Time (S)**
Easy CRATs	60 (5.83)	7.78 (2.13)
Hard CRATs	30 (2.12)	12.53 (2.19)

Rebus Puzzles. Rebus Puzzles involve the presentation of a combination of visual, spatial, verbal or numerical cues and from which one must identify a common word or phrase (Threadgold, Marsh & Ball, 2018). For example, the following Rebus Puzzle 'BUSINESS' has the solution phrase 'unfinished business'. A set of 16 Rebus Puzzles were selected from the normative set presented in Threadgold, Marsh and Ball (2018), within this set, 8 Rebus Puzzles were classed as 'easy' and eight as 'difficult' (See Appendix 22). For the easy word and visual Rebus Puzzles, items with 85-95% of participants solving, and a mean solution time between 7 and 13 seconds, were selected. For the hard word and visual Rebus Puzzles, items with 10-25% of participants solving, and a mean solution time between 13 and 23 seconds, were selected. The mean percentage of participants solving the item and solution times for all the easy and hard, word and visual, Rebus Puzzles are show in Table 2.

Table 2: Mean Percentage of Participants Solving the Item and Solution Times (Seconds) for Easy & Difficult, Word and Visual Rebus Puzzles.

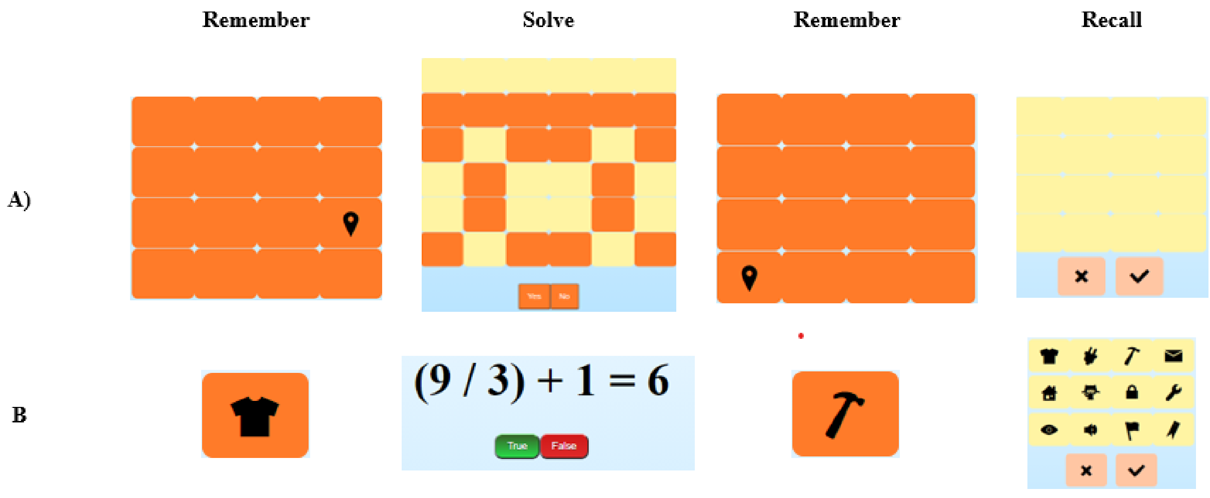
	Mean Percentage of Participants Solving the Item (%)		**Mean Normative Solution Time (S)**	
	Word	Visual	Word	Visual
Easy Rebus Puzzles	89.99 (5.16)	90 (2.12)	9.39 (1.69)	7.94 (.94)
Hard Rebus Puzzles	20 (3.99)	20.29 (1.93)	19.51 (1.58)	14.24 (.37)

Complex Span Tasks of Working Memory Capacity (WMC). Two computerised online administered WMC tasks were employed from the battery developed by Foster et al. (2016). The two WMC tasks were Symmetry Span and Operation Span.

Symmetry Span (SSpan). This task is an efficient test of WMC, which previous research has shown has good internal consistency and test-retest reliability (Unsworth, Redick, Heitz, Broadway & Engle, 2009). During this task, participants were shown a series of grid locations on a 4x4 grid. The participants were tasked with remembering and recalling sequences of 2 to 5 red square locations and the order they appeared in. After each 4x4 grid, the participants were shown an 8x8 grid, with orange and yellow patterns and asked if it was symmetrical, along the vertical axis. Then, they were asked to click an orange 'Yes' or 'No' button, before the next grid was shown (Smith, Persyn & Butler, 2011) (See Figure 1). This task consisted of 3 blocks and 3 trials of each set size, ranging from 2 to 5 items (Engle & Unsworth, 2007). The participants were allowed to practice the symmetry problems. However, this was not accompanied by the icons.

Operation Span (OSPan). This operation span task measured the participants' verbal abilities and reading comprehension. The picture span tests required working memory representations to update and monitor (Turner & Engle, 1989). The current study utilised a variation of OSpan with one difference; the to-be-remembered stimuli consists of pictures of ordinary objects, for example, a t-shirt. Each object was intertwined with an arithmetic problem (Hicks, Foster & Engle, 2016) (See Figure 1). This task consisted of 15 experimental trials: 3 for each size set (2, 3, 4, 5 and 7).

Figure 1. Examples of Symmetry Span A) and Operation Span B)



2.4 Procedure

This three-part experiment was administered online using JavaScript and Qualtrics survey software. At the start of the study and before participating in the experiment, participants read an online information sheet (See Appendix 1), completed a demographic form asking for their age and gender (See Appendix 3) and completed a check-box style consent form (See Appendix 2). Before starting each part, the participants read general instructions for that section (See Appendices 4, 16, 21, 28 & 29). After completing all three tasks, the participants read an online de-brief sheet (See Appendix 30).

Part 1: Serial Digit Recall Task Before starting the task, the participants read a task-specific online information sheet (See Appendix 5), completed a demographic form (see Appendix 7) and a consent form (see Appendix 6). For this part, the participants were instructed to wear headphones and completed some initial competencies checks before proceeding with the digit serial recall task with auditory distractors. Participants completed the digit serial recall task via a link in Qualtrics and participants were asked to copy and paste the link into a new tab. The participants were given instructions at the start of the study, for sound calibration, after completing the sound calibration (See Appendix 9), during the practice trials (See Appendix 10) and before the participants started the experimental trials (See Appendix 13). In addition to this, after the instructions given at the start, participant set-up instructions were then shown.

As implied by the instructions the participants were given 3 practice trials, between the sound calibration and the experimental trials. In the sound calibration, the study progressed automatically, after the participant chose the number ‘1’, ‘2’ or ‘3’, depending on the sound, they thought was the quietest (See Appendix 9). If the participants selected the correct number, they would continue to the trials. However, if they failed, they would not be allowed to continue. During the practice and study trials, the participants pressed a white continue button to move to the next trial, then a white done button to navigate from the serial recall to the question and finally, a white continue button to proceed to the next trial. During the 36 experimental trials, there were no breaks or gaps. After the trials finished, the participants were asked to fill in a questionnaire with post experiment checks (See Appendix 14).

Part 2: CRATs & Rebus Puzzles On completion of the serial recall task, participants were directed to navigate back to Qualtrics and completed the 16 CRATs and 16 Rebus Puzzles. The problems were presented such that they were blocked according to type, with a random presentation of each problem within each set. The participants were given instructions for the CRATs (See Appendix 18) and Rebus Puzzles (See Appendix 21).

Before starting the trials, the participants were given one practice CRAT and one Rebus Puzzle. When the participants thought of their answers, they inputted them into a textbox on the screen. There was a time restriction of 30 seconds for each CRAT and Rebus Puzzle. When they reached this, the participants would continue to the next problem. After each CRAT and Rebus Puzzle, the participants were asked two questions. The first question asked which solution strategy they used; 'Insight' or 'Analysis'. This was rated on a scale of 1 to 100, 1 (Insight) and 100 (Analysis) and the scale was labelled 'Insight or Analysis?' (See Appendix 24). When the participants were presented with this question, there were definitions of Insight and Analysis shown (See Appendix 24). The second question asked how confident they were in their response; 'Not at all Confident' or 'Very Confident'. This was rated on a scale of 1 to 100, 1 (Not at all Confident) and 100 (Very Confident) and the scale was labelled 'How Confident?' (See Appendix 25). If the participants did not enter a response, they did not complete these two questions.

Part 3: Symmetry Span (SSpan) & Operation Span (OSpan) After completing the problem-solving task, the participants completed two working memory tasks: SSPan and OSPan, via javascript, embedded into Qualtrics. Firstly, the participants completed the SSPan task. Before starting this task, the participants were given instructions, accompanied by images (See Appendix 28). As is implied in the instructions, participants were given the opportunity to practice making judgments about whether 8x8 grids are symmetrical or asymmetrical. However, this was not accompanied by the 4x4 grids and the locations. The participants navigated the instructions and the trials by clicking the orange next button above the grids. This task consisted of 3 separate blocks and as there was a pause between blocks, participants were able to have breaks, should this have been wanted or required.

After the participants had completed the SSPan task, the participants complete the OSPan task. Before starting this task, the participants were given instructions, accompanied by images (See Appendix 29). As is implied in the instructions, participants were given the maths problems. However, this was not accompanied by the icons. The participants navigated the instructions and the trials by clicking the orange next button above the grids. This task consisted of 15 separate trials and as there was a pause between trials, participants were able to have breaks, should this have been wanted or required.

Chapter 3: Results

3.1 Data Preparation

3.1.1 Serial Digit Recall Performance Scores and Background Sound Effect Ratings

For the serial digit recall task, performance was scored following the strict serial recall criterion. Digits were scored as ‘correct’ if they were recalled in the correct serial position, and a score was given between 0 and 1 for each trial. For each participant, a mean serial recall performance score was calculated for each condition: quiet, meaningless speech and meaningful speech. In addition to this, after each trial, the participants were asked to rate the effect the background sound had on their performance, on a scale of 1 to 10. This is a metacognitive measure of how distracting the participants felt the background sound was to them, during the task. For each participant, a mean background sound effect rating was calculated for each condition: quiet, meaningless speech and meaningful speech.

For the final research question, low and high distractibility needed to be determined, using the mean background sound effect ratings in the quiet, meaningless speech and meaningful speech conditions. To do this, using all the participants data, the median for the mean background sound effect ratings were calculated for each condition (See Appendix 83 for Statistical Values): quiet (4.33), meaningless speech (6.75) and meaningful speech (7.25). Based on the median, the mean background sound effect ratings, for each participant, were coded as low or high distractibility for each condition; low distractibility (1) if they were lower than the median, and high distractibility (2) if they were higher than the median.

3.1.2 CRATs and Rebus Puzzles

In the present study, there were two types of insight problem-solving tasks used: 16 CRATS (See Appendix 19) and 16 Rebus Puzzles (See Appendix 22). These were selected to compare verbal problem-solving (CRATs) and pictorial problem-solving (Rebus Puzzles). For both the CRATs and Rebus Puzzles, there were 8 easy and 8 difficult tasks included, to investigate the effect of difficulty. Additionally, for the Rebus Puzzles, there were two different types with two levels of difficulty: 8 word and 8 visual, including 4 easy and 4 difficult. This allowed a comparison to be made between the Rebus Puzzles involving verbal or numerical cues, and visual and spatial cues and the effect of the difficulty.

For each CRAT and Rebus Puzzle, data was collected for solution rate, solution time, solution strategy and solution confidence. When calculating the solution rate score, it was determined whether the answers given to the CRATs and Rebus Puzzles were correct or incorrect. The answers were coded as 0, if they were incorrect, and 1, if they were correct. After this, the number of correct answers was calculated, and a mean solution rate score was calculated for the CRATs and Rebus Puzzles. After determining the correct answers for the CRATs and Rebus Puzzles, solution time, solution strategy, and solution confidence scores were noted these. However, these scores for incorrect answers were not recorded.

For the solution strategy score, participants were asked to rate their strategy on a scale of 1 to 100, where 1 was ‘Insight’ and 100 was ‘Analysis’ (See Appendix 24). A score below 50 was deemed as ‘Insight’ and a score over 50 was deemed as ‘Analysis’. In addition to this, for the solution confidence score, participants were asked to rate their confidence in their answer on a scale of 1 to 100, where 1 was ‘Not at all Confident’ and 100 was ‘Very Confident’ (See Appendix 25).

The means were calculated for the solution rate, solution time, solution strategy and solution confidence scores for the CRATs and Rebus Puzzles. In addition to calculating these scores for all the CRATs and Rebus Puzzles, they were also calculated for the easy and difficult CRATs and Rebus Puzzles, the visual and word Rebus Puzzles and the easy and difficult, word and visual Rebus Puzzles.

3.1.3 Working Memory Span Tasks Scores

From the Symmetry Span (SSPan) and Operation Span (OSPan) tasks, three scores were calculated: SSPan Score, OSPan Score and Composite Score for each participant. The SSPan Scores and OSPan Scores were obtained by calculating the number of items recalled in the correct serial order in the SSPan and OSPan tasks, respectively. Also, a Composite Score was created by calculating the mean of the SSPan and OSPan scores.

Before the data was analysed, it was checked to ensure all three scores had been calculated. Some of the data said ‘NULL’, instead of a numerical score, which suggested that the participant had not completed the task. When the participant had this, the data was removed because there was no score for either one or both tasks. Based on this, 7 data sets (10.61%) were removed.

3.1.4 Statistical Testing

To analyse the data, one-way within-subjects ANOVAs, t-tests, correlational analyses, and multiple regressions were conducted.

When one-way within-subjects ANOVAs were conducted, the following assumptions were met: the data was continuous and normally distributed, a random sample was obtained, and Sphericity was met (Emerson, 2022). To check Sphericity was met, the Mauchly’s Test of Sphericity was used to test the null hypothesis, which states that variances of the differences are equal. If the test was statistically significant (>.05), the null hypothesis was rejected and the alternative hypothesis, which states the variances of the differences are not equal, was accepted and therefore sphericity was violated. When this was the case, the

Greenhouse-Geisser correction was made, and the figures were quoted from this line in the 'Test of Within-Subjects' table. However, if the test was statistically not significant (<.05), then the null hypothesis was accepted and the figures were quoted from the Sphericity Assumed line (Armstrong, 2017).

When needed t-tests were conducted as post-hoc tests using paired samples t-test for paired sampled measurements, the following assumptions met: the participants must be independent, each paired samples measure is obtained for each participant, and the measures are normally distributed (Mishra, Mishra, Pandey, Pandey & Singh, 2019). The bonferri correction was used to correct the problem presented by Type I error when there is an increased number of t-tests been run, which can mean a significant difference is present when it is not (Armstrong, 2014) (See Appendix 32, 34, 36 and 38 for Calculations).

When correlational analysis was conducted, the following assumptions were met: the two variables use a continuous scale and have a linear relationship, there are no spurious outliers, and the data is normally distributed (Deipen, Dekker, Jager, Janse, Hoekstra, Tripepi, & Zoccali, 2021).

When multiple linear regression was conducted, the following assumptions were met: there is a linear relationship between the independent and dependent variables, the date is normally distributed, there are no outliers, and the independent variables are linearly independent (Albers & Ernst, 2017).

3.2 Serial Digit Recall

3.2.1 Serial Recall Performance

For each trial on the serial digit recall task, performance was scored following the strict serial recall criterion, where digits are scored as correct if they are recalled in the correct serial position, and a score is given between 0 and 1. A mean serial recall performance score was calculated for each participant for the quiet, meaningless speech and meaningful speech conditions. Table 3 shows the means and standard deviations of the mean Serial Recall Performance Scores for each condition.

Table 3: Means and Standard Deviations for the Mean Serial Recall Performance Scores in the Quiet, Meaningless Speech and Meaningful Speech Conditions

	Mean	Standard Deviation
Quiet	.74	.16
Meaningless Speech	.64	.17
Meaningful Speech	.62	.17

A one-way within-participants ANOVA revealed a significant main effect of serial recall performance score; F (2, 116) = 20.78, p < .001, Partial Eta^2 = .26 (26%) (See Appendix 31 for Statistical Analysis). To explore this main effect, post-hoc tests were conducted in the form of paired samples t-tests (See Appendix 32 for Statistical Analysis). One two-tailed paired samples t-test showed that the mean serial recall performance scores were significantly higher in the quiet condition than the meaningless speech condition; t (58) = 5.12, p < .001. A further two-tailed paired samples t-test revealed that the mean serial recall performance scores were significantly higher in the quiet condition than the meaningful speech condition; t (58) = 5.32, p < .001. These findings suggest that performance was better in silence than in the presence of meaningful, and meaningless, speech. Therefore, one was more distracted by meaningful, and meaningless, speech than silence. A final two-tailed paired samples t-test discovered there was no significant difference between the mean serial recall performance scores in the meaningless and meaningful speech conditions. This suggests that there was not a difference in performance in the presence of meaningful and meaningless speech. Therefore, one was not more distracted by meaningful or meaningless speech.

3.2.2 Background Sound Effect Ratings

After each trial, the participants were asked to rate the effect the background sound had on their performance, on a scale of 1 to 10. This is a metacognitive measure of how distracting the participants felt the background sound was to them. A mean background sound effect rating was calculated for each participant in the quiet, meaningless speech and meaningful speech conditions. Table 4 shows the means and standard deviations for the mean background sound effect ratings for each condition.

Table 4: Means and Standard Deviations for the Mean Background Sound Effect Ratings in the Quiet, Meaningless Speech and Meaningful Speech Conditions.

	Mean	Standard Deviation
Quiet	3.90	1.47
Meaningless Speech	6.71	1.16
Meaningful Speech	7.04	1.09

A one-way within-participants ANOVA revealed a significant main effect of background sound effect ratings; F (2, 116) = 123.39, $p < .001$, Partial Eta^2 = .68 (68%) (See Appendix 33 for Statistical Analysis). To explore this significant main effect, post-hoc tests were conducted in the form of paired samples t-tests (See Appendix 34 for Statistical Analysis). One two-tailed paired samples t-test showed that the mean background sound effect ratings were significantly higher in the meaningless speech condition than the quiet condition; t (58) = -11.31, $p < .001$. Another two-tailed paired samples t-test revealed that the mean background sound effect ratings were significantly higher in the meaningful speech condition than the quiet condition; t (58) = -11.80, $p < .001$. These findings suggest that the presence of meaningful, and meaningless, speech had more of an impact on one's performance than silence. A final two-tailed paired samples t-test discovered there was not a significant difference between the mean background sound effect ratings in the meaningful and meaningless speech conditions. This suggests that the presence of meaningful and meaningless speech did not affect participants performance differently. Therefore, distraction by meaningless and meaningful speech had a similar effect on one's performance.

3.3 Problem-Solving

3.3.1 Solution Rate Scores

The participants' answers were coded, based on whether they were correct or incorrect. The correct answers were coded as 1 and the incorrect answers were coded as 0. For each participant, a mean solution rate score was calculated for the CRATs and Rebus Puzzles.

Firstly, the mean solution rate scores were calculated for the easy and difficult, CRATs and Rebus Puzzles. Table 5 shows the means and standard deviations for the mean solution rate scores for the easy and difficult, CRATs and Rebus Puzzles.

Table 5: The Means and Standard Deviations for the Mean Solution Rate Scores for the Easy and Difficult, CRATs and Rebus Puzzles

	CRATs	**Rebus Puzzles**
Easy	.38 (.34)	.47 (.35)
Difficult	.37 (.27)	.27 (.24)

A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA was conducted to investigate the mean solution rate scores between the easy and difficult CRATs and Rebus Puzzles (See Appendix 35 for Statistical Analysis). Firstly, there was no significant main effect of Task Type. In contrast, a significant main effect of Difficulty was discovered; F (1, 58) = 20.35, p < .001, Partial Eta^2 = .26 (26%). This shows there is a difference between the mean solution rate scores for the easy and difficult CRATs and Rebus Puzzles. From the means, it is suggested that more correct answers were given to easy CRATs and Rebus Puzzles, than difficult ones. Finally, a significant interaction effect was found between Task Type and Difficulty; F (1, 58) = 16.07, p < .001, Partial Eta^2 = .22 (22%).

To explore this significant interaction between Task Type and Difficulty, post-hoc tests were conducted (See Appendix 36 for Statistical Analysis). One two-tailed paired samples t-test discovered there was no significant difference between the mean solution rate scores for the easy and difficult CRATs. This suggests that the number of correct answers given to easy and difficult CRATs and Rebus Puzzles was similar. Another two-tailed paired samples t-test revealed the mean solution rate scores were significantly higher for the easy, than the difficult, Rebus Puzzles; t (58) = 6.53, p < .001. A further two-tailed paired samples t-test showed the mean Solution Rate Scores were significantly higher for the easy Rebus Puzzles than the easy CRATs; t (58) = - 2.41, p = .02. Additionally, a two-tailed paired samples t-test found the mean solution rate scores were significantly higher for the easy CRATs than the difficult Rebus Puzzles; t (58) = 2.75, p = .01. Another two-tailed paired samples t-test discovered the mean solution rate scores were significantly higher for the easy Rebus Puzzles than the difficult CRATs; t (58) = - 6.62, p < .001. A final paired samples t-test revealed the mean solution rate scores were significantly higher for the difficult CRATs than the difficult Rebus Puzzles; t (58) = 6.42, p < .001. These findings suggests that more correct answers were given to easy than difficult Rebus Puzzles, easy Rebus Puzzles than easy CRATs, easy CRATs than difficult Rebus Puzzles, easy Rebus Puzzles than difficult CRATs and difficult CRATs than difficult Rebus Puzzles.

Secondly, the mean solution rate scores were calculated for the easy and difficult, word and visual Rebus Puzzles. Table 6 shows the means and standard deviations for the mean solution rate scores for the easy and difficult, word and visual Rebus Puzzles.

Table 6: The Means and Standard Deviations for the Mean Solution Rate Scores for the Easy and Difficult, Word and Visual Rebus Puzzles

	Word	**Visual**
Easy	.36 (.31)	.18 (.26)
Hard	.31 (.25)	.47 (.35)

A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA was conducted to investigate the mean solution rate scores between the easy and difficult, word and visual Rebus Puzzles (See Appendix 37 for Statistical Analysis). Firstly, there was no significant main effect of Rebus Puzzle Type. In contrast, a significant main effect of Difficulty was discovered; F (1, 58) = 30.82, p < .001, Partial Eta^2 = .35 (35%). This suggests there is a difference between the easy and difficult Rebus Puzzles. From the means, it suggests that more correct answers were given to easy word and visual Rebus Puzzles, than difficult ones. Finally, a significant interaction effect was found between Rebus Puzzle Type and Difficulty; F (1, 58) = 38.28, p < .001, Partial Eta^2 = .40 (40%).

To explore this significant interaction between Rebus Puzzle Type and Difficulty, post-hoc tests were conducted (See Appendix 38 for Statistical Analysis). One two-tailed paired samples t-test discovered there was not a significant difference between the mean solution rate scores for the easy and difficult, word Rebus Puzzles. This suggests that the number of correct answers given to easy and difficult word Rebus Puzzles were similar. Another two-tailed paired samples t-test revealed the mean solution rate scores were significantly higher for the difficult, than the easy, visual Rebus Puzzles; t (58) = -7.34, p < .001. A further two-tailed paired samples t-test showed the mean solution rate scores were significantly higher for the easy word, than the easy visual, Rebus Puzzles; t (58) = 4.77, p <.001. Additionally, a two-tailed paired samples t-test found the mean solution rate scores were significantly higher for the difficult word, than the easy visual, Rebus Puzzles; t (58) = -6.45, p < .001. Another two-tailed paired samples t-test discovered the mean solution rate scores were significantly higher for the difficult visual, than the easy word, Rebus Puzzles; t (58) = 3.67, p < .001. A final paired samples t-test revealed the mean solution rate scores were significantly higher for the difficult visual, than the difficult word, Rebus Puzzles; t (58)

= 6.80, *p* < .001. These findings suggest that more correct answers were given to difficult than easy visual, easy word than easy visual, difficult word than easy visual, difficult visual than easy word, and difficult than easy word, Rebus Puzzles.

3.3.2 Solution Times

For each participant, mean solution times were calculated for the CRATs and Rebus Puzzles. The participants' solution times were only included for correct answers.

Firstly, the mean solution times were calculated for the easy and difficult, CRATs and Rebus Puzzles. Table 7 shows the means and standard deviations for the mean solution times for the easy and difficult, CRATs and Rebus Puzzles.

Table 7: The Means and Standard Deviations for the Mean Solution Times (Seconds) for the Easy and Difficult, CRATs and Rebus Puzzles

	CRATs	**Rebus Puzzles**
Easy	8.31 (4.96)	7.57 (3.83)
Difficult	5.90 (3.71)	6.22 (3.25)

A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Hard) Factorial ANOVA was conducted to investigate the mean solution times between the easy and difficult CRATs and Rebus Puzzles (See Appendix 39 for Statistical Analysis). Firstly, there was no significant main effect of Task Type. In contrast, a significant main effect of Difficulty was discovered; F (1, 31) = 10.64, p = .003, Partial Eta^2 = .26 (26%). This suggest there was a difference in the time taken to solve the easy and difficult CRATs and Rebus Puzzles. From the means, it suggests that easy CRATs and Rebus Puzzles were solved slower than difficult ones. Finally, there was not a significant interaction effect between Task Type and Difficulty.

Secondly, the mean solution times were calculated for the easy and difficult, word and visual Rebus Puzzles. Table 8 shows the means and standard deviations for the mean solution times for the easy and difficult, word and visual Rebus Puzzles.

Table 8: The Means and Standard Deviations for the Mean Solution Times (Seconds) for the Easy and Difficult, Word and Visual Rebus Puzzles

	Word	**Visual**
Easy	8.61 (4.75)	6.39 (2.91)
Difficult	8.52 (3.68)	7.59 (3.54)

A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Hard) Factorial ANOVA was conducted to investigate the mean solution times between the easy and difficult, word and visual Rebus Puzzles (See Appendix 40 for Statistical Analysis). Firstly, a significant main effect of Rebus Puzzle Type was revealed; F (1, 21) = 6.10, p = .02, Partial Eta^2 = .23 (23%). This suggests that there was a difference between the time taken to solve the word and visual Rebus Puzzles. From the means, it suggests that word Rebus Puzzles were solved slower than visual ones. In contrast, there was no significant main effect of Difficulty. Finally, there was not a significant interaction effect found between Rebus Puzzle Type and Difficulty.

3.3.3 Solution Strategy Scores

For each participant, a mean solution strategy score was calculated for the CRATs and Rebus Puzzles. The participants solution strategy scores were only included for correct answers.

Firstly, the mean solution strategy scores were calculated for the easy and difficult, CRATs and Rebus Puzzles. Table 9 shows the means and standard deviations for the mean solution strategy scores for the easy and difficult, CRATs and Rebus Puzzles.

Table 9: The Means and Standard Deviations for the Mean Solution Strategy Scores for the Easy and Difficult CRATs and Rebus Puzzles

	CRATs	**Rebus Puzzles**
Easy	23.42 (16.10)	22.00 (24.66)
Difficult	18.36 (13.99)	16.86 (17.68)

A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA was conducted to investigate the mean solution strategy scores between the easy and difficult, CRATs and Rebus Puzzles (See Appendix 41 for Statistical Analysis). Firstly, there was not a significant main effect of Task Type revealed. In contrast, a significant main effect of Difficulty was discovered; F (1, 32) = 5.52, p = .03, Partial Eta^2 = .15 (15%). This suggests there is a difference in the use of analysis and insight when solving the easy and difficult CRATs and Rebus Puzzles. From the means, it suggests that participants used more insight to solve difficult CRATs and Rebus Puzzles than easy ones.

Finally, there was not a significant interaction effect found between Task Type and Difficulty.

Secondly, the mean solution strategy scores were calculated for the easy and difficult, word and visual Rebus Puzzles. Table 10 shows the means and standard deviations for the mean solution strategy scores for the easy and difficult, word and visual Rebus Puzzles.

Table 10: The Means and Standard Deviations for the Mean Solution Strategy Scores for the Easy and Difficult, Word and Visual Rebus Puzzles

	Word	**Visual**
Easy	30.65 (32.74)	23.31 (27.52)
Difficult	25.98 (26.16)	20.16 (17.74)

A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA was conducted to investigate the mean solution strategy scores between the easy and difficult, word and visual Rebus Puzzles (See Appendix 42 for Statistical Analysis). Firstly, a significant main effect of Type of Rebus Puzzle was revealed; F (1, 21) = 5.16, p = .03, Partial Eta^2 = .20 (20%). This suggests that there is a difference in the use of analysis and insight when solving the word and visual Rebus Puzzles. From the means, it suggest that participants used more insight to solve visual Rebus Puzzles, than word ones. In contrast, there was not a significant main effect of Difficulty discovered. Finally, there was not a significant interaction effect found between Rebus Puzzle Type and Difficulty.

3.3.4 Solution Confidence Scores

For each participant, a mean solution confidence score was calculated for CRATs and Rebus Puzzles. The participants' solution confidence scores were only included for correct answers.

Firstly, the mean solution confidence scores were calculated for the easy and difficult, CRATs and Rebus Puzzles. Table 11 shows the means and standard deviations for the mean solution confidence scores for the easy and difficult, CRATs and Rebus Puzzles.

Table 11: The Means and Standard Deviations for the Mean Solution Confidence Scores for the Easy and Difficult, CRATs and Rebus Puzzles

	CRATs	**Rebus Puzzles**
Easy	47.92 (24.67)	59.78 (29.49)

Difficult	27.32 (16.36)	36.14 (22.22)

A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA was conducted to investigate the mean solution confidence scores between the easy and difficult, CRATs and Rebus Puzzles (See Appendix 43 for Statistical Analysis). Firstly, there were significant main effects revealed for of Task Type; F (1, 31) = 5.20, p = .03, Partial Eta^2 = .14 (14%), and Difficulty; F (1, 31) = 41.10, p < .001, Partial Eta^2 = .57 (57%). This suggests that there is a difference in participants confidence in their answers to CRATs and Rebus Puzzles. From the means, it suggests that participants were more confident in their answers to the Rebus Puzzles, than CRATs. Additionally, it shows that participants were more confident in their answers to the easy, than the difficult, CRATs and Rebus Puzzles. This suggests that there is a difference in the participants confidence in their answers to the easy and difficult CRATs and Rebus Puzzles. From the means, it suggest that the participants were more confident in their answers to the easy CRATs and Rebus Puzzles, than the difficult ones. Finally, there was not a significant interaction effect found between Task Type and Difficulty.

Secondly, the mean solution confidence scores were calculated for the easy and difficult, word and visual Rebus Puzzles. Table 12 shows the means and standard deviations for the mean solution confidence scores for the easy and difficult, word and visual Rebus Puzzles.

Table 12: The Means and Standard Deviations for the Mean Solution Confidence Scores for the Easy and Difficult, Word and Visual Rebus Puzzles

	Word	**Visual**
Easy	71.68 (30.74)	57.24 (27.73)
Difficult	53.22 (26.54)	38.26 (25.10)

A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA was conducted to investigate the mean solution confidence scores between the easy and difficult, word and visual Rebus Puzzles (See Appendix 44 for Statistical Analysis). Firstly, a significant main effect of Rebus Puzzle Type was revealed; F (1, 21) = 13.27, p = .00, Partial Eta^2 = .39 (39%). This suggests that there is a difference in the participants confidence in their answers to word and visual Rebus Puzzles. From the means, it is suggested that participants were more confidence in their answers to word Rebus Puzzles, than visual ones. In contrast, there was not a significant main effect of Difficulty discovered. Finally, there was not a significant interaction effect found between Rebus Puzzle Type and Difficulty.

3.4 Working Memory Capacity Scores

The Symmetry Span (SSPan) and Operation Span (OSPan) scores from the SSPan and OSPan tasks were calculated for all participants. Table 13 shows the means and standard deviations for the two scores.

Table 13: Means and Standard Deviations for Symmetry Span and Operation Span Scores from the Symmetry Span and Operation Span Tasks

Score	Mean	Standard Deviation
Symmetry Span	29.97	8.74
Operation Span	33.41	10.25

One two-tailed paired samples t-test revealed that the OSpan scores were significantly higher than the SSpan scores; t (58) = -2.87, p = .01 (See Appendix 45 for Statistical Analysis). This shows that the verbal WMC was higher than visuo-spatial WMC.

3.5 Distractibility & Insight Problem-Solving

3.5.1 The Relationship Distractibility in the Quiet Condition & Insight Problem-Solving

The distractibility scores in the quiet condition and the mean solution rate, mean solution time, mean solution strategy and mean solution confidence scores for the CRATs and Rebus Puzzles were statistically analyzed to investigate whether there was a relationship between them. Table 22 shows the means and standard deviations for the mean solution rate, mean solution time, mean solution strategy and mean solution confidence scores for the CRATs and Rebus Puzzles for low and high distractibility, in the quiet condition.

Table 14: Means and Standard Deviations for the Mean Solution Rate, Mean Solution Time, Mean Solution Strategy and Mean Solution Confidence Scores for CRATs and Rebus Puzzles for Low and High Distractibility, in the Quiet Condition.

		Scores							
		Rate		**Time**		**Solution Strategy**		**Confidence**	
		CRATs	**Rebus**	**CRATs**	**Rebus**	**CRATs**	**Rebus**	**CRATs**	**Rebus**
Distractibility	**Low**	.42	.49	6.49	6.06	18.06	15.85	31.68	43.64
		(.20)	(.24)	(5.59)	(2.39)	(11.54)	(14.58)	(16.90)	(24.23)
	High	.39	.46	5.59	6.07	18.40	18.59	30.40	38.94

	(.26)	(.25)	(3.95)	(3.49)	(15.01)	(21.78)	(22.36)	(25.04)
Total	.41	.47	6.05	6.07	18.22	17.19	31.06	41.34
	(.23)	(.24)	(3.86)	(2.94)	(13.19)	(18.28)	(19.53)	(24.45)

A two-way 2 (Task Type: CRATs & Rebus Puzzles) x 4 (Score: Solution Rate, Solution Time, Solution Strategy & Solution Confidence) mixed ANOVA with repeated measures of distractibility in the quiet condition (See Appendix 84 for Statistical Analysis). Firstly, there was not a significant between-participants effect shown for Distractibility. Also, there was not a significant main effect discovered for Task Type. However, there was a significant main effect revealed for Score; F (3, 123) = 106.21, $p < .001$, Partial Eta^2= .72 (72%). In addition to this, there was not a significant interaction effect shown between Task Type and Distractibility, Score and Distractibility, and Task Type, Score and Distractibility. However, there was a significant interaction discovered between Task Type and Score; F (3, 120) = 6.89, $p < .001$, Partial Eta^2= .14 (14%).

Further to this statistical analysis, correlation analyses were conducted to determine if distractibility in the quiet condition affected the mean solution rate scores and mean solution times for the CRATs and Rebus Puzzles. The correlation matrix shows that the correlations were not significant (See Appendix 85 for Statistical Analysis). This shows there is no relationship between distractibility in silence, and the number of correct answers given to and the time taken to solve CRATs and Rebus Puzzles.

After the correlation analyses were conducted, four standard multiple regressions were employed to predict mean solution rate scores and mean solution times for the CRATs and Rebus Puzzles, using measures of distractibility in the quiet condition (See Appendix 86, 87, 88 and 89 for Statistical Analysis). The overall models were not significant, showing that distractibility in the quiet condition did not significantly predict the mean solution rate scores and mean solution times for the CRATs and Rebus Puzzles. This shows that distractibility in silence did not predict the number of correct answers given to and the time taken to solve CRATs and Rebus Puzzles.

3.5.2 The Relationship Distractibility in the Meaningless Speech Condition & Insight Problem-Solving

For the distractibility scores in the meaningless speech condition and the mean solution rate, mean solution time, mean solution strategy and mean solution confidence scores for the CRATs and Rebus Puzzles were statistically analyzed to investigate whether there was a relationship between them. Table 23 shows the means and standard deviations for the solution rate, mean solution time, mean solution strategy and mean solution confidence scores for CRATs and Rebus Puzzles for the low and high distractibility groups, in the meaningless speech condition.

Table 15: Means and Standard Deviations for the Mean Solution Rate, Mean Solution Time, Mean Solution Strategy and Mean Solution Confidence Scores for CRATs and Rebus Puzzles for the Low and High Distractibility Groups, in the Meaningless Speech Condition.

		Scores							
		Rate		**Time**		**Solution Strategy**		**Confidence**	
		CRATs	**Rebus**	**CRATs**	**Rebus**	**CRATs**	**Rebus**	**CRATs**	**Rebus**
Distractibility	**Low**	.32 (.19)	.44 (.23)	4.76 (2.31)	5.32 (2.89)	15.94 (10.35)	15.91 (17.76)	24.03 (16.45)	38.44 (22.65)
	High	.46 (.24)	.50 (.25)	6.98 (4.49)	6.61 (2.92)	19.87 (14.89)	18.11 (18.96)	36.12 (20.28)	43.43 (25.91)
	Total	.41 (.23)	.47 (.24)	6.05 (3.86)	6.07 (2.94)	18.22 (13.19)	17.19 (18.28)	31.06 (19.53)	41.34 (24.45)

A two-way 2 (Task Type: CRATs & Rebus) x 4 (Score: Solution Rate, Solution Time, Solution Strategy & Solution Confidence) mixed ANOVA with repeated measures of distractibility in the meaningless speech condition (See Appendix 96 for Statistical Analysis). Firstly, there was not a significant between-participants effect shown for Distractibility. Also, there was not a significant main effect discovered for Task Type. However, there was a significant main effect revealed for Score; F (3, 123) = 102.34, p < .001, Partial Eta^2= .71 (71%). In addition to this, there was not a significant interaction effect shown between Task Type and Distractibility, Score and Distractibility, and Task Type, Score and Distractibility. However, there was a significant interaction discovered between Task Type and Score; F (3, 120) = 7.47, p < .001, Partial Eta^2= .15 (15%).

Further to this statistical analysis, correlation analyses were conducted to determine if distractibility in the meaningless speech condition affected the mean solution rate scores and mean solution times on CRATs and Rebus Puzzles.

From the correlation matrix, it can be seen there were significant correlations shown (See Appendix 97 for Statistical Analysis). Two two-tailed Pearson's correlation revealed a moderate, positive and significant correlation between the mean solution rate scores and solution times for the CRATs, and distractibility in the meaningless speech condition. This shows the more distracted one is by meaningless speech, the higher the number of correct answers given to, and the longer the time taken to solve CRATs. This suggests there is a relationship between distractibility by meaningless speech and the number of correct answers given to, and the time taken to solve CRATs. Further two-tailed Pearson's correlations revealed a weak, positive and significant correlation between the mean solution rate scores and solution times for the Rebus Puzzles, and distractibility in the meaningless speech condition. This shows the more distracted one is by meaningless speech the more correct answers given to and the longer the time taken to solve, Rebus Puzzles. This suggests there is a relationship between distractibility by meaningless speech and the number of correct answers given to and the time taken to solve Rebus Puzzles.

After the correlation analyses were conducted, four standard multiple regressions were conducted. One standard multiple regression was employed to predict mean solution times for the Rebus Puzzles, using measures of distractibility in the meaningless speech condition (See Appendix 99 for Statistical Analysis). The overall model was not significant, showing that distractibility in the meaningless speech condition did not significantly predict mean solution times for the Rebus Puzzles. This shows that distractibility by meaningless speech does not predict the time taken to solve Rebus Puzzles.

A further three standard multiple regressions were employed to predict mean solution rate scores and mean solution times for the CRATs, and the mean solution rate scores for the Rebus Puzzles, using measures of distractibility in the meaningless speech condition. The overall models were significant, showing that distractibility in the meaningless speech condition did significantly predict the mean solution rate scores and mean solution times for the CRATs, with the model explaining 13% and 12% variance, respectively, and the mean solution rate scores for the Rebus Puzzles, with the model explaining 8% variance. (See Appendices 98, 100 and 100 for Statistical Analysis). This suggests that distractibility by meaningless speech might predict the number of correct answers given to CRATs and Rebus Puzzles, and the time taken to solve Rebus Puzzles. Of the three predictors, none were significant. This shows that distractibility by meaningless speech does not predict the number of correct answers given to CRATs and Rebus Puzzles, and the time taken to solve Rebus Puzzles.

3.5.3 The Relationship Distractibility in the Meaningful Speech Condition & Insight Problem-Solving

For the distractibility scores in the meaningful speech condition and mean solution rate, mean solution time, mean solution strategy and mean solution confidence scores for the CRATs and Rebus Puzzles were statistically analyzed to investigate whether there was a relationship between them. Table 26 shows the means and standard deviations for mean solution rate, mean solution time, mean solution strategy and mean solution confidence scores for CRATs and Rebus Puzzles for the low and high distractibility groups, in the meaningful speech condition.

Table 16: Means and Standard Deviations for the Mean Solution Rate, Mean Solution Time, Mean Solution Strategy and Mean Solution Confidence Scores for CRATs and Rebus Puzzles for the Low and High Distractibility Groups, in the Meaningful Speech Condition.

		Scores							
		Rate		**Time**		**Solution Strategy**		**Confidence**	
		CRATs	**Rebus**	**CRATs**	**Rebus**	**CRATs**	**Rebus**	**CRATs**	**Rebus**
Distractibility	**Low**	.35 (.19)	.44 (.20)	5.21 (2.66)	5.79 (2.55)	17.31 (10.44)	17.00 (17.00)	25.91 (17.67)	38.59 (20.17)
	High	.46 (.25)	.50 (.27)	6.77 (4.60)	6.30 (3.28)	19.01 (15.38)	17.35 (19.70)	35.53 (20.33)	43.73 (27.87)
	Total	.41 (.23)	.47 (.24)	6.05 (3.86)	6.07 (2.94)	18.22 (13.19)	17.19 (18.28)	31.06 (19.53)	41.34 (24.45)

A two-way 2 (Task Type: CRATs & Rebus) x 4 (Score: Solution Rate, Solution Time, Solution Strategy & Solution Confidence) mixed ANOVA with repeated measures of distractibility in the meaningful speech condition (See Appendix 90 for Statistical Analysis). Firstly, there was not a significant between-participants effect shown Distractibility. Also, there was not a significant main effect discovered for Task Type. However, there was a significant main effect revealed for Score; F (3, 123) = 106.62, p < .001, Partial Eta^2= .72 (72%). In addition to this, there was not a significant interaction effect shown between Task Type and Distractibility, Score and Distractibility, and Task Type, Score and Distractibility, in the Meaningful Speech condition. However, there was a significant interaction discovered between Task Type and Score; F (3, 123) = 7.07, $p < .001$, Partial Eta^2= .15 (15%).

Further to this statistical analysis, correlation analyses was conducted to determine if distractibility in the meaningless speech condition affected the mean solution rate scores and mean solution times for the CRATs and Rebus Puzzles.

The correlation matrix shows there were significant correlations (See Appendix 91 for Statistical Analysis). One two-tailed Pearson's correlation revealed a moderate, positive and significant correlation between the mean solution rate scores for the CRATs and distractibility in the meaningful speech condition. This shows the more distracted one is by meaningful speech, the higher the number of correct answers given to CRATs. This suggests there is a relationship between distractibility by meaningful speech and the number of correct answers given to CRATs. Another two-tailed Pearson's correlation revealed a weak, positive and significant correlation between the mean solution rate scores for the Rebus Puzzles and distractibility in the meaningful speech. This means that the more correct answers given to the Rebus Puzzles, the more the meaningful speech caused a distraction.

After the correlation analyses were conducted, four standard multiple regressions were conducted. Three standard multiple regression were employed to predict mean solution times for the CRATs, and the mean solution rate scores and mean solution times for the Rebus Puzzles, and the mean solution times for CRATs, using measures of distractibility in the meaningful speech condition (See Appendix 92, 93 and 95 for Statistical Analysis). The overall models were not significant, showing that distractibility in the meaningful speech condition did not significantly predict mean solution times for the CRATs, and the mean solution rate scores and mean solution times for the Rebus Puzzles.

A further standard multiple regression was employed to predict mean solution rate scores for the CRATs, using measures of distractibility in the meaningful speech condition (See Appendix 94 for Statistical Analysis). The overall model was significant, showing that distractibility in the meaningful speech condition did significantly predict the mean solution rate scores for the CRATs, with the model explaining 13% variance. This shows that the more distraction by meaningless speech caused was associated with more correct answers given for the CRATs.

3.6 Distractibility & Working Memory Capacity

Correlational and regression analyses were conducted to explore the relationship between the mean serial recall performance scores for the quiet, meaningless speech and meaningful speech conditions and the Symmetry Span (SSpan), Operation Span (OSPan) and composite scores.

The correlation matrix shows there were significant correlations. Two two-tailed Pearson's correlation discovered a weak, positive, and significant correlation between the mean serial recall performance scores in the meaningless speech, and meaningful speech, conditions and the OSPan scores. This suggests that the more distracted one is by meaningless and meaningful speecg, the higher their verbal working memory capacity (WMC). This suggests there is a relationship between verbal WMC been a domain-specific representational system and the distractibility by meaningless, and meaningful, speech. Another two-tailed Pearson's correlation revealed a weak, positive and significant correlation between the mean serial recall performance scores in the meaningless speech condition and the composite scores. This suggests the more distracted one is by meaningless speech, the higher their combined verbal and visuo-spatial WMC. This suggests there is a relationship between verbal and visuo-spatial WMC as a domain-general representational system and distractibility for meaningless speech.

After the correlation analyses were conducted, three standard multiple regressions were employed to predict the mean serial recall performance scores, in the quiet, meaningless speech and meaningful speech conditions, using the SSpan, OSpan and composite scores (See Appendices 46, 47 and 48 for Statistical Analysis). The overall models were not significant, showing the SSpan, OSpan and composite scores did not significantly predict the mean serial recall performance scores, in the quiet, meaningless speech and meaningful speech conditions. This shows these factors are not causative of each other, which suggests verbal and visuo-spatial WMC been domain-general or domain-specific representational systems does not effect distractibility by quiet, meaningful speech or meaningless speech.

3.7 Working Memory Capacity & Insight Problem-Solving

3.7.1 The Relationship Between Mean Solution Rate & Mean Solution Time Scores for the Difficult CRATS & Rebus Puzzles & Working Memory Capacity

Correlational and regression analyses were conducted to explore the relationship between the mean solution rate scores and mean solution times for the difficult CRATs and Rebus Puzzles and the Symmetry Span (SSPan), Operation Span (OSPan) and composite scores. The correlation matrix showed all the correlations were not significant (See Appendix 63 for Statistical Analysis). This suggests there is not a relationship between verbal and visual working memory capacity (WMC) been domain-specific or domain-general representational systems and the number of correct answers given to, and the time taken to solve, the difficult CRATs and Rebus Puzzles.

After the correlation analyses were conducted, four standard multiple regressions were conducted. Three standard multiple regression were employed to predict the mean solution rate scores and mean solution times for the difficult CRATs and mean solution rate scores for the difficult Rebus Puzzles, using the SSpan, OSpan and composite scores (See Appendix 64, 65 and 67 for Statistical Analysis). The overall models were not significant, showing the SSpan, OSpan and composite scores did not significantly predict the mean solution rate scores and mean solution times for the difficult CRATs, and the mean solution rate scores for the difficult Rebus Puzzles. These factors are shown to not be causative of each other. This suggests that verbal and visuo-spatial WMC been a domain-specific or domain-general representational system does not effect the number of correct answers given to and the time taken to solve difficult CRATs, and the number of correct answers given to difficult Rebus Puzzles.

A final standard multiple regression was employed to predict the mean solution times for the difficult Rebus Puzzles, using the SSpan, OSpan and composite scores. The overall model was significant, showing these three variables did significantly predict the mean solution times for the difficult Rebus Puzzles, with the model explaining 19% variance (See Appendix 66 for Statistical Analysis). This suggests these factors might be causative of each other and therefore, verbal and visuo-spatial WMC been a domain-general or domain-specific representational system could predict the time taken to solve the difficult Rebus Puzzles. Of the three predictors, two were significant: OSpan Scores, indicating that a higher verbal WMC was associated with the difficult Rebus Puzzles been solved slower; and composite Scores, showing that a lower combination of visuo-spatial WMC and verbal WMC was associated with the difficult Rebus Puzzles been solved slower (See Table 15 for Statistical Values). This suggests these factors are causative of each other. This suggest that verbal WMC in a domain-specific, and a combination of verbal and visuo-spatial WMC in a domain-general, representational system does predict the time taken to solve difficult Rebus Puzzles.

3.7.2 The Relationship Between Mean Solution Rate & Mean Solution Time Scores for the Visual & Word Rebus Puzzles & Working Memory Capacity

Correlational and regression analyses were conducted to explore the relationship between the mean solution rate scores and mean solution times for the visual and word Rebus Puzzles and the Symmetry Span (SSPan), Operation Span (OSPan) and composite scores. The correlation matrixes show there were significant correlations (See Appendix 68 and 71 for Statistical Analysis). One two-tailed Pearson's correlation discovered a medium, positive, and significant correlation between the mean solution times for the visual Rebus Puzzles and the OSpan scores. This shows that the higher one's verbal working memory capacity (WMC), the longer they take to solve verbal Rebus Puzzles. This suggests there is a relationship between verbal WMC been a domain-specific representational system and the time taken to solve visual Rebus Puzzles. Another two-tailed Pearson's correlation revealed a moderate, negative and significant correlation between the mean Solution Times for the word Rebus Puzzles and the Symmetry Span Scores. This shows that the higher one's visual-spatial WMC, the less time taken to solve the word Rebus Puzzles. This suggests there is a relationship between visuo-spatial WMC been a domain-general representational system and the time taken to solve word Rebus Puzzles.

After the correlation analyses were conducted, four standard multiple regressions were employed to predict mean solution rate scores and mean solution times for the visual and word Rebus Puzzles, using the SSpan, OSpan and composite scores (See Appendix 69, 70, 72 and 73 for Statistical Analysis). The overall models were not significant, showing the SSpan, OSpan and composite scores did not significantly predict the mean solution rate scores and mean solution times for the visual and word Rebus Puzzles. This shows that the number of correct answers given to and the time taken to solve visual and word Rebus Puzzles is not predicted by visuo-spatial and verbal WMC been domain-general or domain-specific representational systems.

3.7.3 The Relationship Between Mean Solution Rate & Mean Solution Time Scores for the Easy & Difficult Word Rebus Puzzles & Working Memory Capacity

Correlational and regression analyses were conducted to explore the relationship between the mean solution rate scores and mean solution times for the easy and difficult, word Rebus Puzzles and the Symmetry Span (SSPan), Operation Span (OSPan) and composite scores.

The correlation matrix showed there were significant correlations (See Appendix 74 for Statistical Analysis). One two-tailed Pearson's correlation revealed a weak, negative, and significant correlation between the mean solution rate scores for the easy word Rebus Puzzles and the SSpan Scores. This shows the higher one's visuo-spatial working memory capacity (WMC), the less correct answers given to easy word Rebus Puzzles. Another two-tailed Pearson's correlation revealed a moderate, negative, and significant correlation between the mean Solution Times for the difficult word Rebus Puzzles and the SSpan Scores. This shows the higher one's visuo-spatial WMC, the less time taken to solve difficult word Rebus Puzzles. These findings suggest there is a relationship between visuo-spatial WMC in a domain-specific representational system, and the number of correct answers given to easy word, and the time taken to solve difficult word Rebus Puzzles.

After the correlation analyses were conducted, four standard multiple regressions were conducted. Three standard multiple regressions were employed to predict mean solution rate scores and mean solution times for the easy word Rebus Puzzles and the mean solution rate scores for the difficult word Rebus Puzzles, using the SSpan, OSpan and composite scores (See Appendix 77, 79 and 80 for Statistical Analysis). The overall models were not significant, showing the SSpan, OSpan and composite scores did not significantly mean solution rate scores and mean solution times for the easy word Rebus Puzzles and the mean solution rate scores for the difficult word Rebus Puzzles. This shows that these factors do not predict each other. This suggests that verbal and visuo-spatial WMC been a domain-general or domain-specific representational system is not predictive of the number of correct answers given and the time taken on easy word Rebus Puzzles, and the number of correct answers given to difficult word Rebus Puzzles.

A final standard multiple regression was employed to predict mean solution times for the difficult word Rebus Puzzles, using the SSpan, OSpan and composite scores. The overall model was significant, showing the SSpan, OSpan and composite scores did significantly predict mean solution times for the difficult word Rebus Puzzles, with the model explaining

22% variance (See Appendix 78 for Statistical Analysis). This suggests that visuo-spatial and verbal WMC in a domain-general or domain-specific representational system might predict the time taken to solve difficult word Rebus Puzzles. Of the three predictors, two were significant: OSpan scores, indicating that higher verbal WMC were associated with the difficult word Rebus Puzzles been solved slower; and composite scores, showing that a lower combination of visuo-spatial WMC and verbal WMC were associated with the difficult word Rebus Puzzles been solved slower. This suggests that verbal and visuo-spatial WMC in separate domain-general representational system do predict the time taken to solve difficult word Rebus Puzzles.

3.8 Further Analyses

There was a correlational analysis and standard multiple regression conducted showing that Symmetry Span, Picture Span and Composite scores did not significantly predict background sound effect ratings in the Quiet, Meaningless Speech and Meaningful Speech (See Appendices 50, 51, and 52 for Statistical Analysis). Additionally, there were correlational analyses and standard multiple regressions conducted showing that Symmetry Span, Picture Span and Composite scores did not significantly predict the mean Solution Rate scores and the mean Solution Times for the CRATs and Rebus Puzzles (See Appendices 54, 55, 56 and 57 for Statistical Analysis), easy CRATs and Rebus Puzzles (See Appendices 59, 60, 61, and 62 for Statistical Analysis), and easy and difficult visual Rebus Puzzles (See Appendices 75, 76, 77 and 78 for Statistical Analysis).

Chapter 4: Discussion

4.1 The Research Aims

This was an exploratory piece of research, which aimed to investigate the relationship between distractibility, Working Memory Capacity (WMC) and insight problem-solving. There were three main aims of the study. Firstly, the present study aimed to determine whether distractibility predicts insight problem-solving. It was predicted that higher distractibility could be predictive of performance on CRATs. Secondly, this research aimed to determine whether Working Memory Capacity (WMC) predicts distractibility. It was predicted that low WMC could be predictive of high distractibility. Finally, to determine whether WMC predicts performance on insight problem-solving tasks.

4.2 Distractibility

The participants performance on the serial digit recall task in silence, and the presence of meaningful and meaningless speech, and the impact this had on their performance was analysed. There was evidence that performance was better in silence than in the presence of meaningful and meaningless speech. Furthermore, there was evidence that distraction by meaningless and meaningful speech had more of an impact on performance than silence. These findings are supported by previous research, which shows there is a consensus that certain types of auditory distractors elicit an orientating response (OR), which is an involuntary shift of one's attentional focus to the source of the distractor (Sokolov, 1990). Additionally, these findings are supported by three pieces of research. Firstly, Le Compte (1996) and Tremblay and Jones (1998) discovered the presence of an irrelevant sound usually produces an increase in the number of errors made during serial recall, which happens regardless of whether the sound is presented to the participant, during the presentation of to-be-remembered (TBR) speech, retention or both. Secondly, Colle and Walsh (1976) discovered that irrelevant speech does impair performance on a serial recall task.

In contrast, no evidence was found to suggest a difference in performance in the presence of meaningful and meaningless speech, or that meaningless and meaningful speech had a different impact on performance. There appears to be no prior research to support or contradict this. Therefore, future research should be conducted to clarify and further this finding. It could be expected that performance is more effected by meaningless speech, as this will be unfamiliar to the participant, so therefore more likely to cause an orientating response and impact performance. Whereas, the meaningful speech, which the participant is known to the participant, would either not produce an orientating response or less of one, and therefore performance will be less effected.

4.3 Insight Problem-Solving

The number of correct answers given, the time taken to solve, the solution strategy used, and the solution confidence were analysed for the verbal and pictorial problem-solving tasks, and the visual and word pictorial problem-solving tasks. For the time taken to solve, the solution strategy used, and the solution confidence, there was no evidence to suggest a difference. For the solution strategy scores, this might be explained by the emerging consensus of recent research showing participants use a combination of analysis and insight to solve CRATs and Rebus Puzzles (Barr, 2018). However, for the number of correct answers given, there were some differences found.

Firstly, there was evidence that more correct answers were given to difficult than easy pictorial, easy verbal than easy pictorial, easy pictorial than difficult verbal, and difficult verbal than difficult pictorial problem-solving tasks. However, there was no evidence of a difference between the number of correct answers given to easy and difficult, and verbal and pictorial problem-solving tasks. Secondly there was evidence that more correct answers were given to difficult than easy visual, easy word than easy visual, difficult word than easy visual, difficult visual than easy word, and difficult visual than difficult word, pictorial problem-solving tasks. However, there was no evidence that more correct answers were given to easy than difficult word pictorial problem-solving tasks.

There has been no prior research comparing the aforementioned measures for verbal and pictorial problem-solving tasks, and visual and word pictorial problem-solving tasks. Therefore, future research should be conducted to clarify and further these findings. Future research should consider giving participants more time to answer. The present study only gave 30 seconds because the whole study was 45 minutes long. If the participants had been given longer to answer, the number of correct answers given by participants solving by insight may have increased as there would be more time for them to have an ‘Aha’ moment, in line with the Special Process View (Chein & Weisberg, 2014). Alternatively, participants will have more time to change the representation of a problem based on failed attempts, in line with the Business-As-Usual View (Fioratou, Gilhooly & Henretty, 2010). Furthermore, a longer time period would mean insight problem-solvers will be less likely to time out, and analytical solvers will be less likely to make an incorrect guess (Kounois et al, 2008). In addition to the effect on solution strategy scores, this could have increased the confidence scores as the participants might be more confident in the answers they have given as they had more time to think of the answer.

Additionally, future research should consider using different ranges for the solution strategy scoring. In the present study, a score of 1-50 was insight, and a score of 51-100 was analysis. These are very wide ranges and could be shortened to allow the researcher to determine whether a participant completely or partially used insight, and research further whether a combination of insight and analysis is used. For example, '0-25' would be 'Complete Insight', '26-50' would be 'Somewhat Insight', '51-75' would be 'Somewhat Analysis', and '76-100' would be 'Complete Analysis'.

Furthermore, future research should consider the demographic of participants and whether they will understand the explanations of insight and analysis given. The present study only piloted the explanations on academic students and staff, rather than a lay audience. Therefore, some participants may not have fully understood. In future, researchers should pilot the explanations on people with a variety of education levels, to check their understanding and change the explanations if needed. Also, they could add a question after the explanations to check the participants understands, and if they do not, they are withdrawn.

Finally, previous research has shown that CRATs and Rebus Puzzles are more effective and reliable than classic insight problem-solving tasks. This research has contributed to this and shows CRATs and Rebus Puzzles can be used in future research (Ball et al, 2015).

4.4 Distractibility & Insight Problem-Solving

The relationship between the number of correct answers given to, and the time taken to solve visual and pictorial problem-solving tasks, and distractibility by silence, meaningless, and meaningful speech, was analysed.

Firstly, there was no evidence of a relationship between distractibility by silence, and the number of correct answers given to verbal and pictorial problem-solving tasks. Also, there was no evidence that distractibility in silence predicts the number of correct answers given and the time taken to solve visual and pictorial problem-solving tasks. Furthermore, there was no evidence that distractibility for meaningful speech predicts the time-taken to solve pictorial and visual problem-solving tasks, and the number of correct answers given to pictorial problem-solving tasks. Finally, there was no evidence that distractibility by meaningless speech predicts the time taken to solve pictorial problem-solving tasks.

There was evidence of a relationship between the number of correct answers given and the time taken to solve visual and pictorial problem-solving tasks and distractibility by meaningless speech. Also, there was evidence that distractibility by meaningless speecj predicts the number of correct answers given to visual and pictorial problem-solving tasks, and the time taken to solve pictorial problem-solving tasks. Furthermore, there was evidence of a relationship between the number of correct answers given to visual and pictorial problem-solving tasks and distractibility for meaningful speech. Also, there was evidence that distractibility for meaningful speech predicts the number of correct answers given to visual problem-solving tasks. This is supported by Threadgold et al (2019) who found CRAT performance was impeded by music with familiar lyrics.

As there is no prior research looking into the relationship between distractibility and insight problem-solving, there is no research to support or contradict the aforementioned findings. Therefore, future research should be conducted to clarify and further these relationships. Future research should change the order the serial digit recall task, and the problem-solving tasks are administered, and have some participants complete the serial digit recall task first, and some participants complete the problem-solving tasks first. Alternatively, future research could have two separate sessions for the tasks. In the present study, the participants may have found the serial digit recall task mentally exhausting, and therefore be fatigued for the problem-solving tasks. This may have affected the number of correct answers given and the time taken to solve them and therefore, the aforementioned findings.

4.5 Distractibility & Working Memory Capacity

The relationship between verbal and visual working memory capacity (WMC) been a domain-general or domain-specific representational system and distractibility by silence, meaningless, and meaningful speech, was analysed. There was evidence of a relationship between a domain-general or domain-specific representational system of verbal and visuo-spatial WMC and one been less distracted by meaningful and meaningless speech. As there is no prior research looking into the relationship between distractibility and WMC, there is no research to support or contradict this finding. Therefore, future research should be conducted to clarify and further these relationships. Future research should change the order the serial digit recall task, and the symmetry and operation span tasks are administered, and have some participants complete the serial digit recall task first, and some participants complete the symmetry and operation span tasks first. Alternatively, future research could have two separate sessions for the tasks. In the present study, the participants may have found both of these tasks mentally exhausting, and therefore the fatigue could have impacted performance. This may have affected the scores on the symmetry and operation span tasks and therefore, these findings.

Additionally, there is no evidence that these factors are causative of each other. This contradicts the findings of Sorqvist, Nostl and Marsh's (2013) Bayesian meta-analysis. This concluded that, in the context of auditory distraction, data from different studies supported a relationship between WMC and the deviation effects, where participants with higher WMC showed smaller effects. However, this relationship was not discovered for WMC and the changing-state effect. As the serial digit recall utilities the CS effect, this could explain the finding been contradicted, because the deviation effect is not used.

4.6 Working Memory Capacity & Insight Problem-Solving

The relationship between the number of correct answers given to, and the time taken to solve visual and pictorial problem-solving tasks, and verbal and visual working memory capacity (WMC) been a domain-general or domain-specific representational system, was analysed. Firstly, there was no evidence of relationships between the number of correct answers given to and the time taken to solve difficult pictorial and verbal problem-solving tasks and whether verbal and visuo-spatial WMC are a domain-general or domain-specific representational system. This is supported by previous research that suggests a null correlation between WMC and insight problem-solving performance. However, it is contradicted by Ash & Wiley's research, which showed a positive correlation between WMC and insight problem-solving performance. Additionally, there was no evidence that verbal and visuo-spatial WMC predicted the number of correct answers given to verbal and pictorial problem-solving tasks, and the time taken to solve verbal problem-solving tasks. However, there was evidence that verbal WMC in a domain-specific system, and a combination of verbal and visuo-spatial WMC in a domain-general representational system predicts the time taken to solve difficult pictorial problem-solving tasks.

Secondly, there was evidence of a relationship between verbal WMC been a domain-specific representational system and the time taken to solve visual pictorial problem-solving tasks. This is contradicted by previous research that suggests a null correlation between WMC and insight problem-solving performance. However, it is supported by Ash & Wiley's research, which showed a positive correlation between WMC and insight problem-solving performance. However, there was no evidence that the number of correct answers given and the time taken to solve visual pictorial problem-solving tasks is not predicted by verbal and visuo-spatial WMC been a domain-general or domain-specific representational system.

Thirdly, there was evidence of a relationship between visuo-spatial WMC been a domain-specific representational system and the time taken to solve word pictorial problem-solving tasks. This is supported by previous research that suggests a null correlation between WMC and insight problem-solving performance. However, it is contradicted by Ash & Wiley's research, which showed a positive correlation between WMC and insight problem-solving performance. However, there was no evidence that the number of correct answers given and the time taken to solve word pictorial problem-solving tasks is not predicted by verbal and visuo-spatial WMC been a domain-general or domain-specific representational system.

Finally, there was evidence of a relationship between visuo-spatial WMC been a domain-specific representational system and the number of correct answers given to easy word pictorial problem-solving tasks, and the time taken to solve difficult word pictorial problem-solving tasks. This is supported by previous research that suggests a null correlation between WMC and insight problem-solving performance. However, it is contradicted by Ash & Wiley's research, which showed a positive correlation between WMC and insight problem-solving performance. However, there was no evidence that verbal and visuo-spatial WMC in a domain-specific or domain-general representational system predicts the number of correct answers given and the time taken to solve easy word pictorial problem-solving tasks, and the number of correct answers given to difficult word pictorial problem-solving tasks. In contrast, there was evidence that verbal WMC in a domain-general representational system, and verbal and visuo-spatial WMC in a domain-specific representational system, predicts the time-taken to solve difficult word pictorial problem-solving tasks.

Previously, there has been no research to support or contradict whether verbal and visuo-spatial WMC in a domain-general or domain-specific representational system is predictive of the number of correct answers and time-taken to solve visual and pictorial problem-solving tasks, and verbal and visual working memory. Therefore, future research needs to be conducted to clarify and further the aforementioned findings.

4.7 Evaluation of Methodology

Firstly, as a result of the Covid-19 pandemic, this research was conducted online via Prolific Academic (a participant sourcing site), had strengths and weaknesses. Online research allows access to a potentially large participant pool and therefore, the recruitment of larger samples, allowing the study to have greater statistical power (Latkovikj & Popovska, 2020). Also, there is access to geographically diverse participant pool Also, the participants will be from more diverse demographical backgrounds, than those recruited a laboratory study because online research allows global recruitment.

However, implementing such studies online and outside the confines of a controlled laboratory environment, can result in less control over extraneous variables, and potentially less accurate timing measures for tasks such as insight problem solving and working memory capacity tasks (Conway, Kane, Bunting, Hambrick, Wilhelm & Engle, 2005). Indeed, whilst laboratory research has both advantages and disadvantages (Samek, 2019), it cannot be discounted that particularly for studies measuring reaction times or highly sensitive to extraneous variables such as background sound, the laboratory offers a greater degree of experimental control not afforded when conducting studies online.

It is important to note that the findings we have here are supportive of previous research that has been conducted under controlled laboratory settings. For example, Elliott, Bell, Gorin, Nick and Marsh (2022) showed the changing-state effect, and the steady-state effect can be successfully shown in online settings and there was no difference between the participants, who were tested online or in person. Additionally, WMC tasks have been shown to be related to each other and therefore, they are clearly tapping into something similar (Conway et al., 2005).

The present study shows that future research can be conducted online. However, a pilot study should be conducted first to discover any technical difficulties, see if the length of the study might affect the findings, and ensure an online setting is appropriate for the study.

Chapter 5: Conclusion

This was an exploratory piece of research, which aimed to investigate the relationship between distractibility, Working Memory Capacity (WMC) and insight problem-solving.

The present study aimed to determine whether distractibility predicts insight problem-solving. A relationship was discovered between the number of correct answers given and time taken to solve visual and pictorial problem-solving tasks and distractibility by meaningless speech. Also, it was found distractibility by meaningless speech predicts the number of correct answers given to visual and pictorial problem-solving tasks, and the time taken to solve pictorial problem-solving tasks. Furthermore, a relationship was revealed between the number of correct answers given to visual and pictorial problem-solving tasks and distractibility for meaningful speech. Finally, it was shown that distractibility for meaningful speech predicts the number of correct answers given to visual problem-solving tasks.

Secondly, the current study aimed to determine whether WMC predicts distractibility. A relationship was discovered between a domain-general or domain-specific representational system of verbal and visuo-spatial WMC and one been less distracted by meaningful and meaningless speech.

Finally, the present study aimed to investigate whether WMC predicts insight problem-solving. It was discovered verbal WMC in a domain-specific representational system, and a combination of verbal and visuo-spatial WMC in a domain-general representational system predicts the time taken to solve difficult pictorial problem-solving tasks. Also, a relationship was revealed between verbal WMC been a domain-specific representational system and the time taken to solve visual pictorial problem-solving tasks. Additionally, a relationship was discovered between visuo-spatial WMC been a domain-specific representational system, and the time-taken to solve word pictorial problem-solving tasks. Furthermore, a relationship was shown between visuo-spatial WMC been a domain-specific representational system, and the number of correct answers given to easy word pictorial problem-solving tasks, and the time taken to solve difficult word pictorial problem-solving tasks. Finally, it was revealed verbal WMC in a domain-general representational system, and verbal and visuo-spatial WMC in a domain-specific representational system predicts the time taken to solve difficult word pictorial problem-solving tasks.

Appendices

Appendix 1: Brief Form for Whole Study

Memory and Distraction Information Sheet

I would like to invite you to take part in a research study. Before you decide, I would like you to understand why the research is being done and what it would involve for you. Please take your time to read the following information carefully. Talk to others about the experiment if you wish. Ask the researcher if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. You have a right to withdraw at any point during the task, up until you submit the data, without giving any reason.

The purpose of this study is to investigate the relationship between distractibility, problem-solving and working memory capacity. We would like to invite people, aged 18-65 years old to take part in the study. You can decide whether or not to take part. If you do, you asked to provide consent to take part, by ticking the boxes on the screen. At this point, you are still free to withdraw from the study at any time and without giving a reason. However, if you wish to withdraw your data, after completing the experiment, you can do so up until submitting the data because after that, it will be impossible to remove your data as it will become anonymised and stored with other anonymised data. All information gathered during this study is kept strictly. All data from this study will be anonymized to ensure confidentiality.

For the first part of the study, you will be asked to complete a serial digit recall task. During the task, you will be asked to view the numbers 1-9 and recall them in the order presented. Also, you will hear distractor sounds.

For the second part of the study, you will be asked to complete 2 types of problem solving tasks (34 trials in total), including two practice tasks. For each task, you will be asked to answer two questions about the solution strategy and confidence in your response. Before completing the trials, you will asked to give the memorable word, which you created in the first part of this study. This is so we can link your data from the three parts of the study.

For the final part of the study, you will be asked to complete two working memory tasks, including practice trials. Before completing the trials, you will asked to give the memorable word, which you created in first part of this study. This is so we can link your data from the three parts of the study.

We do not anticipate any problems during this study. If you have any complaints or concerns during this study, you are welcome to contact myself (Mollie Wilson – Mwilson19@uclan.ac.uk) or my two project supervisors, Dr Emma Threadgold (EThreadgold1@uclan.ac.uk) and Dr. John Marsh.

Contact Details:

Student Name: Mollie Wilson (Postgraduate Student)
Email: MWilson19@uclan.ac.uk

Director of Studies Name: Dr Emma Threadgold
Email: EThreadgold1@uclan.ac.uk **Tel:** 01772 893443
Room: DB108, School of Psychology, University of Central Lancashire, Preston, PR1 2HE.

Supervisor Name: Dr John Marsh
Email: jemarsh@uclan.ac.uk **Tel:** 01772 893754
Room: DB108, School of Psychology, University of Central Lancashire, Preston, PR1 2HE.

"If you have any concerns about the research that you wish to raise with somebody who is independent of the research team, you should raise this with the University Officer for Ethics OfficerForEthics@uclan.ac.uk"

Ethical Approval Code: SCIENCE 0131

Appendix 2: Consent Form for Whole Study

Consent Form

The relationship between distractibility, problem solving and working memory capacity. Please click all options below, if you consent.

I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions, and I have had these answered satisfactorily.

I understand that my participation is entirely voluntary, I am free to withdraw my participation at any time up until I leave the room when the study is complete.

I understand that group means may be published in peer reviewed journals, or presented at conferences.

I consent to take part in the above study.

→

Appendix 3: Demographic Form for Whole Study

Demographic Form

Age:

18-25

25-45

45-65

65+

Prefer Not To Say

Gender

Male

Female

Other

Prefer Not To Say

→

Appendix 4: Instructions for the Serial Digit Recall Task (Qualtrics)

Part 1: Serial Digit Recall Task

Please copy and paste the following link into a different tab to complete the task. The instructions and task are in the link. When you have completed the task, return to this page and press the blue arrow to continue.

https://open-lab.online/invite/Mollie%20Wilson%20-%20Masters%20by%20Research%20Project/

Appendix 5: The Serial Digit Recall Task Brief Form

Information: Background Sound and Short-term Memory
Dear participant,
My name is Mollie Wilson and I am a Masters by Research student at the University of Central Lancashire, supervised by Dr Emma Threadgold and Dr John Everett Marsh. We would like to invite you to take part in our research experiment.
Before you decide, we would like you to understand why the research is being done, and what it would involve for you.
Please take time to read the following information carefully. Please email me (MWilson19@uclan.ac.uk) or Emma Threadgold (EThreadgold1@uclan.ac.uk) if there is anything that is unclear, or if you would like more information.

<u>What is the purpose of the experiment?</u>

The purpose of the experiment is to remember a sequence of visually-presented items (digits) while they are sometimes accompanied by sound that you should ignore.

<u>Why have I been chosen?</u>
We would like to invite anyone aged 18-65 years old to take part in the study.

<u>Do I have to take part?</u>
No, it is up to you to decide whether to take part. You are free to withdraw from this experiment at any point before submitting your final answers, by simply closing your browser.

<u>What will happen to me if I take part?</u>
The experiment will involve memorising and recalling sequences of randomly presented digits while they are sometimes accompanied by background sound. Further instructions will be provided on starting the task.

<u>What are the possible disadvantages of taking part?</u>
There are no disadvantages of taking part. Many people find this task fun, if a little tiring at times.

<u>What are the advantages of taking part?</u>
There is no immediate benefit from this study, and we do not anticipate that the findings will benefit you directly. However, information we gather will help inform the scientific community about how we make judgements.

<u>What if there is a problem?</u>
We do not anticipate any problems during this experiment. IF you have any questions, please contact the researcher on the details provided above. If you do not wish to speak to the researchers, and you wish to speak to someone independent of the research, please contact the Ethics Office using the following email (ethicsinfo@uclan.ac.uk).

<u>Will my taking part be kept confidential?</u>
Yes. All information gathered during this experiment will be anonymous, and will be kept strictly confidential. The data will be accessible only to the researchers involved in the project, and it will be stored on a password protected computer for a maximum of five years, according to UCLan data requirements.

<u>What will happen if I do not wish to carry on with the experiment?</u>

You are welcome to withdraw from the experiment, without having to give any reason, at any point up to submitting your response. Once you have submitted your response, it will no longer be possible for you to withdraw your response because they will become anonymized and stored with other anonymized data according to UCLan data requirements.

What will happen to my data?
The data will be combined together into means, so that any individual responses are non-identifiable. The overall findings will be published in a journal as part of a peer-reviewed publication, and presented at conferences.

Who has reviewed the experiment?
This experiment has been reviewed and approved by the Psychology and Social Works Ethics Committee at the University of Central Lancashire.

Thank you for taking the time to read this information.

Please press the 'Continue' button to continue.

Appendix 6: The Serial Digit Recall Task Consent Form

Please read the following statements and select "yes" if you confirm.

I confirm that I have read and understand the Participant Information for the study entitled "Background Sound and Short-term Memory".

I have had the opportunity to consider the information, to ask questions by email, and have had these questions answered satisfactorily.

I agree that the data gathered in this study may be stored anonymously and securely for a period of up to five years.

I agree that the data gathered in this study might be published as group means in peer-reviewed journals or as part of conference presentations.

I understand that my participation is voluntary and that I am free to withdraw at any time up to the final submission of my response, without giving a reason.

I understand that once I have submitted my response at the end of the study it will no longer be possible to withdraw my response.

I confirm that I am at least 18 years old.

I consent to take part in this study.

Continue?

Appendix 7: The Serial Digit Recall Task Demographic Form

Welcome!

Please enter your age in years.

Please enter your gender, using 1 = male, 2 = female, 3 = non-binary, 4 = prefer not to say.

Please indicate if you've been diagnosed with hearing loss, using 1 = no, 2 = yes, 3 = other.

Please indicate if English is your first language, using 1 = yes, 2 = no.

Please indicate if you can speak or comprehend the Swedish language, using 1 = yes, 2 = no.

Please type in a memorable word here. You will need to remember this word to input it into other parts of the study.

Continue →

Appendix 8: The Serial Digit Recall Task Instructions

In this task, you will be asked to remember a series of digits, in the order that they were presented to you.
Please close any other applications on your device, and please put away and silence your cell phone.
It is important to minimize any distractions in your environment, so that you can concentrate on this task.
Begin this task when you know that you have at least 30 minutes of uninterrupted time to complete it.
Please do not take your headphones off, and please do not adjust the volume until the study is completed.
It is important that you follow the instructions, as the data will be published as part of a research project.
Please press the 'Continue' button to continue.

Appendix 9: The Serial Digit Recall Task Sound Calibration

You *must* wear headphones during this study!

If you are not already wearing headphones, please put some on before continuing.

Click below after you have fitted your headphones to start the calibration.

Continue →

We will now calibrate the volume of your headphones.

Please take through the following steps to calibrate your headphones:

1. **Set your computer volume to about 25%** of its maximum level.
2. Click here to listen to a calibration sound. **Turn up the volume on your computer until the calibration sound is at a loud but comfortable level.** You can listen to it as many times as you like.

Click below once you have set the computer volume to a loud but comfortable level

Continue →

In the following, you will hear several sequences of three sounds each, separated by silence. **Your task is to judge which of these was the softest or quietest.**

We will ask you for your judgement after each sequence of three sounds. **The sounds will only be played once**, so please pay close attention.

Click below to start the task.

Continue →

Please listen carefully to the sounds

The study will progress automatically

Which of the three sounds was the softest (quietest)?

1 2 3

Please make your choice by clicking on one of the buttons.

You have failed the calibration test.
Please try again, making sure you have set
your headphones to a stereo setting.
You could also try increasing the volume.
You may take the calibration test up to 5 times.

Thank you!

You have successfully completed the calibration task.

Please click below to continue with the study.

Continue →

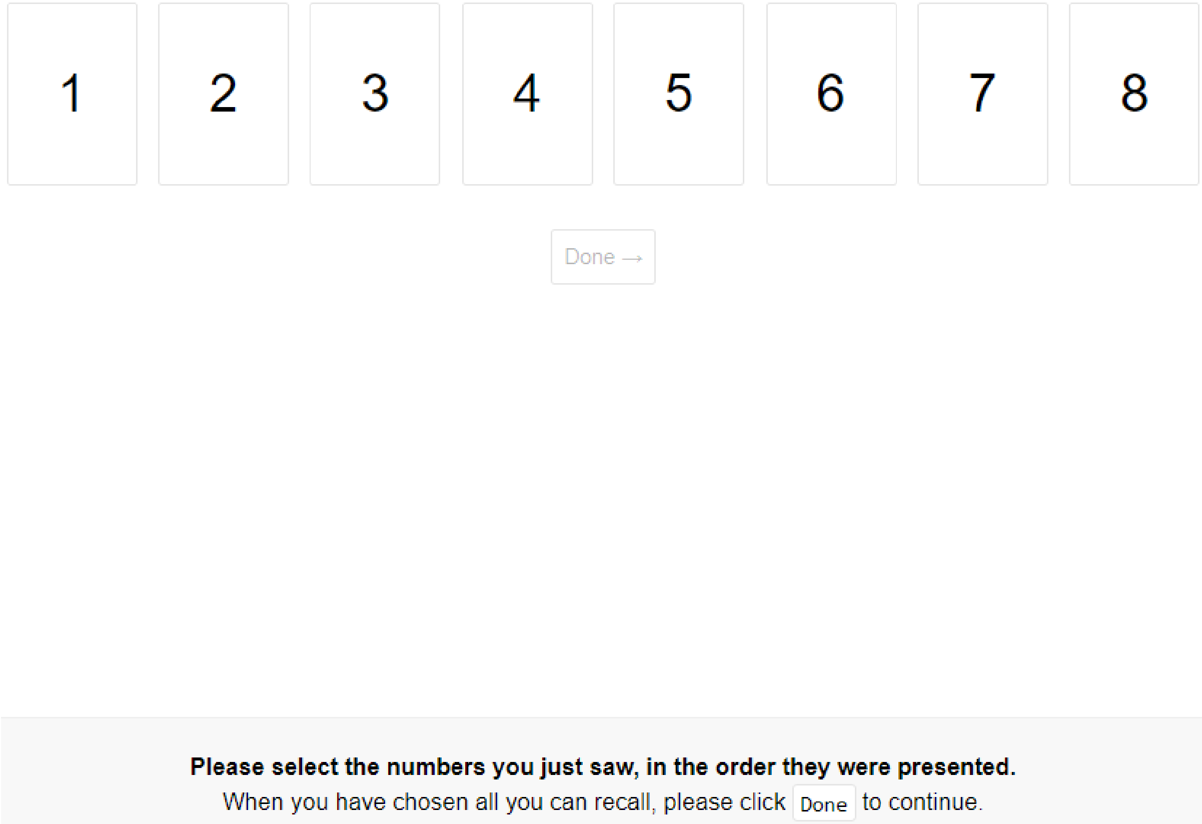
Appendix 10: The Serial Digit Recall Practice Instructions

Ready?

Practice Go - In a moment, we're going to show you a sequence of digits. Please try to remember them as best you can, you'll be asked to recall them immediately after, in the order in which they were presented. Please concentrate on remembering the digits, and ignore any sounds that you hear through the headphones. The sounds are completely irrelevant to the task. Please do not speak the digits aloud. It is important that you remain quiet.

When you're ready, please press Continue below.

Appendix 11: Example of the Serial Digit Recall Trial Screen



Appendix 12: The Serial Digit Recall Background Sound Effect Question

How much do you think your last recall performance was affected by background sound?

1 – the sound helped my performance.
5 – the sound neither helped nor hindered my performance.
9 – the sound hindered my performance.

	1	2	3	4	5	6	7	8	9
Rating	○	○	○	○	○	○	○	○	○

Appendix 13: The Serial Digit Recall Instructions, Given Before Trials Start

Ready?

In a moment, we're going to show you a sequence of digits. Please try to remember them as best you can, you'll be asked to recall them immediately after, in the order in which they were presented. Please concentrate on remembering the digits, and ignore any sounds that you hear through the headphones. The sounds are completely irrelevant to the task. Please do not speak the digits aloud. It is important that you remain quiet.

When you're ready, please press Continue below.

Appendix 14: The Digit Serial Recall End of Experiment Checks

Thank you for completing the task.

Please answer the following questions.

1. Did you have any help from another person when remembering the digits?

○ yes

○ no

2. Did you use any external help (e.g., paper and pencil) to remember the digits?

○ yes

○ no

3. Did you say the digits aloud when trying to remember them?

○ yes

○ no

4. Did you turn off the volume on your headphones during the task?

○ yes

○ no

5. Did you remove or unplug your headphones during the task?

○ yes

○ no

6. Type in the number 2.

7. While you were completing the study, were there any external sources of visual or auditory distraction (e.g., other people speaking in the same room, a running video, a song playing in the background, etc.)?

- yes
- no

7b. If Yes, what was the source of distraction?

8. What equipment did you use to do the experiment?

- Desktop computer
- Laptop computer
- Tablet
- Smartphone

9. What type of headphones did you use to play the sounds?

- ○ In-ear
- ○ On-ear
- ○ Over-ear

10. What device did you use to record your responses?

- ○ Mouse
- ○ Trackpad
- ○ Touchscreen

11. How motivated were you to obtain the best test-score possible?

- ○ Lowest motivation
- ○ Low motivation
- ○ Average motivation
- ○ High motivation
- ○ Highest motivation

12. How concentrated were you on the task?

- ○ Lowest concentration
- ○ Low concentration
- ○ Average concentration
- ○ High concentration
- ○ Highest concentration

13. When performing the task were you switching between different tasks or browsers?

- ○ yes
- ○ no

14. Did you experience any technical difficulties during the study (e.g., problems with the internet connection, delays in presentation, etc)?

- ○ yes
- ○ no

15. What is the current time at your location (please specify am or pm)?

16. If you reported that you have hearing loss at the start of the study, please tell us more about this now.

1. I have difficulty controlling my thoughts.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

2. I find it hard to switch my thoughts off.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

3. I have two or more different thoughts going on at the same time.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

4. My thoughts are disorganised and 'all over the place'.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

5. My thoughts are 'on the go' all the time.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

6. Because my mind is 'on the go' at bedtime, I have difficulty falling off to sleep.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

7. I experience ceaseless mental activity.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

8. I find it difficult to think about one thing without another thought entering my mind.

- ○ not at all or rarely
- ○ some of the time
- ○ most of the time
- ○ nearly all of the time

9. I find my thoughts are distracting and prevent me from focusing on what I am doing.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

10. I try to distract myself from my thoughts by doing something else or listening to music.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

11. I have difficulty slowing my thoughts down and focusing on one thing at a time.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

12. I find it difficult to think clearly, as if my mind is in a fog.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

13. I find myself flitting back and forth between different thoughts.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

14. I use alcohol and other drugs to slow down my thoughts and stop constant 'mental chatter'.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

15. I can only focus my thoughts on one thing at a time with considerable effort.

- not at all or rarely
- some of the time
- most of the time
- nearly all of the time

Appendix 15: The Serial Digit Recall De-Brief Sheet

Background Sound and Short-term Memory

Thank you for taking part in our research study, your time is very much appreciated. The research you have just taken part in aims to investigate how an individual's short-term memory is affected by the presence of background sound that they attempt to ignore. In this task you attempted to memorise sequences of numbers that were sometimes presented with background sound. We are interested in whether the presence of that sound makes short-term memory performance better, or worse.

You will never be identified in any findings of this experiment nor will it be possible to link the findings back to you. We would like to remind you that this is the final opportunity to withdraw your data from the experiment. If you wish to withdraw, simply close your browser. If you have any concerns about the research that you wish to raise with somebody who is independent of the research team, you should raise this with the University Officer for Ethics (OfficerForEthics@uclan.ac.uk. If any aspect of this study has affected you negatively and you feel in need of help, then would you please contact the Samaritans by phone (08457 90 90 90) or email (jo@samaritans.org).

By clicking the confirm button, below, you are submitting your response and accepting that you can no longer withdraw.
Please press the 'Confirm' button to continue.

Appendix 16: Instructions for the Problem-Solving Tasks

Part 2: Problem Solving Tasks

You are going to complete two types of problem-solving tasks; 16 Compound Remote Associate Tasks (CRATs) and 16 Rebus Puzzles. Before each set of problem-solving tasks, there are instructions and a practice trial.

Appendix 17: Memorable Word for the CRATs and Rebus Puzzles

Before completing the problem-solving tasks, please state the memorable word, which you created in Part 1: The Digit Serial Recall Task of this study. This is so we can link your data from the three parts of the study.

Memorable Word:

→

Appendix 18: Instructions for the CRATs

You are going to be presented with 16 compound associate problems. You will be shown three words and you need to provide a term, which will link all three. For example, for 'sleeping', 'bean' and 'bin', the term would be 'bag' (sleeping-bag, bean bag, bin bag). There will be a combination of easy and hard problems. You will have thirty seconds to complete each problem and the timer will be on the screen.

Appendix 19: CRATs

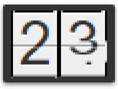
Easy CRATs:

CRAT Number	Word 1	Word 2	Word 3	Solution Word
Practice	Dew	Comb	Bee	Honey
1	Type	Ghost	Screen	Write
2	Boot	Summer	Ground	Camp
3	Horse	Human	Drag	Race
4	Hammer	Gear	Hunter	Head
5	Opera	Hand	Dish	Soap
6	Shine	Beam	Stuck	Moon
7	Fox	Man	Peep	Hole
8	Hound	Pressure	Shot	Blood

Hard CRATs:

CRAT Number	Word 1	Word 2	Word 3	Solution Word
9	Force	Line	Mail	Air
10	Tooth	Potato	Heart	Sweet
11	Baby	Spring	Cap	Shower
12	Fight	Control	Machine	Gun
13	Lift	Card	Mask	Face
14	Pine	Crab	Sauce	Apple
15	Off	Military	First	Base
16	Cut	Cream	War	Cold

Appendix 20: Example of a CRAT on Qualtrics



Opera	Hand	Dish

→

Appendix 21: Instructions for the Rebus Puzzles

You are going to be presented with 16 rebus puzzles. You will be shown an image and asked to state the word, phrase or saying. For example, the answer to the puzzle 'BUSINES,' would be 'Unfinished Business'. There will be a combination of hard and easy puzzles. You will have thirty seconds to complete each problem and the timer will be on the screen.

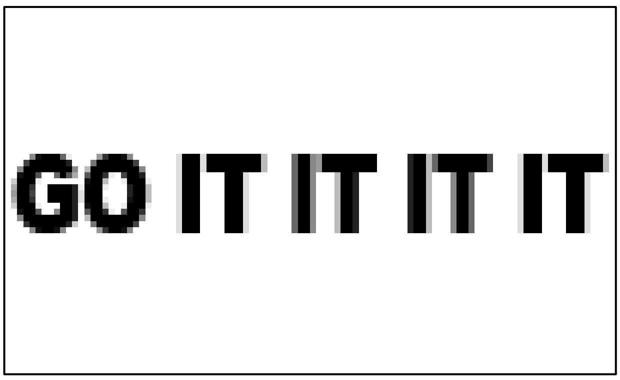
Appendix 22: Rebus Puzzles

Practice Rebus Puzzle

Easy Word Rebus Puzzle 1 – Man Overboard

Easy Word Rebus Puzzle 2 – Long Overdue

Easy Word Rebus Puzzle 3 – Go For It

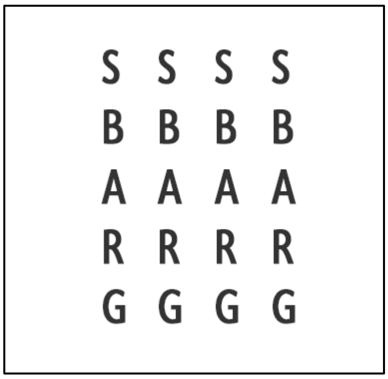


Easy Word Rebus Puzzle 4 – London Underground

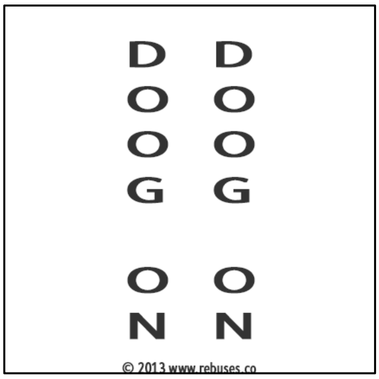
Hard Word Rebus Puzzle 1 – Foot in the Door

Hard Word Rebus Puzzle 2 – Reading Between the Lines

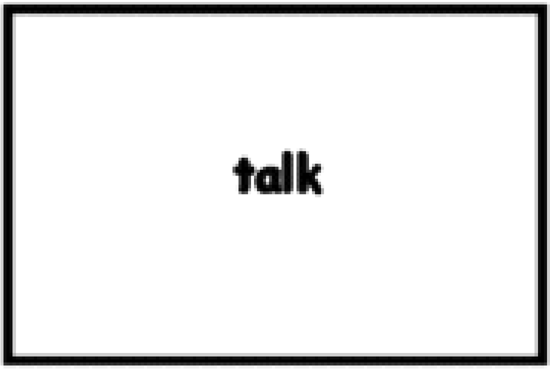
Hard Word Rebus Puzzle 3 – Up for Grabs



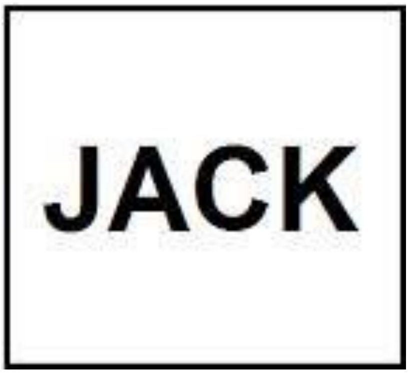
Hard Word Rebus Puzzle 4 – Up to No Good



Easy Visual Rebus Puzzle 1 – Small Talk

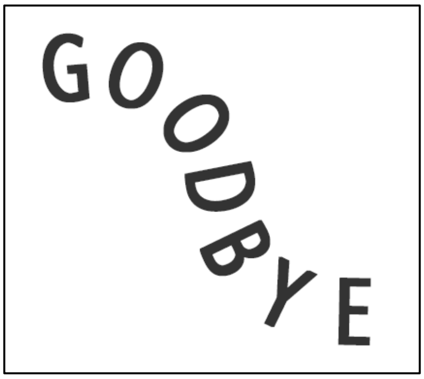


Easy Visual Rebus Puzzle 2 – Jack in the Box



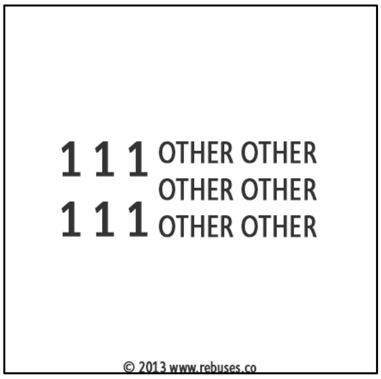
Easy Visual Rebus Puzzle 3 – Split Personality

Easy Visual Rebus Puzzle 4 – Wave Goodbye



Hard Visual Rebus Puzzle 1 – What Goes Up Must Come Down

Hard Visual Rebus Puzzle 2 – Six of One, Half a Dozen of the Other



Hard Visual Rebus Puzzle 3 – Your Time is Up

Hard Visual Rebus Puzzle 4 – Through Thick and Thin

Appendix 23: Example of a Rebus Puzzle on Qualtrics

22

Answer:

→

Appendix 24: Solution Strategy Question

Did you feel as if the problem was solved more by insight or more by analysis?

If you DID NOT input any response to the problem, please tick the 'not-applicable' box.

It is important to understand that insight and analysis are two ends of a continuum, and we are asking if your solution was more 'insight like' or more 'analytic like'?

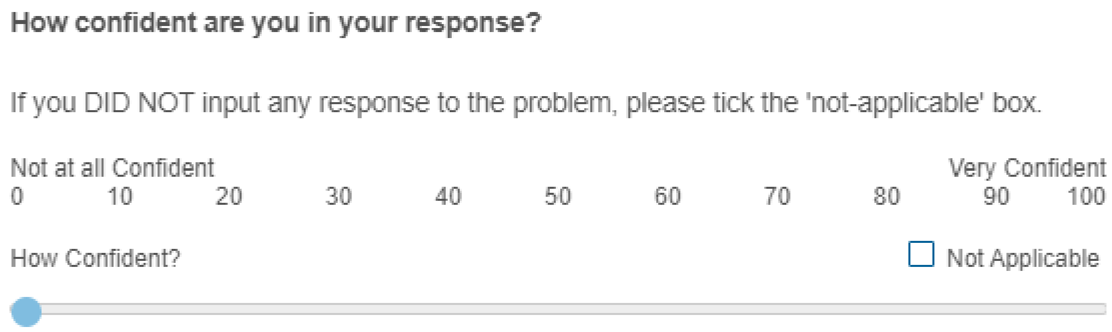
Insight - Insight means that the answer suddenly (i.e. unexpectedly) came to your mind while you were trying to solve the problem, even though you are unable to articulate how you achieved the solution. This kind of solution is often associated with surprise exclamations such as 'A-ha'.

Analysis - Analysis means that you figured out the answer after you deliberately and consciously tested out different ideas before you found the right phrase or saying. In this case for instance, you are able to report the steps that you used to reach the solution.

Insight | Analysis
0 10 20 30 40 50 60 70 80 90 100

Insight or Analysis? ☐ Not Applicable

Appendix 25: Confidence Question



How confident are you in your response?

If you DID NOT input any response to the problem, please tick the 'not-applicable' box.

Not at all Confident Very Confident

0 10 20 30 40 50 60 70 80 90 100

How Confident? ☐ Not Applicable

Appendix 26: Instructions for Working Memory Capacity Tasks

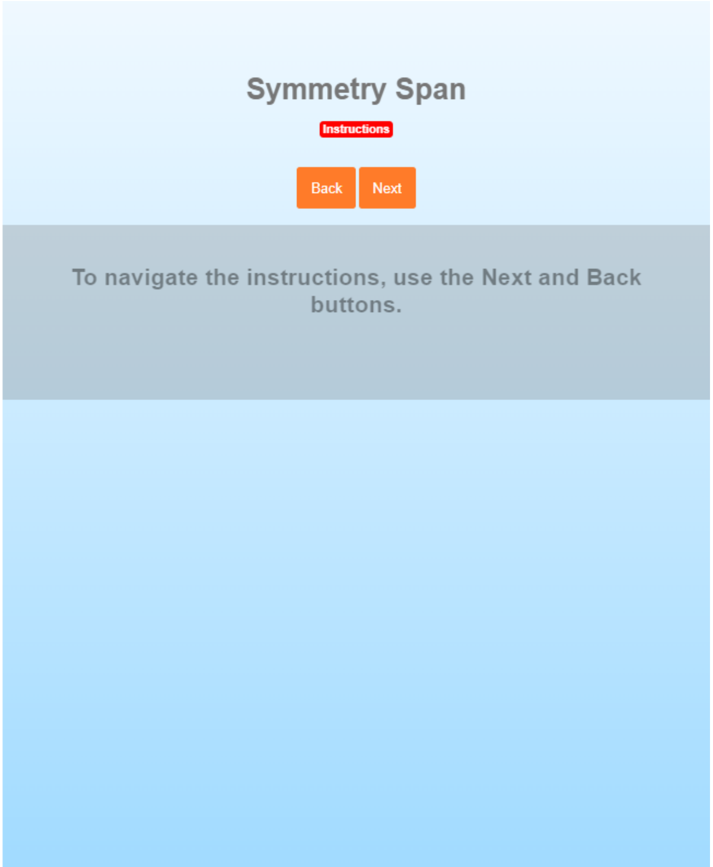
Part 3: Working Memory Capacity (WMC) Tasks

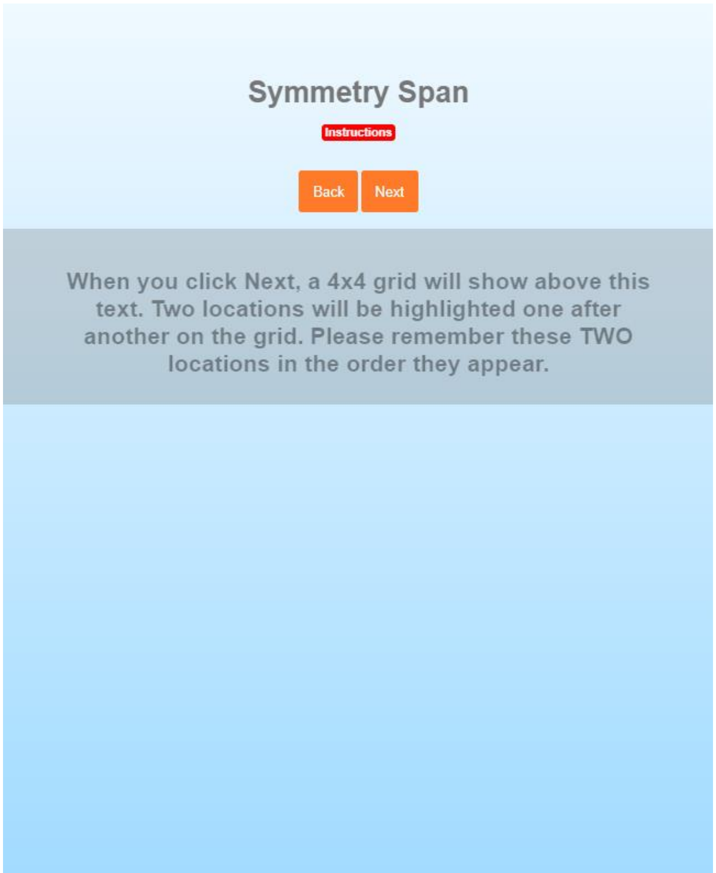
You are going to complete two types of WMC tasks: Symmetry Span and Operation Span. Before each set of problem-solving tasks, there are instructions.

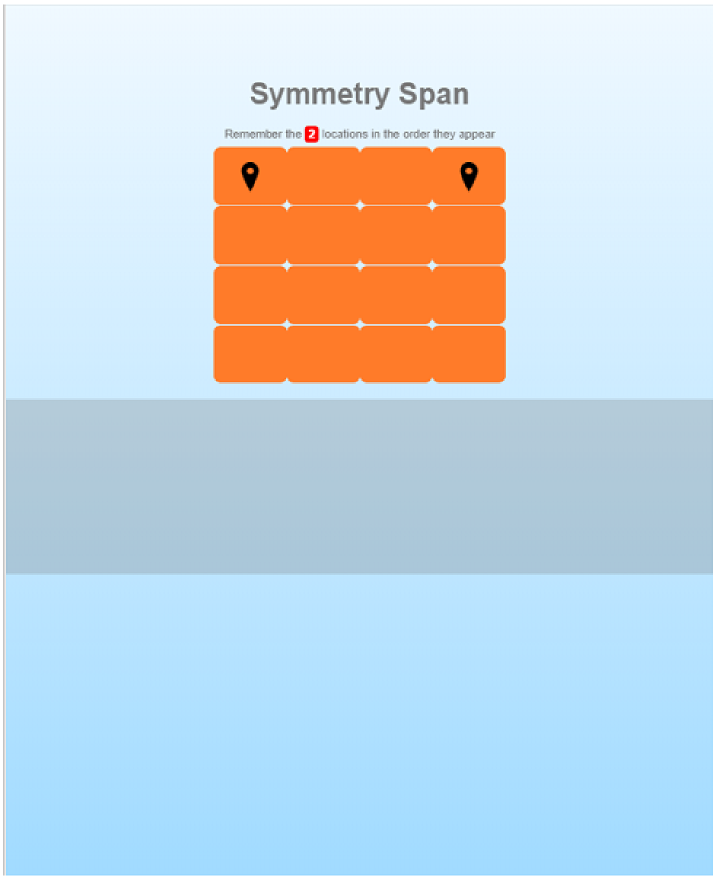
Appendix 27: Memorable Word for Working Memory Capacity Tasks

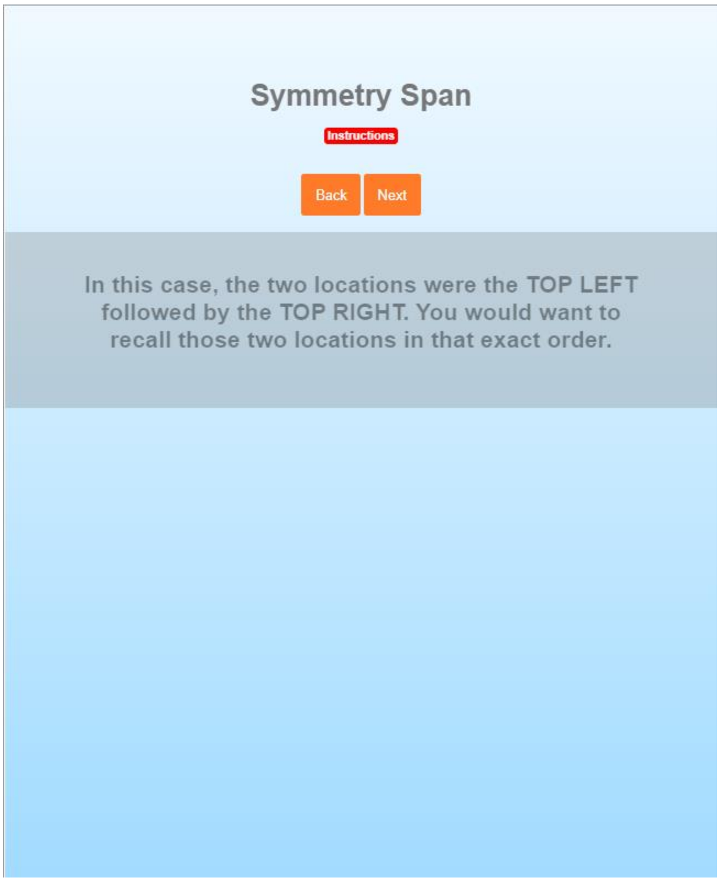
Before starting the Working Memory Tasks, please state the memorable word, which you created in Part 1: The Digit Serial Recall Task of this study. This is so we can link your data from the three parts of the study.

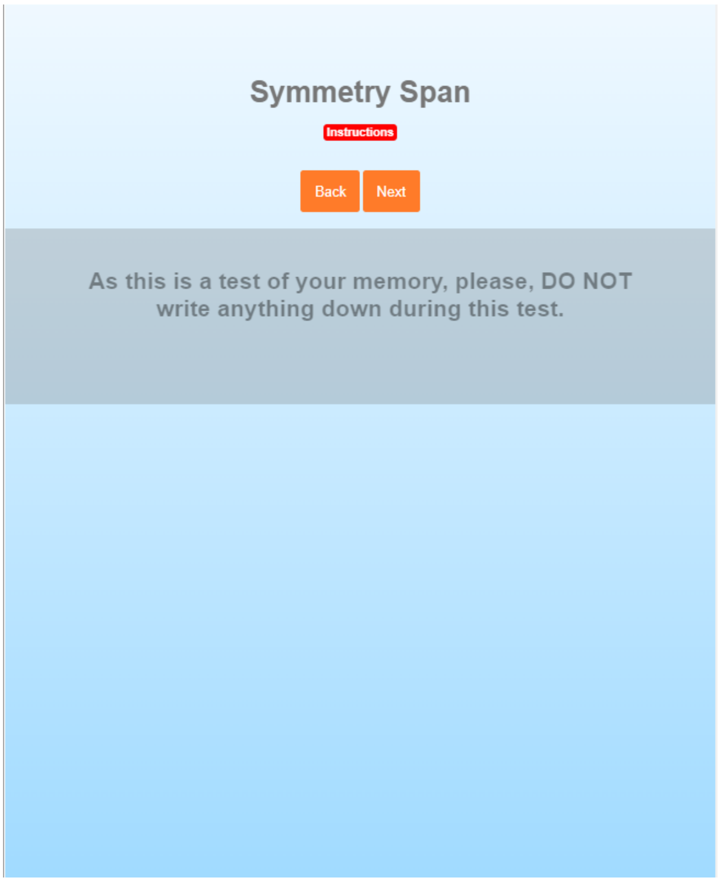
Appendix 28: Symmetry Span Task Instructions

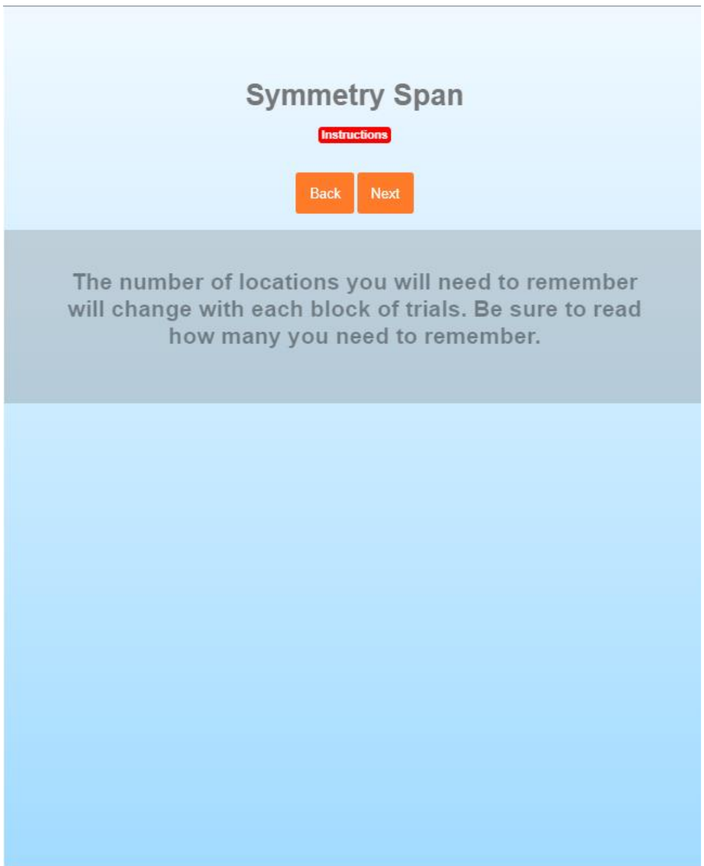

Symmetry Span
Instructions
Back
Next
To navigate the instructions, use the Next and Back buttons.

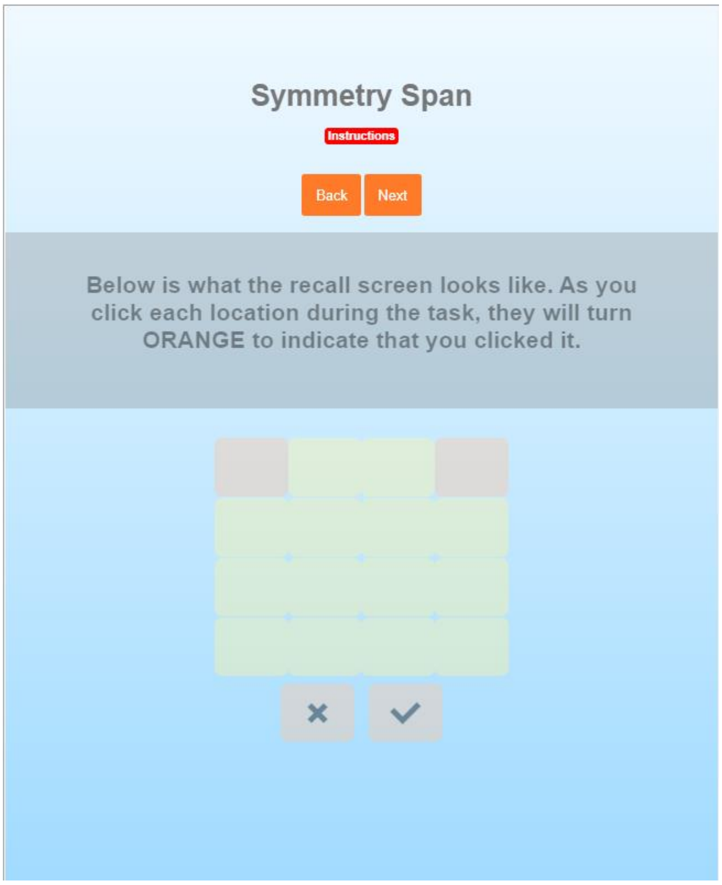

Symmetry Span
Instructions
Back
Next
When you click Next, a 4x4 grid will show above this text. Two locations will be highlighted one after another on the grid. Please remember these TWO locations in the order they appear.

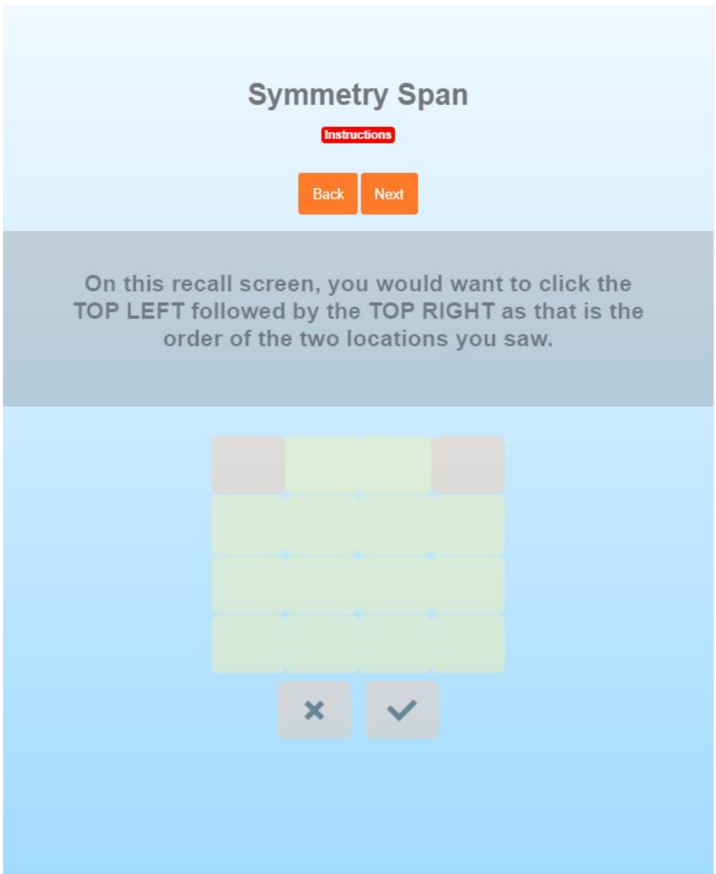

Symmetry Span
Remember the 2 locations in the order they appear

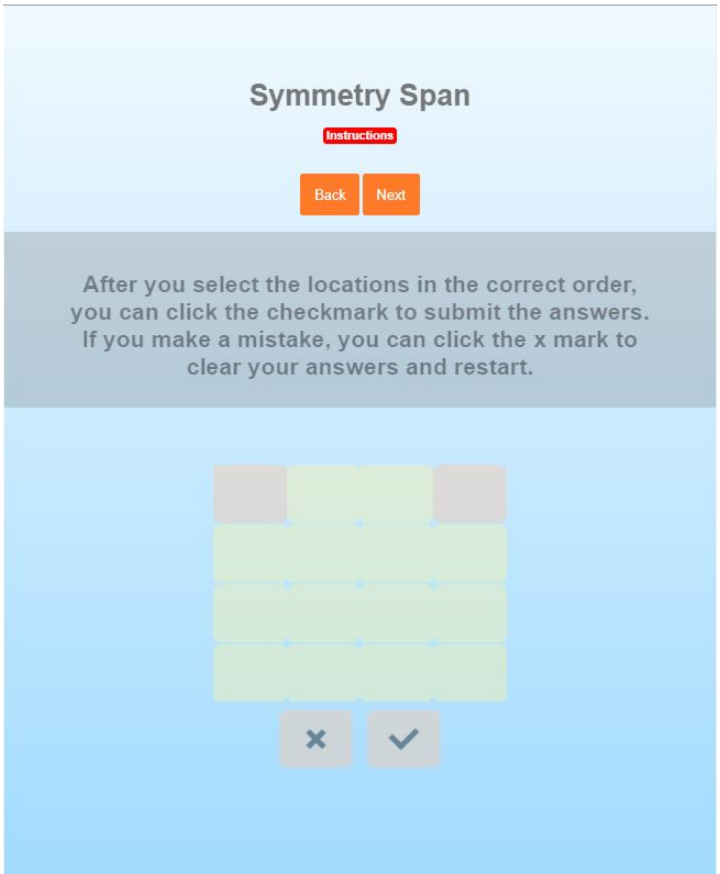

Symmetry Span
Instructions
Back
Next
In this case, the two locations were the TOP LEFT followed by the TOP RIGHT. You would want to recall those two locations in that exact order.

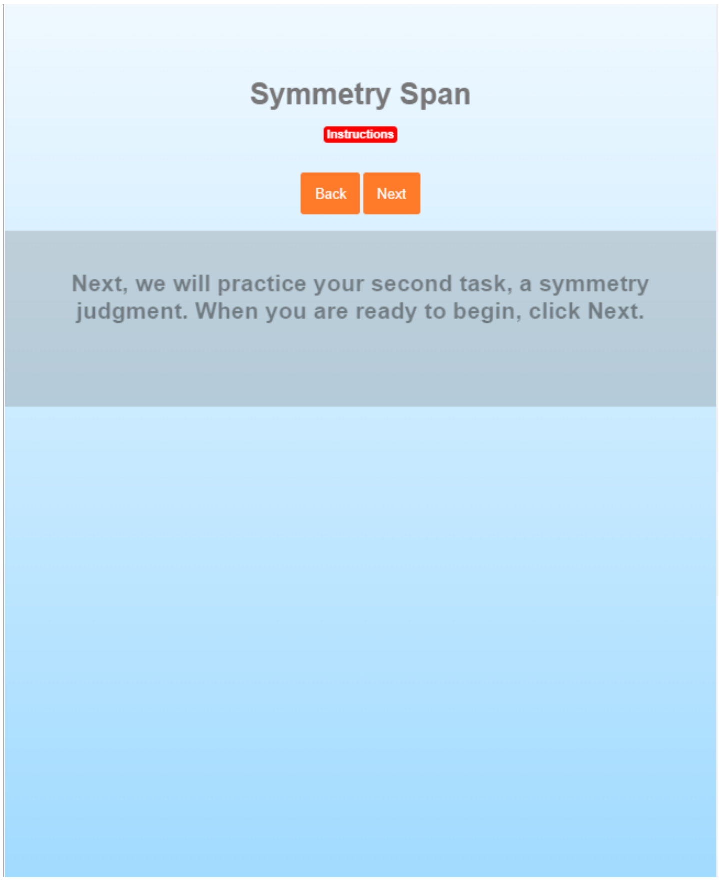

Symmetry Span
Instructions
Back
Next
As this is a test of your memory, please, DO NOT write anything down during this test.

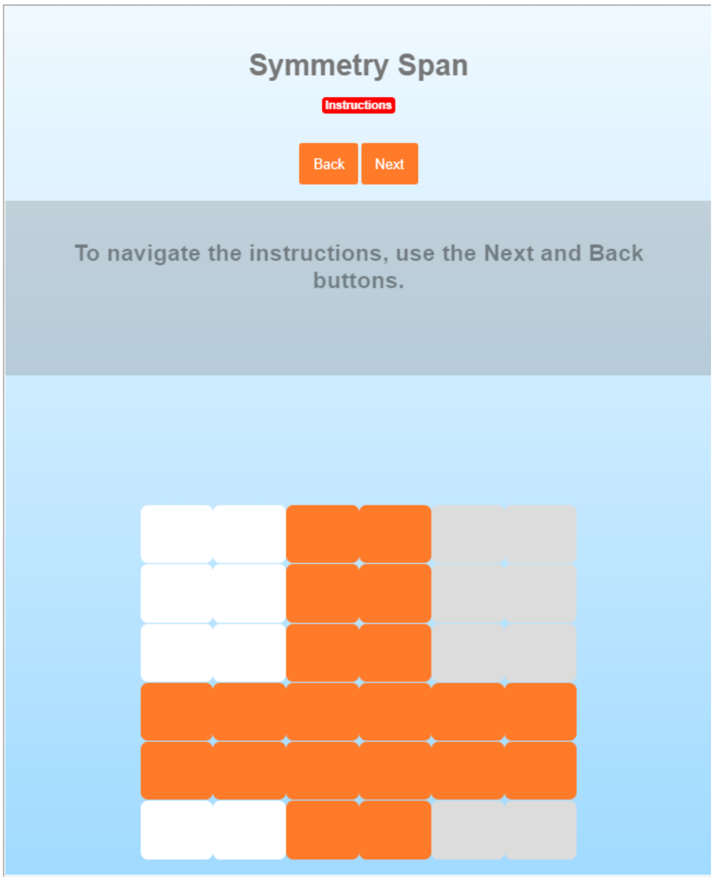

Symmetry Span
Instructions
Back
Next
The number of locations you will need to remember will change with each block of trials. Be sure to read how many you need to remember.

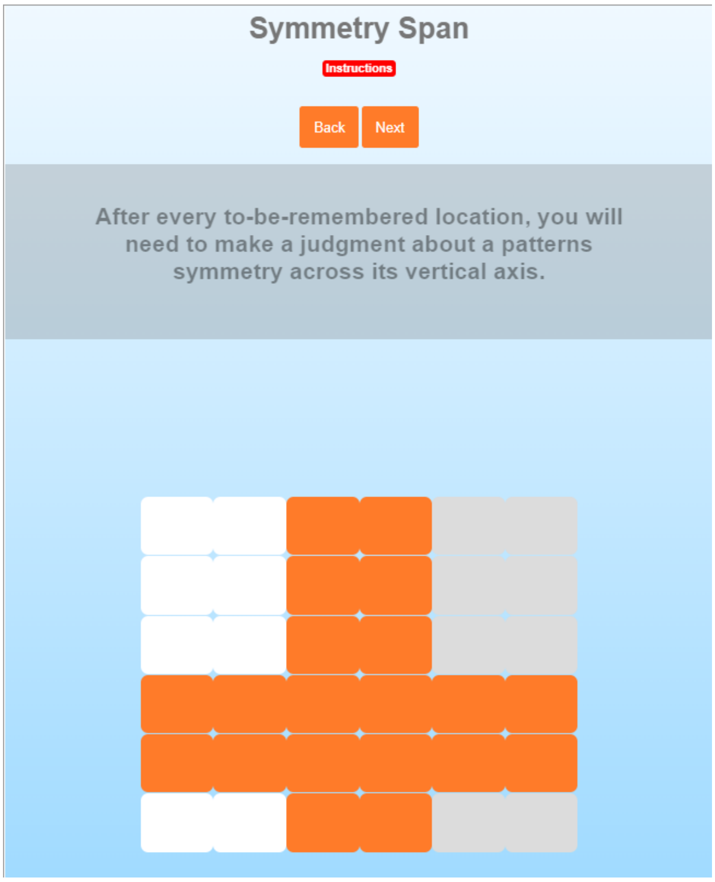

Symmetry Span
Instructions
Back
Next
Below is what the recall screen looks like. As you click each location during the task, they will turn ORANGE to indicate that you clicked it.

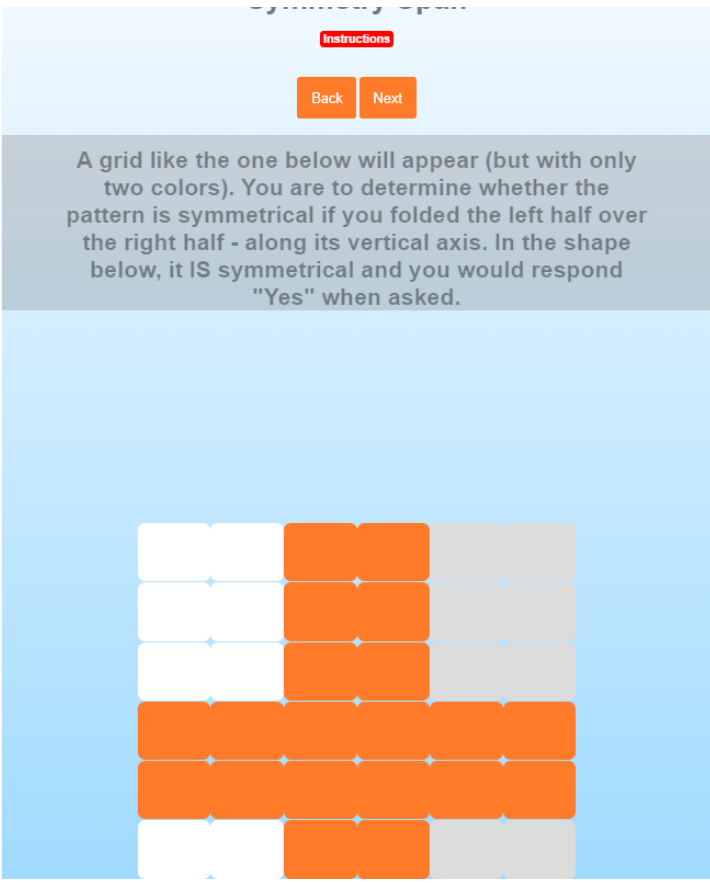

Symmetry Span
Instructions
Back
Next
On this recall screen, you would want to click the TOP LEFT followed by the TOP RIGHT as that is the order of the two locations you saw.

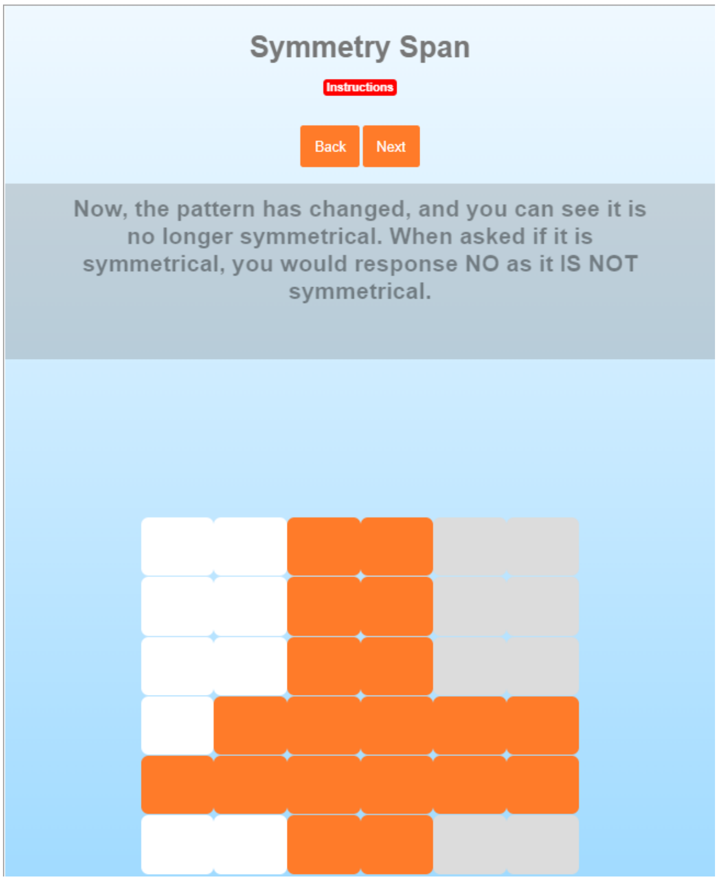

Symmetry Span
Instructions
Back
Next
After you select the locations in the correct order, you can click the checkmark to submit the answers. If you make a mistake, you can click the x mark to clear your answers and restart.

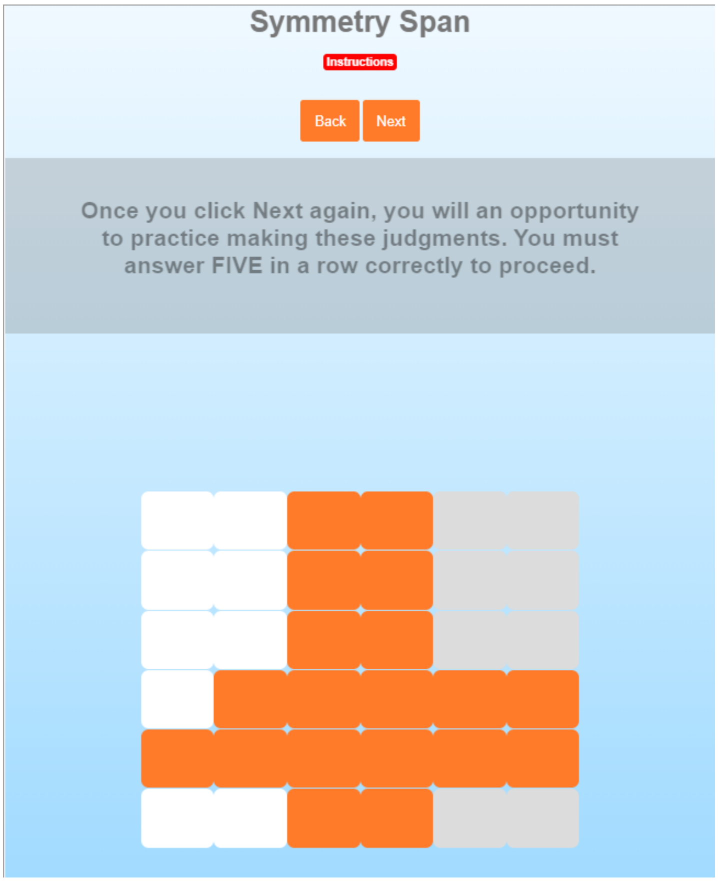

Symmetry Span
Instructions
Back
Next
Next, we will practice your second task, a symmetry judgment. When you are ready to begin, click Next.

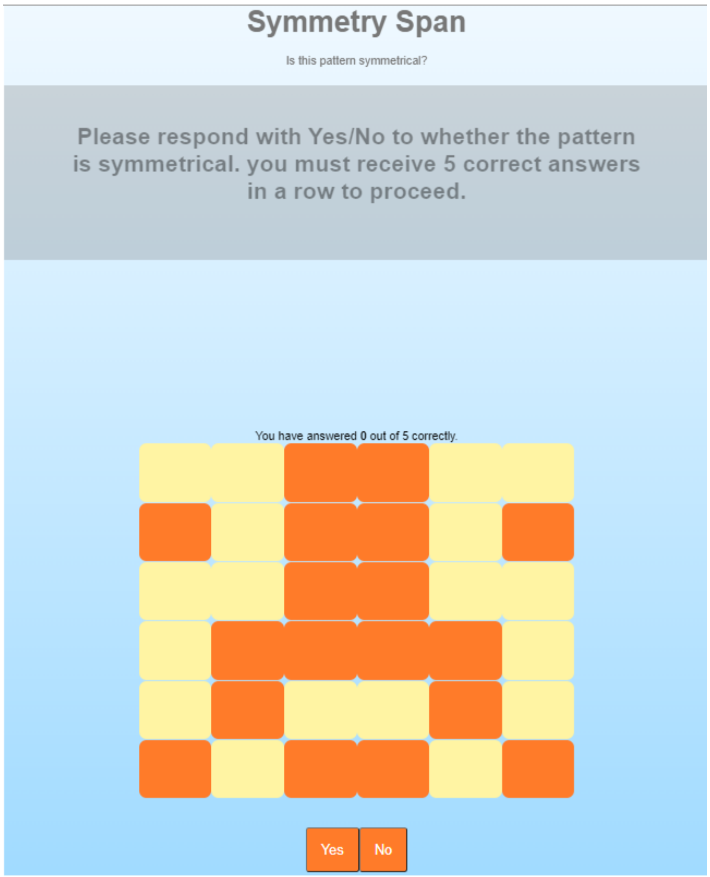

Symmetry Span
Instructions
Back
Next
To navigate the instructions, use the Next and Back buttons.

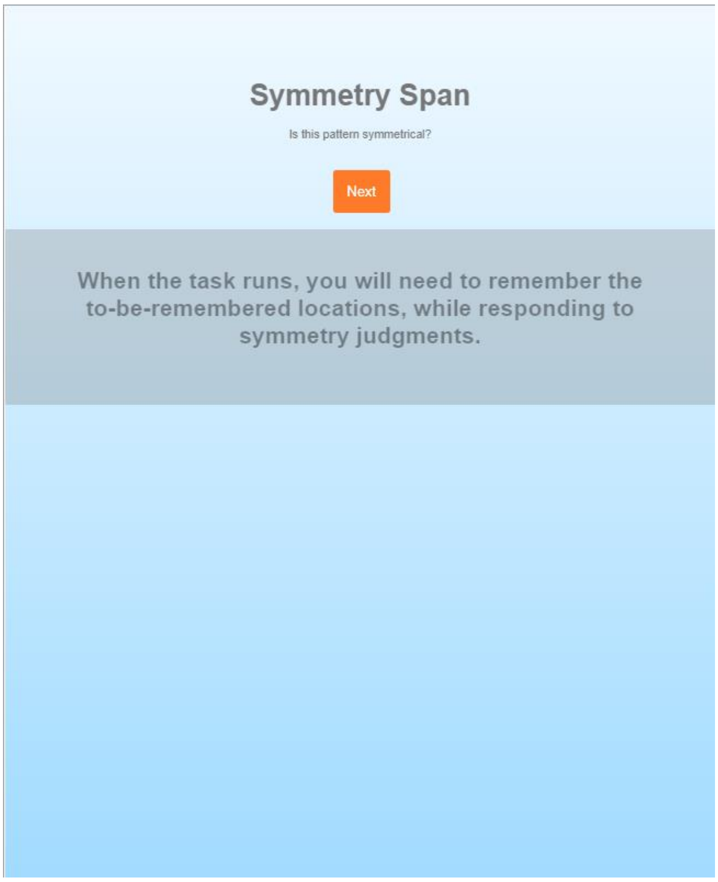

Symmetry Span
Instructions
Back
Next
After every to-be-remembered location, you will need to make a judgment about a patterns symmetry across its vertical axis.

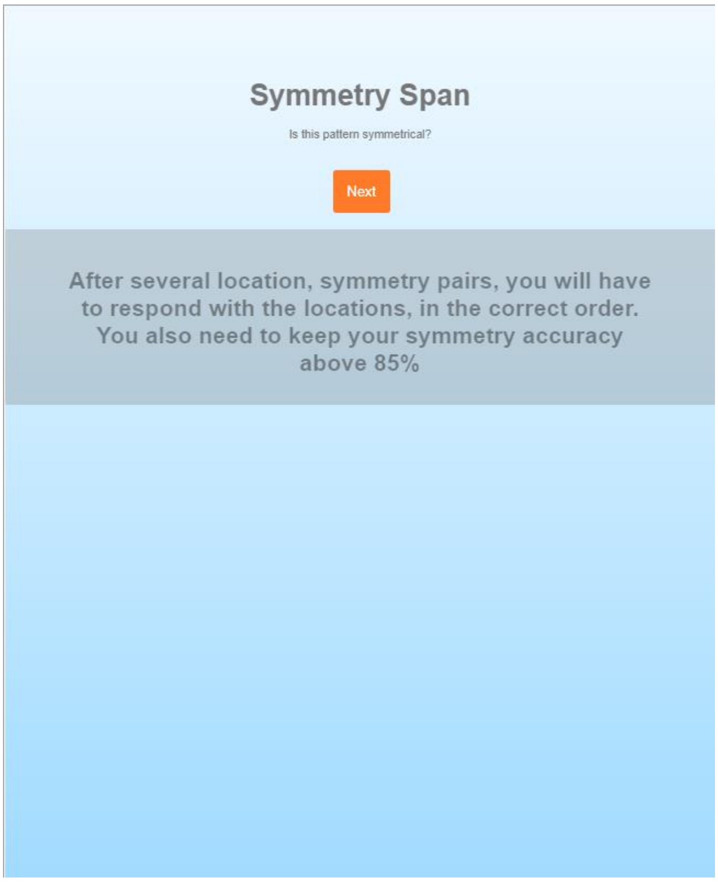

Instructions
Back
Next
A grid like the one below will appear (but with only two colors). You are to determine whether the pattern is symmetrical if you folded the left half over the right half - along its vertical axis. In the shape below, it IS symmetrical and you would respond "Yes" when asked.

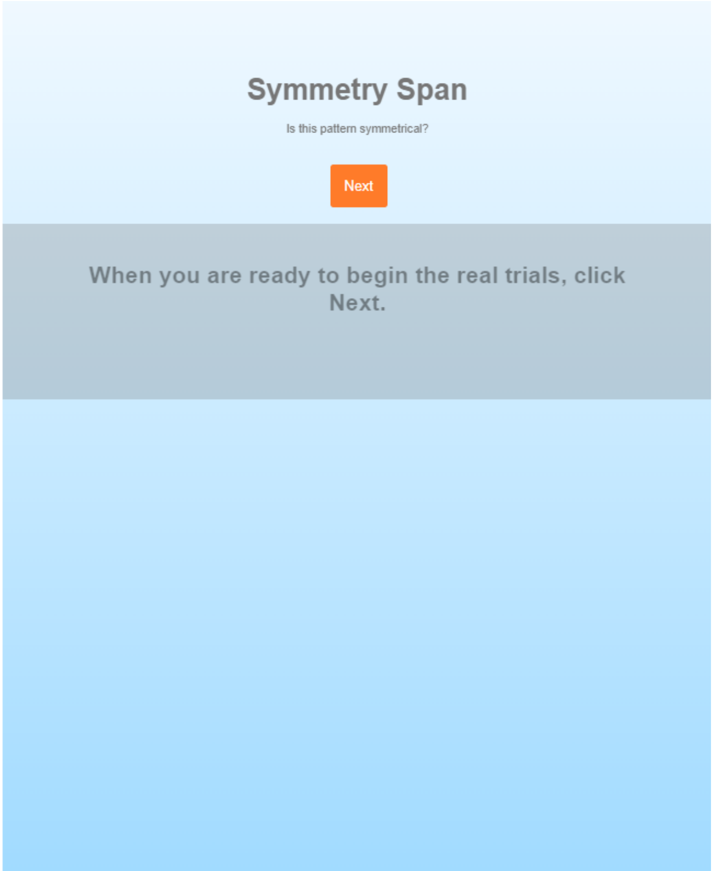

Symmetry Span
Instructions
Back
Next
Now, the pattern has changed, and you can see it is no longer symmetrical. When asked if it is symmetrical, you would response NO as it IS NOT symmetrical.


Symmetry Span
Instructions
Back
Next
Once you click Next again, you will an opportunity to practice making these judgments. You must answer FIVE in a row correctly to proceed.

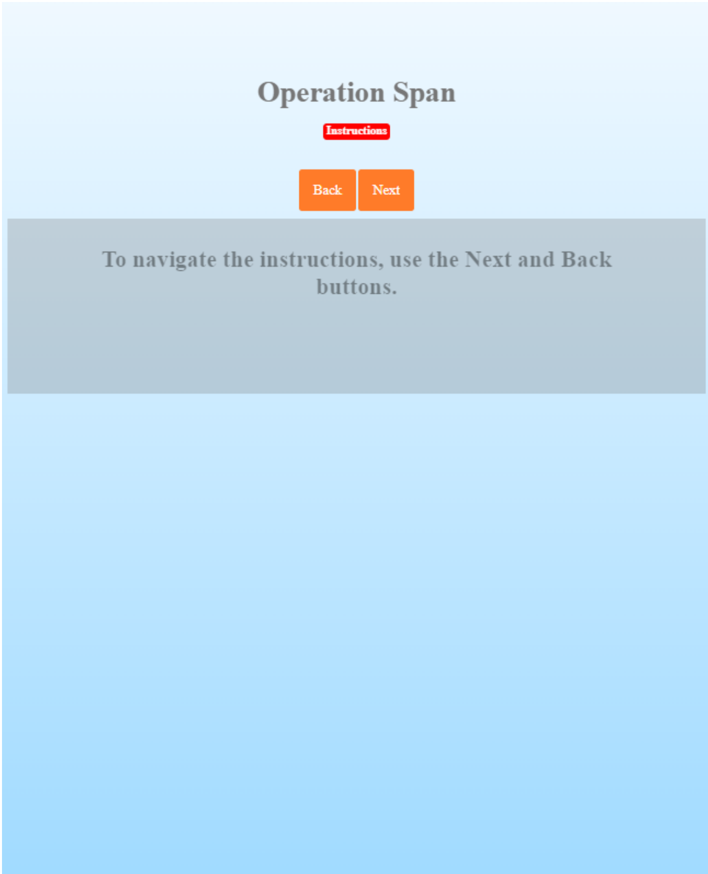

Symmetry Span
Is this pattern symmetrical?
Please respond with Yes/No to whether the pattern is symmetrical. you must receive 5 correct answers in a row to proceed.
You have answered 0 out of 5 correctly.
Yes
No

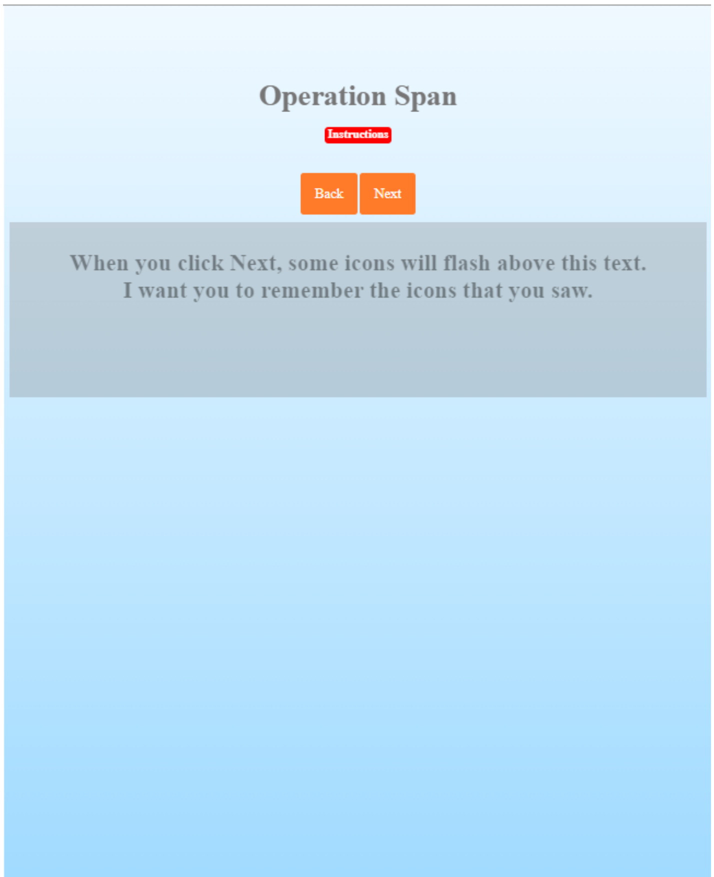

Symmetry Span
Is this pattern symmetrical?
Next
When the task runs, you will need to remember the to-be-remembered locations, while responding to symmetry judgments.

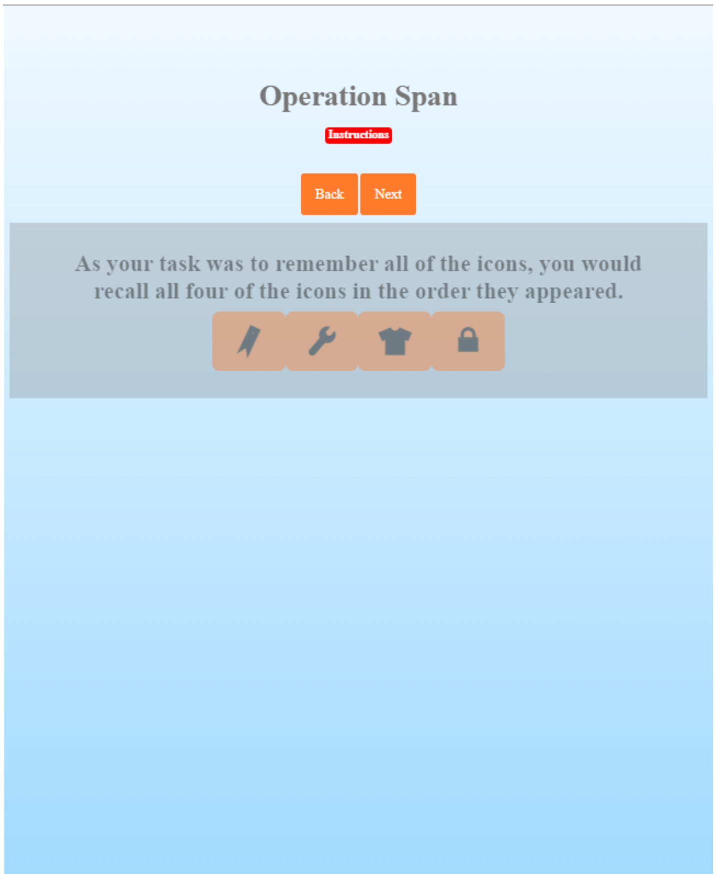

Symmetry Span
Is this pattern symmetrical?
Next
After several location, symmetry pairs, you will have to respond with the locations, in the correct order. You also need to keep your symmetry accuracy above 85%

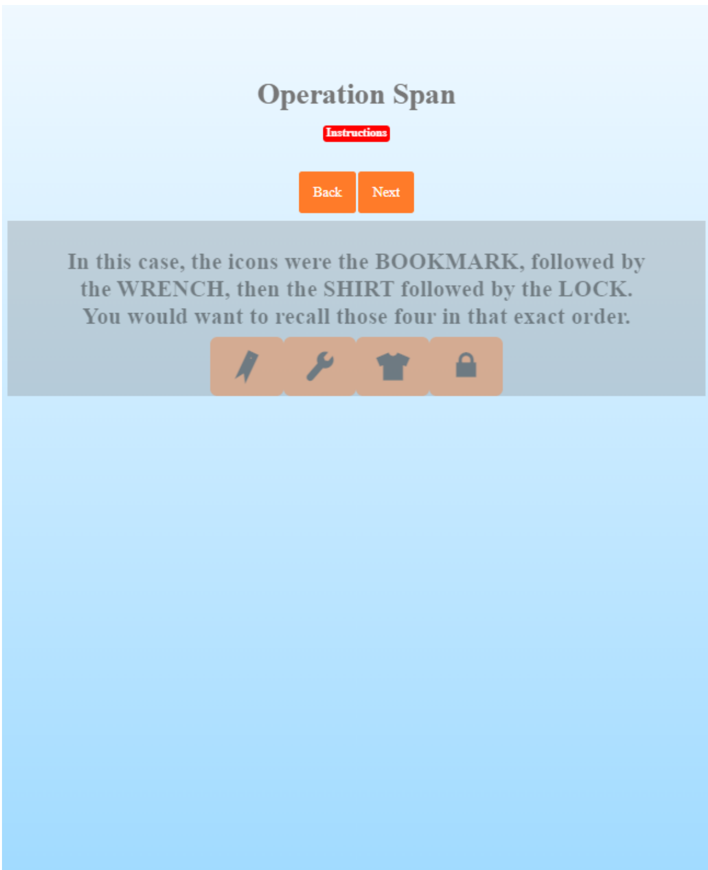

Symmetry Span
Is this pattern symmetrical?
Next
When you are ready to begin the real trials, click Next.

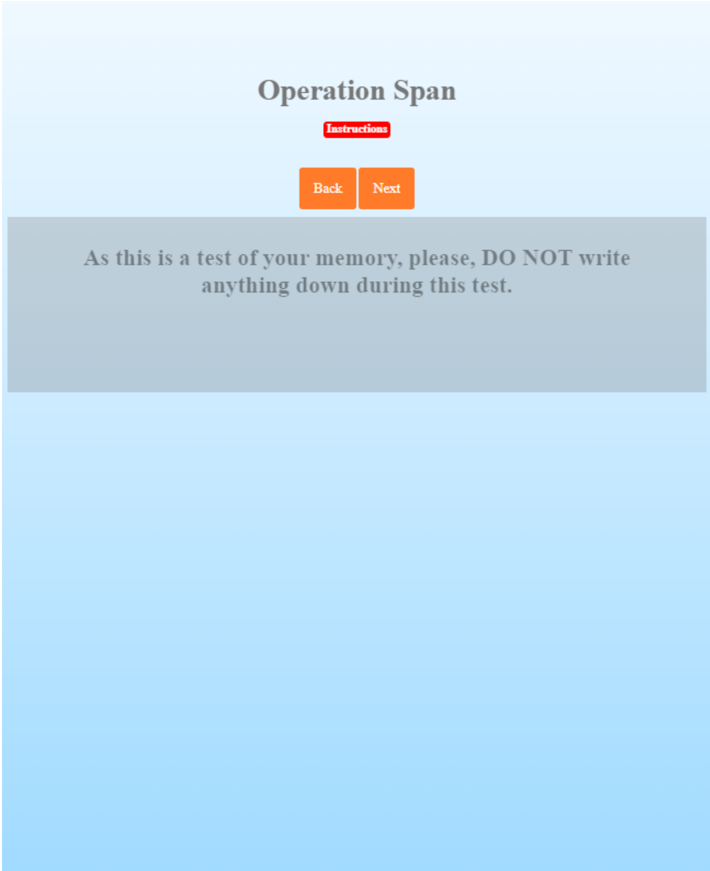
Appendix 29: Picture Span Task Instructions

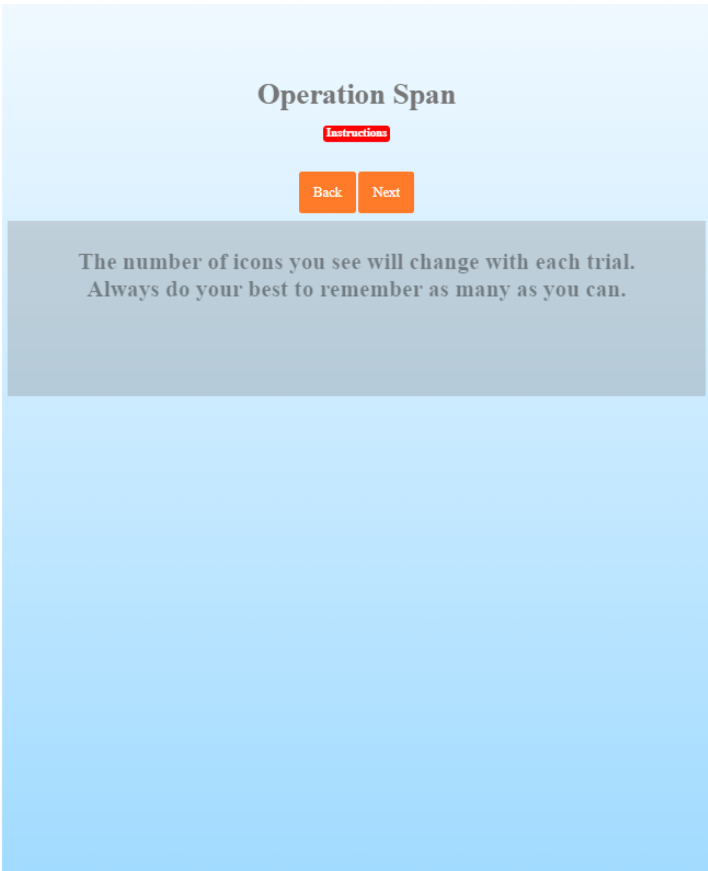


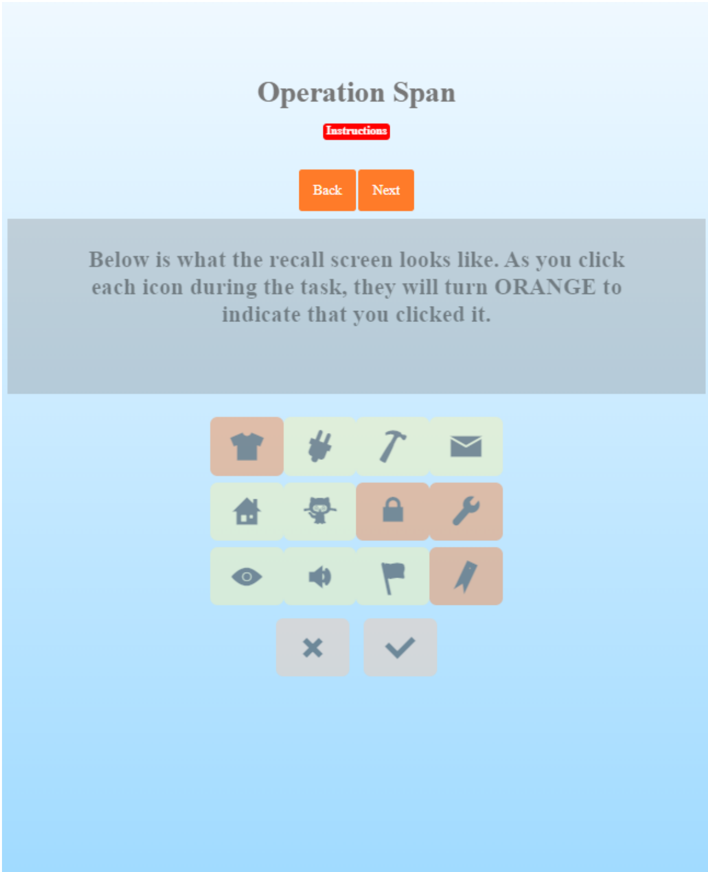


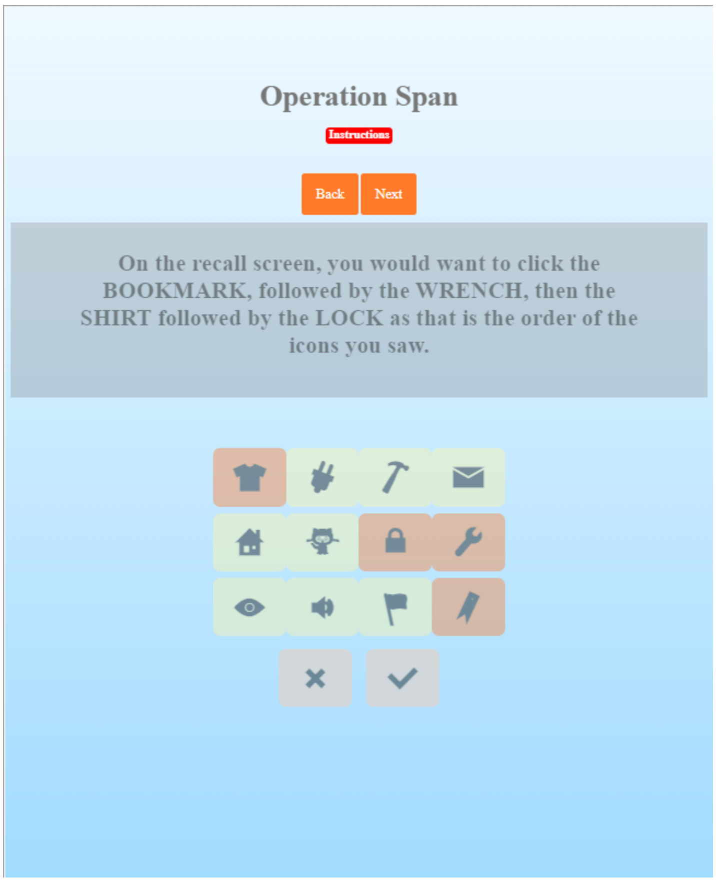

Operation Span
Instructions
Back
Next
As your task was to remember all of the icons, you would recall all four of the icons in the order they appeared.

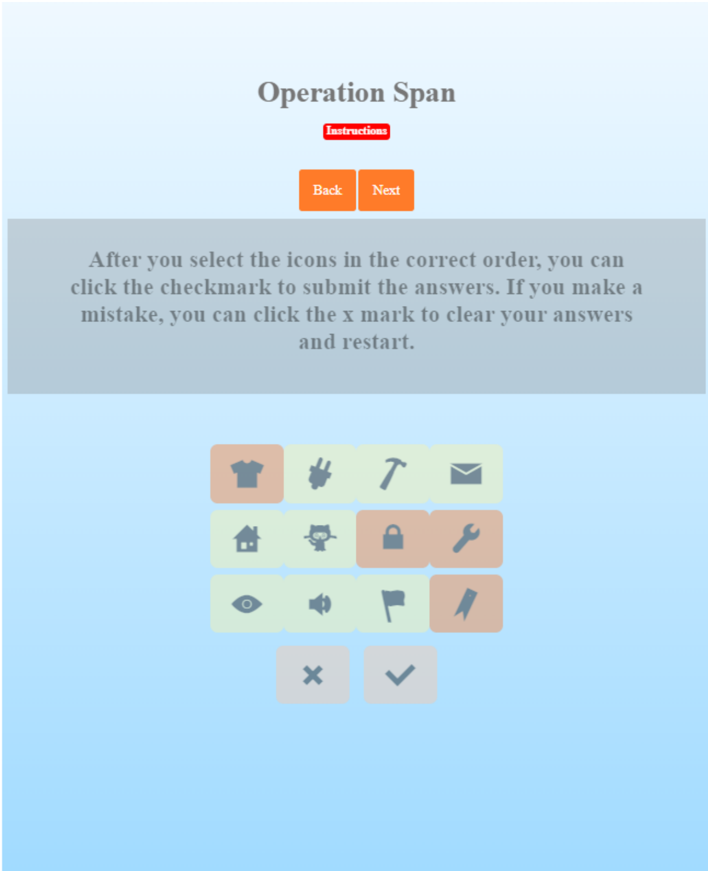

Operation Span
Instructions
Back
Next
In this case, the icons were the BOOKMARK, followed by the WRENCH, then the SHIRT followed by the LOCK. You would want to recall those four in that exact order.

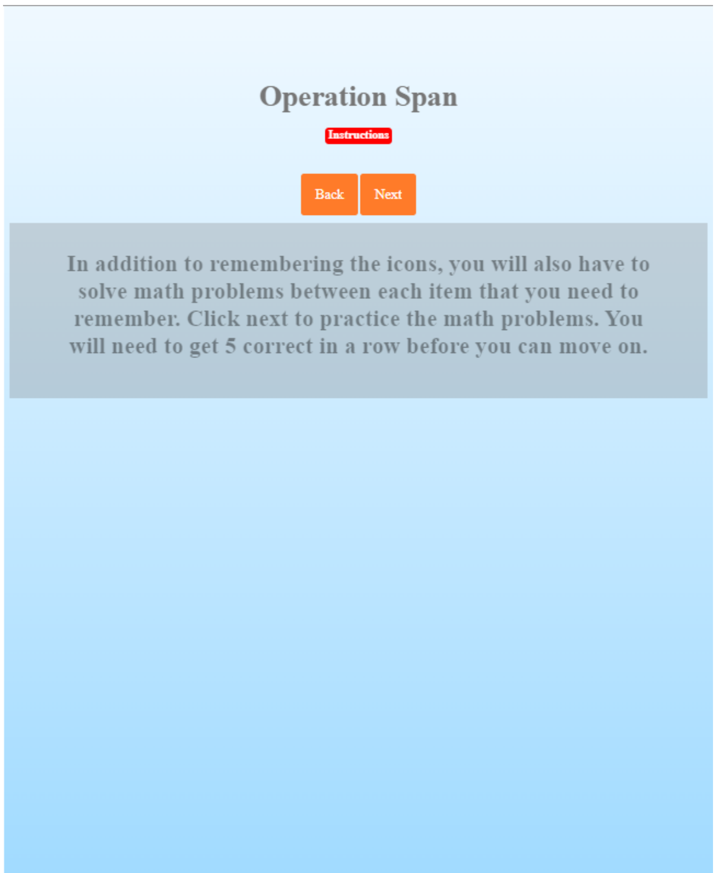

Operation Span
Instructions
Back
Next
As this is a test of your memory, please, DO NOT write anything down during this test.

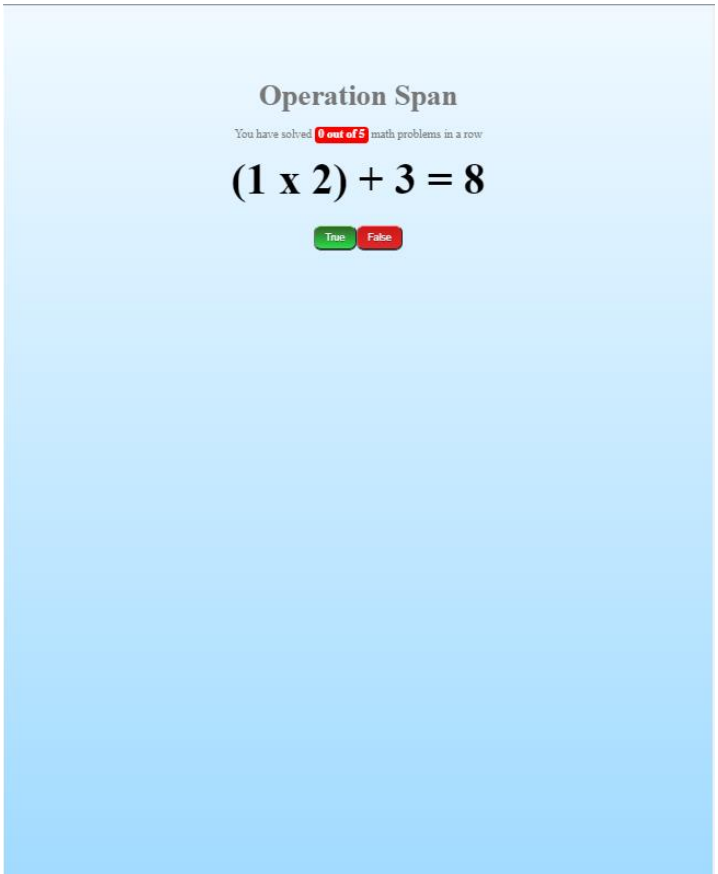

Operation Span
Instructions
Back
Next
The number of icons you see will change with each trial. Always do your best to remember as many as you can.

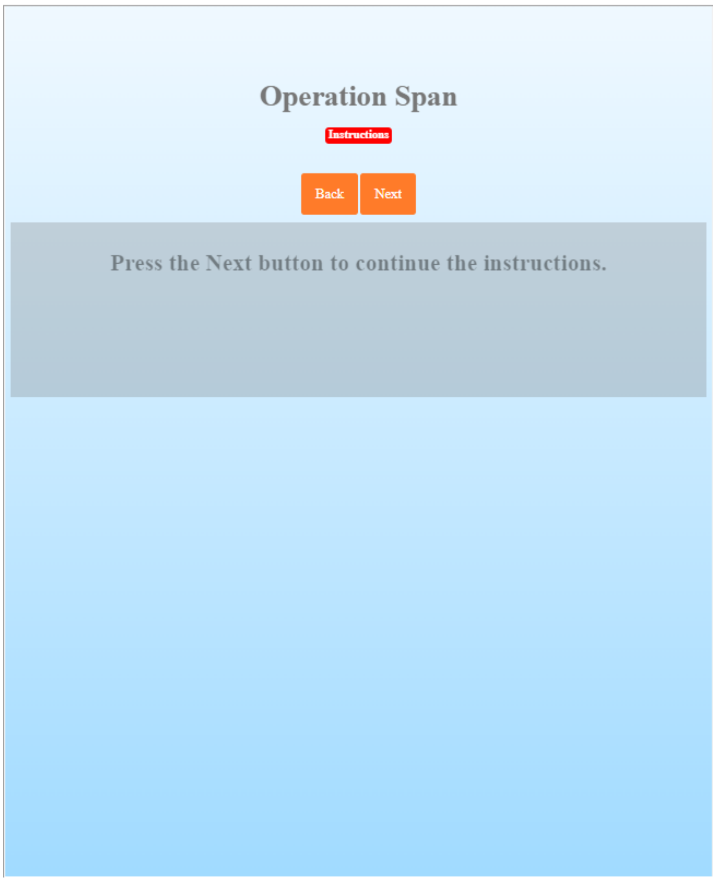

Operation Span
Instructions
Back
Next
Below is what the recall screen looks like. As you click each icon during the task, they will turn ORANGE to indicate that you clicked it.

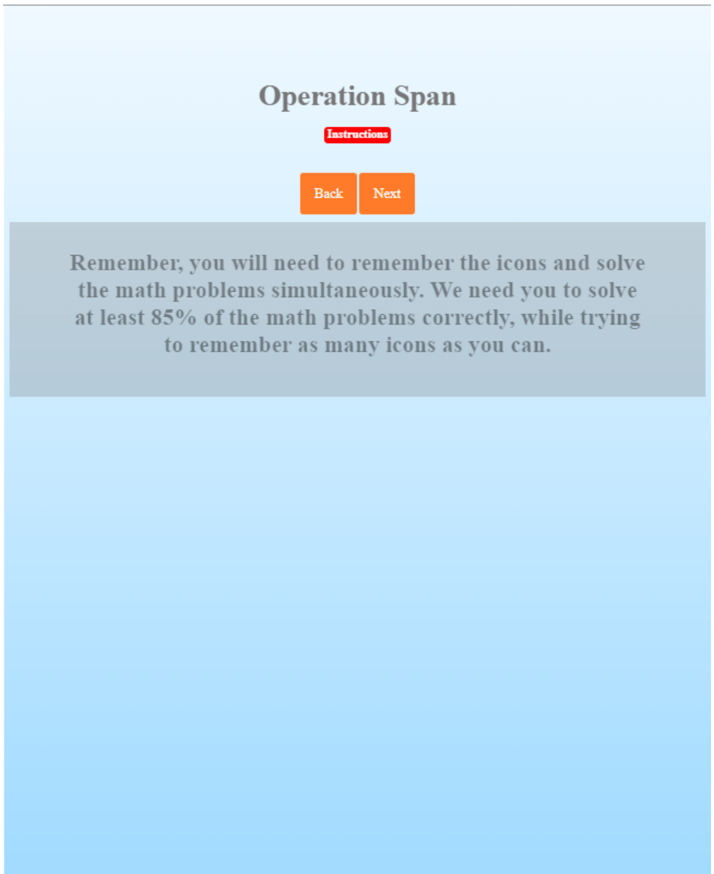

Operation Span
Instructions
Back
Next
On the recall screen, you would want to click the BOOKMARK, followed by the WRENCH, then the SHIRT followed by the LOCK as that is the order of the icons you saw.

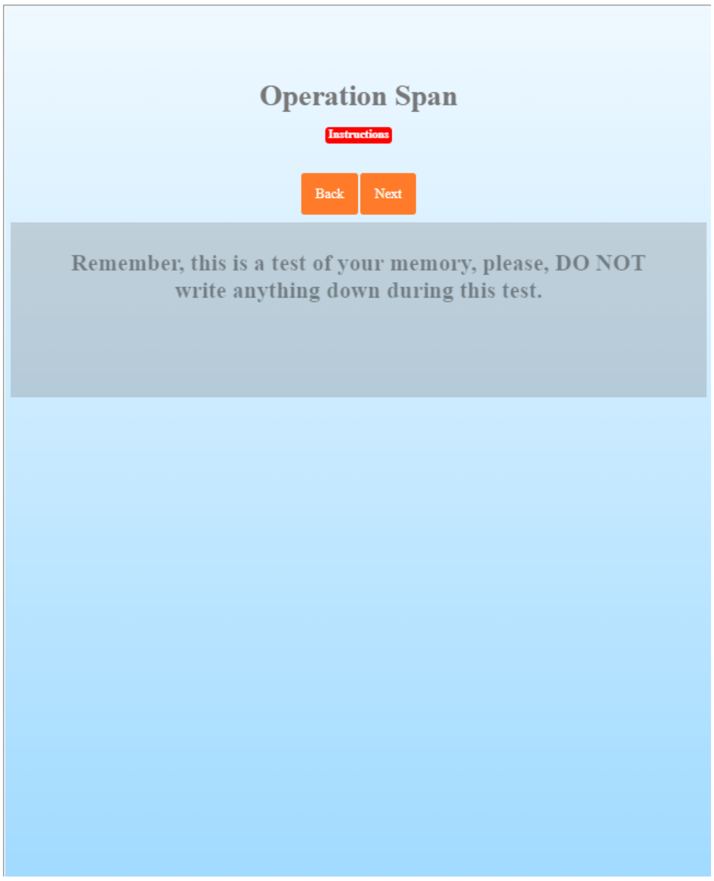

Operation Span
Instructions
Back
Next
After you select the icons in the correct order, you can click the checkmark to submit the answers. If you make a mistake, you can click the x mark to clear your answers and restart.

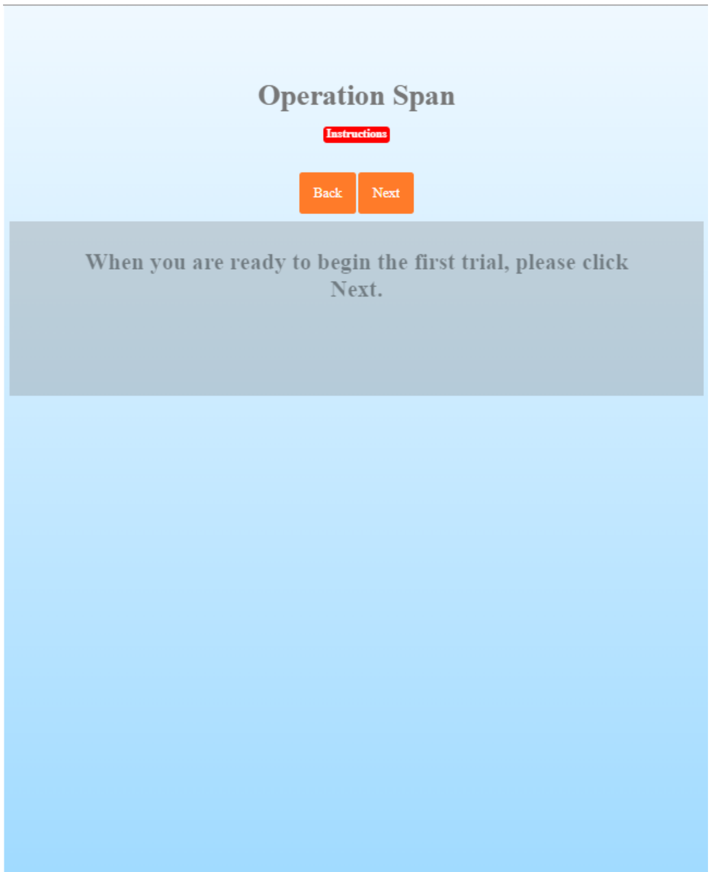

Operation Span
Instructions
Back
Next
In addition to remembering the icons, you will also have to solve math problems between each item that you need to remember. Click next to practice the math problems. You will need to get 5 correct in a row before you can move on.


Operation Span
You have solved 0 out of 5 math problems in a row
(1 x 2) + 3 = 8
True
False


Operation Span
Instructions
Back
Next
Press the Next button to continue the instructions.


Operation Span
Instructions
Back
Next
Remember, you will need to remember the icons and solve the math problems simultaneously. We need you to solve at least 85% of the math problems correctly, while trying to remember as many icons as you can.


Operation Span
Instructions
Back
Next
Remember, this is a test of your memory, please, DO NOT write anything down during this test.


Operation Span
Instructions
Back
Next
When you are ready to begin the first trial, please click Next.

Appendix 30: De-Brief Form for Whole Study

De-Brief

Thank you for taking part in this study, your time is very much appreciated. The main aim of this research is to investigate the relationship between distractibility, problem-solving and working memory capacity. There is one key research questions, related to this part of the study: 'Is working memory capacity a predictor of insight-problem solving?'. As part of this study, you were presented with working memory task. I am interested in determining whether the working memory capacity predicts the use of insight-problem solving. I would be grateful if you would not share the details of this study with anyone that might subsequently become a participant. You are reminded that once you leave the room today, it will no longer be possible to withdraw your data.

If you felt upset by any of the issues raised in this study, or then you may find the following contact helpful, alternatively, you can contact your GP.

Student Counselling Services – First Floor of the Foster Building
Opening hours - Monday, Thursday and Friday 8.30 am - 5.00 pm
Tuesday and Wednesday 8.30 am - 8.00 pm
Telephone: 01772 893020
Telephone from outside the UK: +44 1772 893020
Enquiries: wellbeing@uclan.ac.uk

If you require any further details about this research, please contact:

Student Name: Mollie Wilson (Postgraduate Student)
Email: MWilson19@uclan.ac.uk

Director of Studies Name: Dr Emma Threadgold
Email: EThreadgold1@uclan.ac.uk Tel: 01772 893443
Room: DB108, School of Psychology, University of Central Lancashire, Preston, PR1 2HE.

Supervisor Name: Dr John Marsh
Email: jemarsh@uclan.ac.uk Tel: 01772 893754
Room: DB108, School of Psychology, University of Central Lancashire, Preston, PR1 2HE.

"If you have any concerns about the research that you wish to raise with somebody who is independent of the research team, you should raise this with the University Officer for Ethics OfficerForEthics@uclan.ac.uk"

Thank you for your time and participation; it is greatly appreciated

Ethical Approval Code: SCIENCE 0131

Appendix 31: One-Way Within-Subjects ANOVA Investigating the Effect of the Mean Serial Recall Performance Scores in the Quiet, Meaningless Speech and Meaningful Speech Conditions

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
MeanSerialRecallPerformanceScores	Sphericity Assumed	.426	2	.213	20.780	<.001	.264
	Greenhouse-Geisser	.426	1.847	.231	20.780	<.001	.264
	Huynh-Feldt	.426	1.906	.224	20.780	<.001	.264
	Lower-bound	.426	1.000	.426	20.780	<.001	.264
Error (MeanSerialRecallPerformanceScores)	Sphericity Assumed	1.190	116	.010			
	Greenhouse-Geisser	1.190	107.152	.011			
	Huynh-Feldt	1.190	110.520	.011			
	Lower-bound	1.190	58.000	.021			

Appendix 32: Paired Samples T-Test, Comparing the Mean Serial Digit Recall Performance Scores in the Quiet, Meaningless Speech and Meaningful Speech Conditions

To calculate the bonferri correction, the p value of 0.05 was divided by 3 to obtain a new p value of 0.02.

Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	MeanQuietSerialRecallPerformanceScores - MeanMeaninglessSpeechSerialRecallPerformanceScores	.09569	.14343	.01867	.05831	.13307	5.124	58	<.001	<.001
Pair 2	MeanQuietSerialRecallPerformanceScores - MeanMeaningfulSpeechSerialRecallPerformanceScores	.11088	.16000	.02083	.06918	.15257	5.323	58	<.001	<.001
Pair 3	MeanMeaninglessSpeechSerialRecallPerformanceScores - MeanMeaningfulSpeechSerialRecallPerformanceScores	.01518	.12404	.01615	-.01714	.04751	.940	58	.176	.351

Appendix 33: One-Way Within-Subjects ANOVA Investigating the Mean Background Sound Effect Ratings on Serial Recall in the Quiet, Meaningless Speech and Meaningful Speech Conditions

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
MeanBackgroundSoundEffectRatings	Sphericity Assumed	351.578	2	175.789	123.391	<.001	.680
	Greenhouse-Geisser	351.578	1.272	276.441	123.391	<.001	.680
	Huynh-Feldt	351.578	1.287	273.075	123.391	<.001	.680
	Lower-bound	351.578	1.000	351.578	123.391	<.001	.680
Error (MeanBackgroundSoundEffectRatings)	Sphericity Assumed	165.259	116	1.425			
	Greenhouse-Geisser	165.259	73.765	2.240			
	Huynh-Feldt	165.259	74.674	2.213			
	Lower-bound	165.259	58.000	2.849			

Appendix 34: Paired-Samples T-Tests, Comparing the Mean Background Sound Effect Ratings, in the Quiet, Meaningless Speech and Meaningful Speech Conditions

To calculate the bonferri correction, the p value of 0.05 was divided by 3 to obtain a new p value of 0.02.

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	MeanQuietBackgroundSoundEffectRatings - MeanMeaninglessSpeechBackgroundSoundEffectRatings	-2.81073	1.90977	.24863	-3.30842	-2.31305	-11.305	58	<.001	<.001
Pair 2	MeanQuietBackgroundSoundEffectRatings - MeanMeaningfulSpeechBackgroundSoundEffectRatings	-3.14124	2.04571	.26633	-3.67436	-2.60813	-11.795	58	<.001	<.001
Pair 3	MeanMeaninglessSpeechBackgroundSoundEffectRatings - MeanMeaningfulSpeechBackgroundSoundEffectRatings	-.33051	.84602	.11014	-.55098	-.11003	-3.001	58	.002	.004

Appendix 35: A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Rate Scores

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	.000	1	.000	.009	.927	.000
	Greenhouse-Geisser	.000	1.000	.000	.009	.927	.000
	Huynh-Feldt	.000	1.000	.000	.009	.927	.000
	Lower-bound	.000	1.000	.000	.009	.927	.000
Error (TaskType)	Sphericity Assumed	1.154	58	.020			
	Greenhouse-Geisser	1.154	58.000	.020			
	Huynh-Feldt	1.154	58.000	.020			
	Lower-bound	1.154	58.000	.020			
Difficulty	Sphericity Assumed	.664	1	.664	20.348	<.001	.260
	Greenhouse-Geisser	.664	1.000	.664	20.348	<.001	.260
	Huynh-Feldt	.664	1.000	.664	20.348	<.001	.260
	Lower-bound	.664	1.000	.664	20.348	<.001	.260
Error (Difficulty)	Sphericity Assumed	1.893	58	.033			
	Greenhouse-Geisser	1.893	58.000	.033			
	Huynh-Feldt	1.893	58.000	.033			
	Lower-bound	1.893	58.000	.033			
TaskType* Difficulty	Sphericity Assumed	.590	1	.590	16.070	<.001	.217
	Greenhouse-Geisser	.590	1.000	.590	16.070	<.001	.217
	Huynh-Feldt	.590	1.000	.590	16.070	<.001	.217

	Lower-bound	.590	1.000	.590	16.070	<.001	.217
Error (TaskType * Difficulty)	Sphericity Assumed	2.129	58	.037			
	Greenhouse-Geisser	2.129	58.000	.037			
	Huynh-Feldt	2.129	58.000	.037			
	Lower-bound	2.129	58.000	.037			

Appendix 36: Paired Samples T-Tests, Comparing the Mean Solution Rate Scores for the Easy and Difficult, CRATs and Rebus Puzzles

To calculate the bonferri correction, the p value of 0.05 was divided by 6 to obtain a new p value of 0.01.

Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	EasyCRATs - DifficultCRATs	.00610	.28259	.03679	-.06754	.07974	.166	58	.434	.869
Pair 2	EasyRebusPuzzles - DifficultRebusPuzzles	.20610	.24261	.03158	.14288	.26933	6.525	58	<.001	<.001
Pair 3	EasyCRATs - EasyRebusPuzzles	-.09831	.31374	.04085	-.18007	-.01654	-2.407	58	.010	.019
Pair 4	EasyCRATs - DifficultRebusPuzzles	.10780	.30070	.03915	.02943	.18616	2.754	58	.004	.008
Pair 5	DifficultCRATs - EasyRebusPuzzles	-.10441	.12108	.01576	-.13596	-.07285	-6.624	58	<.001	<.001
Pair 6	DifficultCRATs - DifficultRebusPuzzles	.10169	.12161	.01583	.07000	.13339	6.423	58	<.001	<.001

Appendix 37: A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Rate Scores

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
RebusPuzzleType	Sphericity Assumed	.003	1	.003	.249	.619	.004
	Greenhouse-Geisser	.003	1.000	.003	.249	.619	.004
	Huynh-Feldt	.003	1.000	.003	.249	.619	.004
	Lower-bound	.003	1.000	.003	.249	.619	.004
Error (RebusPuzzleType)	Sphericity Assumed	.763	58	.013			
	Greenhouse-Geisser	.763	58.000	.013			
	Huynh-Feldt	.763	58.000	.013			
	Lower-bound	.763	58.000	.013			
Difficulty	Sphericity Assumed	.943	1	.943	30.822	<.001	.347
	Greenhouse-Geisser	.943	1.000	.943	30.822	<.001	.347
	Huynh-Feldt	.943	1.000	.943	30.822	<.001	.347
	Lower-bound	.943	1.000	.943	30.822	<.001	.347
Error (Difficulty)	Sphericity Assumed	1.775	58	.031			
	Greenhouse-Geisser	1.775	58.000	.031			
	Huynh-Feldt	1.775	58.000	.031			
	Lower-bound	1.775	58.000	.031			
RebusPuzzleType * Difficulty	Sphericity Assumed	1.715	1	1.715	38.283	<.001	.398
	Greenhouse-Geisser	1.715	1.000	1.715	38.283	<.001	.398

	Huynh-Feldt	1.715	1.000	1.715	38.283	<.001	.398
	Lower-bound	1.715	1.000	1.715	38.283	<.001	.398
Error (RebusPuzzleType *Difficulty)	Sphericity Assumed	2.599	58	.045			
	Greenhouse-Geisser	2.599	58.000	.045			
	Huynh-Feldt	2.599	58.000	.045			
	Lower-bound	2.599	58.000	.045			

Appendix 38: Paired Samples T-Test Comparing the Mean Solution Rate Scores for the Easy and Difficult, Word and Visual Rebus Puzzles

To calculate the bonferri correction, the p value of 0.05 was divided by 6 to obtain a new p value of 0.01.

Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	EasyWordRebusPuzzles - DifficultWordRebusPuzzles	.04407	.23314	.03035	-.01669	.10482	1.452	58	.076	.152
Pair 2	EasyVisualRebusPuzzles - DifficultVisualRebusPuzzles	-.29695	.31059	.04044	-.37789	-.21601	-7.344	58	<.001	<.001
Pair 3	EasyWordRebusPuzzles - EasyVisualRebusPuzzles	.17797	.28637	.03728	.10334	.25259	4.774	58	<.001	<.001
Pair 4	EasyVisuaRebusPuzzles - DifficultWordRebusPuzzles	-.13390	.15943	.02076	-.17545	-.09235	-6.451	58	<.001	<.001
Pair 5	DifficultVisualRebusPuzzles - EasyWordRebusPuzzles	.11898	.24922	.03245	.05404	.18393	3.667	58	<.001	<.001
Pair 6	DifficultVisualRebusPuzzles - DifficultWordRebusPuzzles	.16305	.18419	.02398	.11505	.21105	6.800	58	<.001	<.001

Appendix 39: A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Times

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	1.380	1	1.380	.082	.776	.003
	Greenhouse-Geisser	1.380	1.000	1.380	.082	.776	.003
	Huynh-Feldt	1.380	1.000	1.380	.082	.776	.003
	Lower-bound	1.380	1.000	1.380	.082	.776	.003
Error (TaskType)	Sphericity Assumed	519.159	31	16.747			
	Greenhouse-Geisser	519.159	31.000	16.747			
	Huynh-Feldt	519.159	31.000	16.747			
	Lower-bound	519.159	31.000	16.747			
Difficulty	Sphericity Assumed	113.195	1	113.195	10.641	.003	.256
	Greenhouse-Geisser	113.195	1.000	113.195	10.641	.003	.256
	Huynh-Feldt	113.195	1.000	113.195	10.641	.003	.256
	Lower-bound	113.195	1.000	113.195	10.641	.003	.256
Error (Difficulty)	Sphericity Assumed	329.773	31	10.638			
	Greenhouse-Geisser	329.773	31.000	10.638			
	Huynh-Feldt	329.773	31.000	10.638			
	Lower-bound	329.773	31.000	10.638			
TaskType * Difficulty	Sphericity Assumed	8.867	1	8.867	.905	.349	.028
	Greenhouse-Geisser	8.867	1.000	8.867	.905	.349	.028

	Huynh-Feldt	8.867	1.000	8.867	.905	.349	.028
	Lower-bound	8.867	1.000	8.867	.905	.349	.028
Error (TaskType * Difficulty)	Sphericity Assumed	303.593	31	9.793			
	Greenhouse-Geisser	303.593	31.000	9.793			
	Huynh-Feldt	303.593	31.000	9.793			
	Lower-bound	303.593	31.000	9.793			

Appendix 40: A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Times

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
RebusPuzzleType	Sphericity Assumed	54.653	1	54.653	6.104	.022	.225
	Greenhouse-Geisser	54.653	1.000	54.653	6.104	.022	.225
	Huynh-Feldt	54.653	1.000	54.653	6.104	.022	.225
	Lower-bound	54.653	1.000	54.653	6.104	.022	.225
Error (RebusPuzzleType)	Sphericity Assumed	188.032	21	8.954			
	Greenhouse-Geisser	188.032	21.000	8.954			
	Huynh-Feldt	188.032	21.000	8.954			
	Lower-bound	188.032	21.000	8.954			
Difficulty	Sphericity Assumed	6.694	1	6.694	.428	.520	.020
	Greenhouse-Geisser	6.694	1.000	6.694	.428	.520	.020
	Huynh-Feldt	6.694	1.000	6.694	.428	.520	.020
	Lower-bound	6.694	1.000	6.694	.428	.520	.020
Error (Difficulty)	Sphericity Assumed	328.709	21	15.653			
	Greenhouse-Geisser	328.709	21.000	15.653			
	Huynh-Feldt	328.709	21.000	15.653			
	Lower-bound	328.709	21.000	15.653			
RebusPuzzleType * Difficulty	Sphericity Assumed	9.120	1	9.120	.726	.404	.033

	Greenhouse-Geisser	9.120	1.000	9.120	.726	.404	.033
	Huynh-Feldt	9.120	1.000	9.120	.726	.404	.033
	Lower-bound	9.120	1.000	9.120	.726	.404	.033
Error (RebusPuzzleType * Difficulty)	Sphericity Assumed	263.825	21	12.563			
	Greenhouse-Geisser	263.825	21.000	12.563			
	Huynh-Feldt	263.825	21.000	12.563			
	Lower-bound	263.825	21.000	12.563			

Appendix 41: 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Strategy Scores

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	70.401	1	70.401	.175	.678	.005
	Greenhouse-Geisser	70.401	1.000	70.401	.175	.678	.005
	Huynh-Feldt	70.401	1.000	70.401	.175	.678	.005
	Lower-bound	70.401	1.000	70.401	.175	.678	.005
Error (TaskType)	Sphericity Assumed	12852.153	32	401.630			
	Greenhouse-Geisser	12852.153	32.000	401.630			
	Huynh-Feldt	12852.153	32.000	401.630			
	Lower-bound	12852.153	32.000	401.630			
Difficulty	Sphericity Assumed	857.208	1	857.208	5.523	.025	.147
	Greenhouse-Geisser	857.208	1.000	857.208	5.523	.025	.147
	Huynh-Feldt	857.208	1.000	857.208	5.523	.025	.147
	Lower-bound	857.208	1.000	857.208	5.523	.025	.147
Error (Difficulty)	Sphericity Assumed	4966.462	32	155.202			
	Greenhouse-Geisser	4966.462	32.000	155.202			
	Huynh-Feldt	4966.462	32.000	155.202			
	Lower-bound	4966.462	32.000	155.202			
TaskType * Difficulty	Sphericity Assumed	.060	1	.060	.000	.983	.000
	Greenhouse-Geisser	.060	1.000	.060	.000	.983	.000
	Huynh-Feldt	.060	1.000	.060	.000	.983	.000

	Lower-bound	.060	1.000	.060	.000	.983	.000
Error (TaskType * Difficulty)	Sphericity Assumed	3948.680	32	123.396			
	Greenhouse-Geisser	3948.680	32.000	123.396			
	Huynh-Feldt	3948.680	32.000	123.396			
	Lower-bound	3948.680	32.000	123.396			

Appendix 42: A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Strategy Scores

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
RebusPuzzleType	Sphericity Assumed	952.389	1	952.389	5.158	.034	.197
	Greenhouse-Geisser	952.389	1.000	952.389	5.158	.034	.197
	Huynh-Feldt	952.389	1.000	952.389	5.158	.034	.197
	Lower-bound	952.389	1.000	952.389	5.158	.034	.197
Error (RebusPuzzleType)	Sphericity Assumed	3877.736	21	184.654			
	Greenhouse-Geisser	3877.736	21.000	184.654			
	Huynh-Feldt	3877.736	21.000	184.654			
	Lower-bound	3877.736	21.000	184.654			
Difficulty	Sphericity Assumed	336.182	1	336.182	.851	.367	.039
	Greenhouse-Geisser	336.182	1.000	336.182	.851	.367	.039
	Huynh-Feldt	336.182	1.000	336.182	.851	.367	.039
	Lower-bound	336.182	1.000	336.182	.851	.367	.039
Error (Difficulty)	Sphericity Assumed	8295.068	21	395.003			
	Greenhouse-Geisser	8295.068	21.000	395.003			
	Huynh-Feldt	8295.068	21.000	395.003			
	Lower-bound	8295.068	21.000	395.003			
RebusPuzzleType * Difficulty	Sphericity Assumed	12.753	1	12.753	.037	.849	.002
	Greenhouse-Geisser	12.753	1.000	12.753	.037	.849	.002

	Huynh-Feldt	12.753	1.000	12.753	.037	.849	.002
	Lower-bound	12.753	1.000	12.753	.037	.849	.002
Error (RebusPuzzleType * Difficulty)	Sphericity Assumed	7175.060	21	341.670			
	Greenhouse-Geisser	7175.060	21.000	341.670			
	Huynh-Feldt	7175.060	21.000	341.670			
	Lower-bound	7175.060	21.000	341.670			

Appendix 43: A 2 (Task Type: CRATs vs Rebus Puzzles) x 2 (Difficulty: Easy vs Difficult) Factorial ANOVA for the Mean Solution Confidence Scores

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	3417.991	1	3417.991	5.202	.030	.144
	Greenhouse-Geisser	3417.991	1.000	3417.991	5.202	.030	.144
	Huynh-Feldt	3417.991	1.000	3417.991	5.202	.030	.144
	Lower-bound	3417.991	1.000	3417.991	5.202	.030	.144
Error (TaskType)	Sphericity Assumed	20369.091	31	657.067			
	Greenhouse-Geisser	20369.091	31.000	657.067			
	Huynh-Feldt	20369.091	31.000	657.067			
	Lower-bound	20369.091	31.000	657.067			
Difficulty	Sphericity Assumed	15658.748	1	15658.748	41.098	<.001	.570
	Greenhouse-Geisser	15658.748	1.000	15658.748	41.098	<.001	.570
	Huynh-Feldt	15658.748	1.000	15658.748	41.098	<.001	.570
	Lower-bound	15658.748	1.000	15658.748	41.098	<.001	.570
Error (Difficulty)	Sphericity Assumed	11811.206	31	381.007			
	Greenhouse-Geisser	11811.206	31.000	381.007			
	Huynh-Feldt	11811.206	31.000	381.007			
	Lower-bound	11811.206	31.000	381.007			
TaskType * Difficulty	Sphericity Assumed	73.994	1	73.994	.355	.555	.011
	Greenhouse-Geisser	73.994	1.000	73.994	.355	.555	.011

	Huynh-Feldt	73.994	1.000	73.994	.355	.555	.011
	Lower-bound	73.994	1.000	73.994	.355	.555	.011
Error (TaskType * Difficulty)	Sphericity Assumed	6455.997	31	208.258			
	Greenhouse-Geisser	6455.997	31.000	208.258			
	Huynh-Feldt	6455.997	31.000	208.258			
	Lower-bound	6455.997	31.000	208.258			

Appendix 44: A 2 (Rebus Puzzle Type: Word vs Visual) x 2 (Difficulty: Easy vs Hard) Factorial ANOVA for the Mean Solution Confidence Scores

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
RebusPuzzleType	Sphericity Assumed	4753.245	1	4753.245	13.270	.002	.387
	Greenhouse-Geisser	4753.245	1.000	4753.245	13.270	.002	.387
	Huynh-Feldt	4753.245	1.000	4753.245	13.270	.002	.387
	Lower-bound	4753.245	1.000	4753.245	13.270	.002	.387
Error (RebusPuzzleType)	Sphericity Assumed	7522.114	21	358.196			
	Greenhouse-Geisser	7522.114	21.000	358.196			
	Huynh-Feldt	7522.114	21.000	358.196			
	Lower-bound	7522.114	21.000	358.196			
Difficulty	Sphericity Assumed	7710.955	1	7710.955	19.726	<.001	.484
	Greenhouse-Geisser	7710.955	1.000	7710.955	19.726	<.001	.484
	Huynh-Feldt	7710.955	1.000	7710.955	19.726	<.001	.484
	Lower-bound	7710.955	1.000	7710.955	19.726	<.001	.484
Error (Difficulty)	Sphericity Assumed	8209.092	21	390.909			
	Greenhouse-Geisser	8209.092	21.000	390.909			
	Huynh-Feldt	8209.092	21.000	390.909			
	Lower-bound	8209.092	21.000	390.909			
RebusPuzzleType *	Sphericity Assumed	1.438	1	1.438	.004	.951	.000

Difficulty	Greenhouse-Geisser	1.438	1.000	1.438	.004	.951	.000
	Huynh-Feldt	1.438	1.000	1.438	.004	.951	.000
	Lower-bound	1.438	1.000	1.438	.004	.951	.000
Error (RebusPuzzleType * Difficulty)	Sphericity Assumed	7891.921	21	375.806			
	Greenhouse-Geisser	7891.921	21.000	375.806			
	Huynh-Feldt	7891.921	21.000	375.806			
	Lower-bound	7891.921	21.000	375.806			

Appendix 45: Paired Samples T-Test, Comparing the Symmetry Span and Picture Span Scores

Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	SymmetrySpanScores - PictureSpanScores	-3.44068	9.20508	1.19840	-5.83953	-1.04182	-2.871	58	.003	.006

Appendix 46: Standard Multiple Regression, Predicting the Mean Serial Recall Performance Scores, in the Quiet Condition, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.223[a]	.050	-.002	.15928

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.073	3	.024	.956	.420[b]
	Residual	1.395	55	.025		
	Total	1.468	58			

a. Dependent Variable: MeanQuietSerialRecallPerformanceScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.634	.084		7.514	<.001
	SymmetrySpanScores	-.005	.008	-.287	-.654	.516
	PictureSpanScores	-.001	.009	-.078	-.135	.893
	CompositeScores	.009	.017	.485	.564	.575

a. Dependent Variable: MeanQuietSerialRecallPerformanceScores

Appendix 47: Standard Multiple Regression, Predicting the Mean Serial Recall Performance Scores, in the Meaningless Speech Condition, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.324[a]	.105	.056	.16270

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.171	3	.057	2.155	.104[b]
	Residual	1.456	55	.026		
	Total	1.627	58			

a. Dependent Variable: MeanMeaninglessSpeechSerialRecallPerformanceScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.470	.086		5.450	<.001
	SymmetrySpanScores	-.009	.008	-.458	-1.076	.286
	PictureSpanScores	-.004	.009	-.262	-.469	.641
	CompositeScores	.018	.017	.889	1.067	.291

a. Dependent Variable: MeanMeaninglessSpeechSerialRecallPerformanceScores

Appendix 48: Standard Multiple Regression, Predicting the Mean Serial Recall Performance Scores, in the Meaningful Speech Condition, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.302[a]	.091	.042	.17036

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.160	3	.053	1.837	.151[b]
	Residual	1.596	55	.029		
	Total	1.756	58			

a. Dependent Variable: MeanMeaningfulSpeechSerialRecallPerformanceScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.472	.090		5.229	<.001
	SymmetrySpanScores	.006	.009	.313	.729	.469
	PictureSpanScores	.012	.010	.681	1.210	.232
	CompositeScores	-.013	.018	-.625	-.744	.460

a. Dependent Variable: MeanMeaningfulSpeechSerialRecallPerformanceScores

Appendix 49: Correlational Analysis Between the Mean Background Sound Effect Ratings in the Quiet, Meaningless Speech and Meaningful Speech Conditions and Symmetry Span, Picture Span and Composite Scores

Correlations

		SymmetrySpanScores	PictureSpanScores	CompositeScores	MeanQuietBackgroundSoundEffectRatings	MeanMeaninglessSpeechBackgroundSoundEffectRatings	MeanMeaningfulSpeechBackgroundSoundEffectRatings
SymmetrySpanScores	Pearson Correlation	1	.540**	.826**	.076	.035	.074
	Sig. (2-tailed)		<.001	<.001	.569	.791	.577
	N	59	59	59	59	59	59
PictureSpanScores	Pearson Correlation	.540**	1	.903**	.172	.021	-.021
	Sig. (2-tailed)	<.001		<.001	.193	.875	.875
	N	59	59	59	59	59	59
CompositeScores	Pearson Correlation	.826**	.903**	1	.128	.011	.026
	Sig. (2-tailed)	<.001	<.001		.335	.933	.848
	N	59	59	59	59	59	59
MeanQuietBackgroundSoundEffectRatings	Pearson Correlation	.076	.172	.128	1	-.036	-.257*
	Sig. (2-tailed)	.569	.193	.335		.784	.050
	N	59	59	59	59	59	59
MeanMeaninglessSpeechBackgroundSoundEffectRatings	Pearson Correlation	.035	.021	.011	-.036	1	.719**
	Sig. (2-tailed)	.791	.875	.933	.784		<.001
	N	59	59	59	59	59	59
MeanMeaningfulSpee	Pearson Correlation	.074	-.021	.026	-.257*	.719**	1

chBackgroundSoundEffectRatings	Sig. (2-tailed)	.577	.875	.848	.050	<.001	
	N	59	59	59	59	59	59

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 50: Standard Multiple Regression, Predicting the Mean Background Noise Effect Ratings, in the Quiet Condition, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.214[a]	.046	-.006	1.47858

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.796	3	1.932	.884	.455[b]
	Residual	120.241	55	2.186		
	Total	126.036	58			

a. Dependent Variable: MeanQuietBackgroundSoundEffectRatings

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.286	.783		4.197	<.001
	SymmetrySpanScores	.062	.074	.370	.842	.404
	PictureSpanScores	.103	.083	.718	1.244	.219
	CompositeScores	-.148	.154	-.826	-.959	.342

a. Dependent Variable: MeanQuietBackgroundSoundEffectRatings

Appendix 51: Standard Multiple Regression, Predicting the Mean Background Noise Effect Ratings, in the Meaningless Speech Condition, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.131[a]	.017	-.037	1.18262

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.333	3	.444	.318	.813[b]
	Residual	76.922	55	1.399		
	Total	78.255	58			

a. Dependent Variable: MeanMeaninglessSpeechBackgroundSoundEffectRatings

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.685	.626		10.674	<.001
	SymmetrySpanScores	.057	.059	.426	.954	.344
	PictureSpanScores	.060	.066	.532	.909	.367
	CompositeScores	-.116	.123	-.821	-.940	.351

a. Dependent Variable: MeanMeaninglessSpeechBackgroundSoundEffectRatings

Appendix 52: Standard Multiple Regression, Predicting the Mean Background Noise Effect Ratings, in the Meaningful Speech Condition, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.106[a]	.011	-.043	1.11274

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.778	3	.259	.210	.889[b]
	Residual	68.100	55	1.238		
	Total	68.879	58			

a. Dependent Variable: MeanMeaningfulSpeechBackgroundSoundEffectRatingRatings
b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.869	.589		11.658	<.001
	SymmetrySpanScores	.006	.056	.045	.101	.920
	PictureSpanScores	-.020	.062	-.187	-.319	.751
	CompositeScores	.021	.116	.157	.180	.858

a. Dependent Variable: MeanMeaningfulSpeechBackgroundSoundEffectRatingRatings

Appendix 53: Correlational Analysis Between the Mean Solution Rate Scores and Mean Solution Times for the CRATs and Rebus Puzzles and the Symmetry Span, Picture Span and Composite Scores

Correlations

		SymmetrySpanScores	PictureSpanScores	CompositeScores	CRATMeanSolutionTimes	CRATSMeanSolutionRateScores	RebusPuzzleMeanSolutionRateScores	RebusPuzzleMeanSolutionTimes
SymmetrySpanScores	Pearson Correlation	1	.540**	.826**	.036	-.055	-.168	-.090
	Sig. (2-tailed)		<.001	<.001	.809	.681	.204	.524
	N	59	59	59	47	59	59	52
PictureSpanScores	Pearson Correlation	.540**	1	.903**	-.051	.069	-.016	.180
	Sig. (2-tailed)	<.001		<.001	.733	.602	.903	.200
	N	59	59	59	47	59	59	52
CompositeScores	Pearson Correlation	.826**	.903**	1	-.020	.027	-.092	.070
	Sig. (2-tailed)	<.001	<.001		.894	.837	.487	.623
	N	59	59	59	47	59	59	52
CRATMeanSolutionTimes	Pearson Correlation	.036	-.051	-.020	1	.833**	.199	.391**
	Sig. (2-tailed)	.809	.733	.894		<.001	.180	.009
	N	47	47	47	47	47	47	44
CRATMeanSolutionRateScores	Pearson Correlation	-.055	.069	.027	.833**	1	.601**	.626**
	Sig. (2-tailed)	.681	.602	.837	<.001		<.001	<.001
	N	59	59	59	47	59	59	52
RebusPuzzleMeanSolutionRateScores	Pearson Correlation	-.168	-.016	-.092	.199	.601**	1	.820**
	Sig. (2-tailed)	.204	.903	.487	.180	<.001		<.001
	N	59	59	59	47	59	59	52
RebusPuzzlesMeanSolutionTimes	Pearson Correlation	-.090	.180	.070	.391**	.626**	.820**	1
	Sig. (2-tailed)	.524	.200	.623	.009	<.001	<.001	

N	52	52	52	44	52	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 54: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the CRATs, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.141[a]	.020	-.033	.26519

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.079	3	.026	.375	.772[b]
	Residual	3.868	55	.070		
	Total	3.947	58			

a. Dependent Variable: CRATMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.287	.140		2.047	.045
	SymmetrySpanScores	-.009	.013	-.309	-.693	.491
	PictureSpanScores	-.003	.015	-.102	-.175	.862
	CompositeScores	.012	.028	.375	.430	.669

a. Dependent Variable: CRATMeanSolutionRateScores

Appendix 55: Standard Multiple Regression, Predicting the Mean Solution Times for the CRATs, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.089[a]	.008	-.061	3.95861

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.339	3	1.780	.114	.952[b]
	Residual	673.837	43	15.671		
	Total	679.175	46			

a. Dependent Variable: CRATMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.761	2.466		2.336	.024
	SymmetrySpanScores	.048	.199	.105	.243	.809
	PictureSpanScores	-.022	.228	-.060	-.096	.924
	CompositeScores	-.023	.420	-.049	-.055	.956

a. Dependent Variable: CRATMeanSolutionTimes

Appendix 56: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.190[a]	.036	-.016	.27620

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.157	3	.052	.687	.564[b]
	Residual	4.196	55	.076		
	Total	4.353	58			

a. Dependent Variable: RebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.490	.146		3.352	.001
	SymmetrySpanScores	-.006	.014	-.192	-.435	.665
	PictureSpanScores	.004	.015	.148	.256	.799
	CompositeScores	-.002	.029	-.067	-.078	.938

a. Dependent Variable: RebusPuzzleMeanSolutionRateScores

Appendix 57: Standard Multiple Regression, Predicting the Mean Solution Times for the Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.285[a]	.081	.024	3.06351

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.885	3	13.295	1.417	.249[b]
	Residual	450.486	48	9.385		
	Total	490.370	51			

a. Dependent Variable: RebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.240	1.769		2.963	.005
	SymmetrySpanScores	-.037	.155	-.101	-.236	.814
	PictureSpanScores	.156	.176	.525	.886	.380
	CompositeScores	-.123	.325	-.323	-.377	.708

a. Dependent Variable: RebusPuzzleMeanSolutionTimes

Appendix 58: Correlational Analysis Between the Mean Solution Rate Scores and Mean Solution Time Scores for the Easy CRATs and Rebus Puzzles and Symmetry Span, Picture Span and Composite Scores

Correlations

		SymmetrySpanScores	PictureSpanScores	CompositeScores	EasyCRATMeanSolutionRateScores	EasyCRATMeanSolutionTimes	EasyRebusPuzzleMeanSolutionRateScores	EasyRebusPuzzleMeanSolutionTimes
SymmetrySpanScores	Pearson Correlation	1	.540**	.826**	-.079	.010	-.246	-.101
	Sig. (2-tailed)		<.001	<.001	.552	.952	.061	.477
	N	59	59	59	59	42	59	52
PictureSpanScores	Pearson Correlation	.540**	1	.903**	-.012	-.205	-.089	.127
	Sig. (2-tailed)	<.001		<.001	.927	.193	.500	.370
	N	59	59	59	59	42	59	52
CompositeScores	Pearson Correlation	.826**	.903**	1	-.046	-.151	-.165	.051
	Sig. (2-tailed)	<.001	<.001		.731	.338	.213	.718
	N	59	59	59	59	42	59	52
EasyCRATMeanSolutionRateScores	Pearson Correlation	-.079	-.012	-.046	1	.757**	.581**	.500**
	Sig. (2-tailed)	.552	.927	.731		<.001	<.001	<.001
	N	59	59	59	59	42	59	52
EasyCRATMeanSolutionTimes	Pearson Correlation	.010	-.205	-.151	.757**	1	.008	.235
	Sig. (2-tailed)	.952	.193	.338	<.001		.959	.139
	N	42	42	42	42	42	42	41
EasyRebusPuzzleMeanSolutionRateScores	Pearson Correlation	-.246	-.089	-.165	.581**	.008	1	.708**
	Sig. (2-tailed)	.061	.500	.213	<.001	.959		<.001
	N	59	59	59	59	42	59	52
EasyRebusPuzzleMeanSolutionTimes	Pearson Correlation	-.101	.127	.051	.500**	.235	.708**	1
	Sig. (2-tailed)	.477	.370	.718	<.001	.139	<.001	

N	52	52	52	52	41	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 59: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Easy CRATs, Using the Symmetry Span Scores, Picture Span Scores and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.087[a]	.008	-.047	.34642

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.050	3	.017	.139	.936[b]
	Residual	6.600	55	.120		
	Total	6.650	58			

a. Dependent Variable: EasyCRATMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.448	.183		2.443	.018
	SymmetrySpanScores	-.004	.017	-.100	-.222	.825
	PictureSpanScores	.002	.019	.046	.079	.938
	CompositeScores	.000	.036	-.005	-.006	.995

a. Dependent Variable: EasyCRATMeanSolutionRateScores

Appendix 60: Standard Multiple Regression, Predicting the Mean Solution Times for the Easy CRATs, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.259[a]	.067	-.006	4.731

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61.304	3	20.435	.913	.444[b]
	Residual	850.417	38	22.379		
	Total	911.721	41			

a. Dependent Variable: EasyCRATMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.727	3.057		3.182	.003
	SymmetrySpanScores	.213	.240	.390	.886	.381
	PictureSpanScores	.039	.276	.088	.140	.889
	CompositeScores	-.308	.508	-.538	-.606	.548

a. Dependent Variable: EasyCRATMeanSolutionTimes

Appendix 61: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Easy Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.260[a]	.068	.017	.34410

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.473	3	.158	1.332	.273[b]
	Residual	6.512	55	.118		
	Total	6.985	58			

a. Dependent Variable: EasyRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.718	.182		3.938	<.001
	SymmetrySpanScores	-.020	.017	-.493	-1.134	.262
	PictureSpanScores	-.008	.019	-.229	-.401	.690
	CompositeScores	.019	.036	.449	.528	.600

a. Dependent Variable: EasyRebusPuzzleMeanSolutionRateScores

Appendix 62: Standard Multiple Regression, Predicting the Mean Solution Times for the Easy Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.247[a]	.061	.002	3.82458

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.461	3	15.154	1.036	.385[b]
	Residual	702.114	48	14.627		
	Total	747.576	51			

a. Dependent Variable: EasyRebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.874	2.208		2.660	.011
	SymmetrySpanScores	-.208	.194	-.465	-1.075	.288
	PictureSpanScores	-.036	.220	-.099	-.164	.870
	CompositeScores	.242	.406	.516	.595	.555

a. Dependent Variable: EasyRebusPuzzleMeanSolutionTimes

Appendix 63: Correlational Analysis Between the Mean Solution Rate Scores and Mean Solution Times for the Difficult CRATs and Rebus Puzzles and Symmetry Span, Picture Span and Composite Scores

Correlations

		SymmetrySpanScores	PictureSpanScores	CompositeScores	DifficultCRATMeanSolutionRateScores	DifficultCRATMeanSolutionTimes	DifficultRebusPuzzleMeanSolutionRateScores	DifficultRebusPuzzleMeanSolutionTimes
SymmetrySpanScores	Pearson Correlation	1	.540**	.826**	-.006	.195	-.032	-.156
	Sig. (2-tailed)		<.001	<.001	.963	.227	.811	.318
	N	59	59	59	59	40	59	43
PictureSpanScores	Pearson Correlation	.540**	1	.903**	.183	.155	.093	.140
	Sig. (2-tailed)	<.001		<.001	.165	.341	.482	.371
	N	59	59	59	59	40	59	43
CompositeScores	Pearson Correlation	.826**	.903**	1	.136	.212	.027	-.027
	Sig. (2-tailed)	<.001	<.001		.304	.188	.840	.862
	N	59	59	59	59	40	59	43
DifficultCRATMeanSolutionRateScores	Pearson Correlation	-.006	.183	.136	1	.813**	.469**	.396**
	Sig. (2-tailed)	.963	.165	.304		<.001	<.001	.009
	N	59	59	59	59	40	59	43
DifficultCRATMeanSolutionTimes	Pearson Correlation	.195	.155	.212	.813**	1	.038	.169
	Sig. (2-tailed)	.227	.341	.188	<.001		.815	.347
	N	40	40	40	40	40	40	33
DifficultRebusPuzzleMeanSolutionRateScores	Pearson Correlation	-.032	.093	.027	.469**	.038	1	.802**
	Sig. (2-tailed)	.811	.482	.840	<.001	.815		<.001
	N	59	59	59	59	40	59	43
DifficultRebusPuzzleMeanSolutionTimes	Pearson Correlation	-.156	.140	-.027	.396**	.169	.802**	1
	Sig. (2-tailed)	.318	.371	.862	.009	.347	<.001	
	N	43	43	43	43	33	43	43

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 64: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Difficult CRATs, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.261[a]	.068	.017	.21942

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.193	3	.064	1.335	.272[b]
	Residual	2.648	55	.048		
	Total	2.841	58			

a. Dependent Variable: DifficultCRATMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.125	.116		1.079	.285
	SymmetrySpanScores	-.015	.011	-.576	-1.326	.190
	PictureSpanScores	-.007	.012	-.316	-.554	.582
	CompositeScores	.024	.023	.897	1.055	.296

a. Dependent Variable: DifficultCRATMeanSolutionRateScores

Appendix 65: Standard Multiple Regression, Predicting the Mean Solution Times for the Difficult CRATs, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.242[a]	.058	-.020	3.57382

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.544	3	9.515	.745	.532[b]
	Residual	459.799	36	12.772		
	Total	488.344	39			

a. Dependent Variable: DifficultCRATMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.146	2.382		.901	.374
	SymmetrySpanScores	-.060	.181	-.138	-.330	.743
	PictureSpanScores	-.137	.210	-.433	-.651	.519
	CompositeScores	.304	.384	.718	.793	.433

a. Dependent Variable: DifficultCRATMeanSolutionTimes

Appendix 66: Results of the Standard Multiple Regression Analysis of the Mean Solution Times for the Difficult Rebus Puzzles

	t	p	β	F	df	p	adj. R^2
Overall Model				2.96	3, 39	.04	.12
Symmetry Span Score	1.19	.24	.47				
Picture Span Score	2.56	.01	1.51				

Appendix 67: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Difficult Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.180[a]	.032	-.020	.24649

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.112	3	.037	.613	.610[b]
	Residual	3.342	55	.061		
	Total	3.453	58			

a. Dependent Variable: DifficultRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.266	.131		2.041	.046
	SymmetrySpanScores	.007	.012	.255	.576	.567
	PictureSpanScores	.016	.014	.657	1.131	.263
	CompositeScores	-.023	.026	-.777	-.896	.374

a. Dependent Variable: DifficultRebusPuzzleMeanSolutionRateScores

Appendix 68: Correlation Matrix for the Mean Solution Rate and Solution Time Scores for the Visual Rebus Puzzles and the Symmetry Span, Picture Span and Composite Scores

Variable	n	1	2	3	4	5
1. Mean Solution Rate Scores	59	-				
2. Mean Solution Times	46	.74**	-			
3. Symmetry Span Score	59	-.10	.15	-		
4. Operation Span Score	59	.12	.30	.54**	-	
5. Composite Score	59	.03	.25	.83**	.90**	-

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Appendix 69: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Visual Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.221[a]	.049	-.003	.25135

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.179	3	.060	.944	.426[b]
	Residual	3.475	55	.063		
	Total	3.654	58			

a. Dependent Variable: VisualRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.316	.133		2.373	.021
	SymmetrySpanScores	-.004	.013	-.139	-.317	.752
	PictureSpanScores	.008	.014	.347	.603	.549
	CompositeScores	-.005	.026	-.173	-.201	.841

a. Dependent Variable: VisualRebusPuzzleMeanSolutionRateScores

Appendix 70: Standard Multiple Regression, Predicting the Mean Solution Times for the Visual Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.308[a]	.095	.030	2.89954

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.008	3	12.336	1.467	.237[b]
	Residual	353.109	42	8.407		
	Total	390.117	45			

a. Dependent Variable: VisualRebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.586	1.703		1.519	.136
	SymmetrySpanScores	.063	.147	.190	.427	.671
	PictureSpanScores	.168	.168	.623	1.000	.323
	CompositeScores	-.161	.309	-.471	-.523	.604

a. Dependent Variable: VisualRebusPuzzleMeanSolutionTimes

Appendix 71: Correlation Matrix for the Mean Solution Rate and Solution Time Scores for the Word Rebus Puzzles and the Symmetry Span, Picture Span and Composite Scores

Variable	n	1	2	3	4	5
1. Mean Solution Rate Scores	59	-				
2. Mean Solution Times	47	.79**	-			
3. Symmetry Span Score	59	-.21	-.34*	-		
4. Operation Span Score	59	-.11	-.02	.54**	-	
5. Composite Score	59	-.17	-.18	.83**	.90**	-

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Appendix 72: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Word Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.208[a]	.043	-.009	.33637

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.281	3	.094	.828	.484[b]
	Residual	6.223	55	.113		
	Total	6.504	58			

a. Dependent Variable: WordRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.670	.178		3.760	<.001
	SymmetrySpanScores	-.008	.017	-.220	-.500	.619
	PictureSpanScores	.000	.019	-.014	-.024	.981
	CompositeScores	.001	.035	.024	.028	.978

a. Dependent Variable: WordRebusPuzzleMeanSolutionRateScores

Appendix 73: Standard Multiple Regression, Predicting the Mean Solution Times for the Word Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.402[a]	.162	.103	3.29884

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90.217	3	30.072	2.763	.053[b]
	Residual	467.940	43	10.882		
	Total	558.157	46			

a. Dependent Variable: WordRebusMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.919	2.060		5.300	<.001
	SymmetrySpanScores	-.070	.167	-.167	-.419	.677
	PictureSpanScores	.220	.194	.669	1.133	.263
	CompositeScores	-.281	.355	-.656	-.790	.434

a. Dependent Variable: WordRebusMeanSolutionTimes

Appendix 74: Correlational Analysis Between the Mean Solution Rate Scores and Mean Solution Times for the Easy and Difficult Visual Rebus Puzzles and Symmetry Span, Picture Span and Composite Scores

Correlations

		SymmetrySpanScores	PictureSpanScores	CompositeScores	EasyVisualRebusPuzzleMeanSolutionRateScores	DifficultVisualRebusPuzzleMeanSolutionRateScores	EasyVisualRebusPuzzleMeanSolutionTimes	DifficultVisualRebusPuzzleMeanSolutionTimes
SymmetrySpanScores	Pearson Correlation	1	.540**	.826**	-.182	.050	.114	.144
	Sig. (2-tailed)		<.001	<.001	.168	.705	.455	.502
	N	59	59	59	59	59	45	24
PictureSpanScores	Pearson Correlation	.540**	1	.903**	.007	.216	.198	.246
	Sig. (2-tailed)	<.001		<.001	.956	.100	.191	.246
	N	59	59	59	59	59	45	24
CompositeScores	Pearson Correlation	.826**	.903**	1	-.076	.147	.187	.230
	Sig. (2-tailed)	<.001	<.001		.570	.267	.218	.280
	N	59	59	59	59	59	45	24
EasyVisualRebusPuzzleMeanSolutionRateScores	Pearson Correlation	-.182	.007	-.076	1	.442**	.531**	.066
	Sig. (2-tailed)	.168	.956	.570		<.001	<.001	.758
	N	59	59	59	59	59	45	24
DifficultVisualRebusPuzzleMeanSolutionRateScores	Pearson Correlation	.050	.216	.147	.442**	1	-.002	.672**
	Sig. (2-tailed)	.705	.100	.267	<.001		.988	<.001
	N	59	59	59	59	59	45	24
EasyVisualRebusPuzzleMeanSolutionTimes	Pearson Correlation	.114	.198	.187	.531**	-.002	1	.402
	Sig. (2-tailed)	.455	.191	.218	<.001	.988		.057
	N	45	45	45	45	45	45	23
DifficultVisualRebusPuz	Pearson Correlation	.144	.246	.230	.066	.672**	.402	1

zleMeanSolutionTimes	Sig. (2-tailed)	.502	.246	.280	.758	<.001	.057	
	N	24	24	24	24	24	23	24

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 75: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Easy Visual Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.225[a]	.051	-.001	.32955

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.319	3	.106	.980	.409[b]
	Residual	5.973	55	.109		
	Total	6.292	58			

a. Dependent Variable: EasyVisualRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.565	.175		3.238	.002
	SymmetrySpanScores	-.015	.017	-.399	-.910	.367
	PictureSpanScores	-.001	.018	-.036	-.062	.950
	CompositeScores	.011	.034	.286	.334	.740

a. Dependent Variable: EasyVisualRebusPuzzleMeanSolutionRateScores

Appendix 76: Standard Multiple Regression, Predicting the Mean Solution Times for the Easy Visual Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.200[a]	.040	-.030	3.35056

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.156	3	6.385	.569	.639[b]
	Residual	460.277	41	11.226		
	Total	479.433	44			

a. Dependent Variable: EasyVisualRebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.176	1.972		2.118	.040
	SymmetrySpanScores	-.020	.170	-.053	-.116	.908
	PictureSpanScores	.031	.194	.102	.157	.876
	CompositeScores	.053	.357	.138	.148	.883

a. Dependent Variable: EasyVisualRebusPuzzleMeanSolutionTimes

Appendix 77: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Difficult Visual Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.254[a]	.065	.014	.25692

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.251	3	.084	1.267	.295[b]
	Residual	3.630	55	.066		
	Total	3.881	58			

a. Dependent Variable: DifficultVisualRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.060	.136		.440	.662
	SymmetrySpanScores	.007	.013	.245	.563	.576
	PictureSpanScores	.018	.014	.723	1.267	.210
	CompositeScores	-.022	.027	-.708	-.832	.409

a. Dependent Variable: DifficultVisualRebusPuzzleMeanSolutionRateScores

Appendix 78: Standard Multiple Regression, Predicting the Mean Solution Times for the Difficult Visual Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.317[a]	.101	-.034	3.64422

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.769	3	9.923	.747	.537[b]
	Residual	265.607	20	13.280		
	Total	295.376	23			

a. Dependent Variable: DifficultVisualRebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.452	3.301		1.349	.192
	SymmetrySpanScores	-3.590	3.814	-8.048	-.941	.358
	PictureSpanScores	-3.491	3.794	-9.881	-.920	.368
	CompositeScores	7.153	7.587	16.065	.943	.357

a. Dependent Variable: DifficultVisualRebusPuzzleMeanSolutionTimes

Appendix 79: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Easy Word Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.275[a]	.076	.025	.41371

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.773	3	.258	1.505	.223[b]
	Residual	9.414	55	.171		
	Total	10.186	58			

a. Dependent Variable: EasyWordRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.866	.219		3.954	<.001
	SymmetrySpanScores	-.024	.021	-.498	-1.150	.255
	PictureSpanScores	-.014	.023	-.347	-.611	.543
	CompositeScores	.026	.043	.510	.602	.549

a. Dependent Variable: EasyWordRebusPuzzleMeanSolutionRateScores

Appendix 80: Standard Multiple Regression, Predicting the Mean Solution Times for the Easy Word Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.261[a]	.068	-.004	4.70669

a. Predictors: (Constant), CompositeScore, SymmetrySpanScore, PictureSpanScore

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63.105	3	21.035	.950	.426[b]
	Residual	863.963	39	22.153		
	Total	927.068	42			

a. Dependent Variable: EasyWordRebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	9.257	3.002		3.083	.004
	SymmetrySpanScores	-.269	.239	-.483	-1.127	.267
	PictureSpanScores	-.047	.278	-.108	-.170	.866
	CompositeScores	.269	.508	.471	.530	.599

a. Dependent Variable: EasyWordRebusPuzzleMeanSolutionTimes

Appendix 81: Results of the Standard Multiple Regression Analyses Mean Solution Times for the Difficult Word Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

	t	p	β	F	df
Overall Model				3.59	3, 38
Symmetry Span Score	1.23	.23	.48		
Picture Span Score	2.47	.02	1.43		
Composite Score	-2.38	.02	-1.92		

The dependent variable for this regression was the mean solution times for the difficult word Rebus Puzzles

Appendix 82: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Difficult Word Rebus Puzzles, Using the Symmetry Span, Picture Span and Composite Scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.142[a]	.020	-.033	.31016

a. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.110	3	.037	.380	.768[b]
	Residual	5.291	55	.096		
	Total	5.400	58			

a. Dependent Variable: DifficultWordRebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), CompositeScores, SymmetrySpanScores, PictureSpanScores

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.473	.164		2.881	.006
	SymmetrySpanScores	.007	.016	.207	.465	.644
	PictureSpanScores	.014	.017	.454	.778	.440
	CompositeScores	-.025	.032	-.666	-.763	.449

a. Dependent Variable: DifficultWordRebusPuzzleMeanSolutionRateScores

Appendix 83: Median Values for the Mean Background Sound Effect Ratings in the Quiet, Meaningless Speech and Meaningful Speech Conditions

Statistics

		MeanQuietBackgroundSoundEffectRatings	MeanMeaninglessSpeechBackgroundSoundEffectRatings	MeanMeaningfulSpeechBackgroundSoundEffectRatings
N	Valid	59	59	59
	Missing	0	0	0
Median		4.3333	6.7500	7.2500

Appendix 84: A Two-Way 2 (Task Type: CRATS & Rebus Puzzles) x 4 (Score: Solution Rate, Solution Time, Solution Strategy & Solution Confidence) Mixed ANOVA with Repeated Measures of Distractibility in the Quiet Condition

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	467.867	1	467.867	1.931	.172	.045
	Greenhouse-Geisser	467.867	1.000	467.867	1.931	.172	.045
	Huynh-Feldt	467.867	1.000	467.867	1.931	.172	.045
	Lower-bound	467.867	1.000	467.867	1.931	.172	.045
TaskType * QuietDistractibility	Sphericity Assumed	.014	1	.014	.000	.994	.000
	Greenhouse-Geisser	.014	1.000	.014	.000	.994	.000
	Huynh-Feldt	.014	1.000	.014	.000	.994	.000
	Lower-bound	.014	1.000	.014	.000	.994	.000
Error (TaskType)	Sphericity Assumed	9933.097	41	242.271			
	Greenhouse-Geisser	9933.097	41.000	242.271			
	Huynh-Feldt	9933.097	41.000	242.271			
	Lower-bound	9933.097	41.000	242.271			
Score	Sphericity Assumed	64239.128	3	21413.043	106.208	<.001	.721
	Greenhouse-Geisser	64239.128	1.789	35907.772	106.208	<.001	.721
	Huynh-Feldt	64239.128	1.911	33617.725	106.208	<.001	.721
	Lower-bound	64239.128	1.000	64239.128	106.208	<.001	.721
Score * QuietDistractibility	Sphericity Assumed	227.815	3	75.938	.377	.770	.009
	Greenhouse-Geisser	227.815	1.789	127.342	.377	.664	.009
	Huynh-Feldt	227.815	1.911	119.220	.377	.678	.009
	Lower-bound	227.815	1.000	227.815	.377	.543	.009

Error (Score)	Sphericity Assumed	24798.517	123	201.614			
	Greenhouse-Geisser	24798.517	73.349	338.089			
	Huynh-Feldt	24798.517	78.346	316.527			
	Lower-bound	24798.517	41.000	604.842			
TaskType * Score	Sphericity Assumed	1808.290	3	602.763	6.894	<.001	.144
	Greenhouse-Geisser	1808.290	1.648	1097.006	6.894	.003	.144
	Huynh-Feldt	1808.290	1.750	1033.079	6.894	.003	.144
	Lower-bound	1808.290	1.000	1808.290	6.894	.012	.144
TaskType * Score * QuietDistractibility	Sphericity Assumed	98.408	3	32.803	.375	.771	.009
	Greenhouse-Geisser	98.408	1.648	59.700	.375	.648	.009
	Huynh-Feldt	98.408	1.750	56.221	.375	.660	.009
	Lower-bound	98.408	1.000	98.408	.375	.544	.009
Error (TaskType * Score)	Sphericity Assumed	10753.581	123	87.427			
	Greenhouse-Geisser	10753.581	67.584	159.115			
	Huynh-Feldt	10753.581	71.766	149.842			
	Lower-bound	10753.581	41.000	262.282			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	78338.023	1	78338.023	182.316	<.001	.816
QuietDistractibility	19.853	1	19.853	.046	.831	.001
Error	17616.941	41	429.681			

Appendix 85: Correlational Analysis Between the Mean Solution Rate Scores and the Mean Solution Time Scores for the CRATs and Rebus Puzzles and Distractibility in the Quiet Condition

Correlations

		QuietDistractibility	CRATMeanSolutionRateScores	CRATMeanSolutionTimes	RebusPuzzleMeanSolutionRateScores	RebusPuzzleMeanSolutionTime
QuietDistractibility	Pearson Correlation	1	-.026	-.126	.008	-.054
	Sig. (2-tailed)		.846	.400	.951	.703
	N	59	59	47	59	52
CRATMeanSolutionRateScores	Pearson Correlation	-.026	1	.833**	.601**	.626**
	Sig. (2-tailed)	.846		<.001	<.001	<.001
	N	59	59	47	59	52
CRATMeanSolutionTimes	Pearson Correlation	-.126	.833**	1	.199	.391**
	Sig. (2-tailed)	.400	<.001		.180	.009
	N	47	47	47	47	44
RebusPuzzleMeanSolutionRateScores	Pearson Correlation	.008	.601**	.199	1	.820**
	Sig. (2-tailed)	.951	<.001	.180		<.001
	N	59	59	47	59	52
RebusPuzzleMeanSolutionTimes	Pearson Correlation	-.054	.626**	.391**	.820**	1
	Sig. (2-tailed)	.703	<.001	.009	<.001	
	N	52	52	44	52	52

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 86: Standard Multiple Regression, Predicting Mean Solution Rate Scores for CRATs, Using Distractibility in the Quiet Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.026[a]	.001	-.017	.26305

a. Predictors: (Constant), QuietDistractibility

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.003	1	.003	.038	.846[b]
	Residual	3.944	57	.069		
	Total	3.947	58			

a. Dependent Variable: CRATMeanSolutionRateScores

b. Predictors: (Constant), QuietDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.322	.107		3.016	.004
	QuietDistractibility	-.013	.069	-.026	-.195	.846

a. Dependent Variable: CRATMeanSolutionRateScores

Appendix 87: Standard Multiple Regression, Predicting Mean Solution Times for CRATs, Using Distractibility in the Quiet Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.126[a]	.016	-.006	3.85418

a. Predictors: (Constant), QuietDistractibility

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.712	1	10.712	.721	.400[b]
	Residual	668.463	45	14.855		
	Total	679.175	46			

a. Dependent Variable: CRATMeanSolutionTimes

b. Predictors: (Constant), QuietDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.159	1.767		4.052	<.001
	QuietDistractibility	-.955	1.125	-.126	-.849	.400

a. Dependent Variable: CRATMeanSolutionTimes

Appendix 88: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Rebus Puzzles, Using Distractibility in the Quiet Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.008[a]	.000	-.017	.27634

a. Predictors: (Constant), QuietDistractibility

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.000	1	.000	.004	.951[b]
	Residual	4.353	57	.076		
	Total	4.353	58			

a. Dependent Variable: RebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), QuietDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.364	.112		3.245	.002
	QuietDistractibility	.004	.072	.008	.062	.951

a. Dependent Variable: RebusPuzzleMeanSolutionRateScores

Appendix 89: Standard Multiple Regression, Predicting the Mean Solution Times for Rebus Puzzles, Using Distractibility in the Quiet Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.054[a]	.003	-.017	3.12708

a. Predictors: (Constant), QuietDistractibility

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.438	1	1.438	.147	.703[b]
	Residual	488.932	50	9.779		
	Total	490.370	51			

a. Dependent Variable: RebusPuzzleMeanSolutionTimes

b. Predictors: (Constant), QuietDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.922	1.388		4.266	<.001
	QuietDistractibility	-.333	.868	-.054	-.384	.703

a. Dependent Variable: RebusPuzzleMeanSolutionTimes

Appendix 90: A Two-Way 2 (Task Type: CRATS & Rebus Puzzles) x 4 (Score: Solution Rate, Solution Time, Solution Strategy & Solution Confidence) Mixed ANOVA with Repeated Measures of Distractibility in the Meaningful Speech Condition

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	490.367	1	490.367	2.037	.161	.047
	Greenhouse-Geisser	490.367	1.000	490.367	2.037	.161	.047
	Huynh-Feldt	490.367	1.000	490.367	2.037	.161	.047
	Lower-bound	490.367	1.000	490.367	2.037	.161	.047
TaskType * MeaningfulSpeechDistractibility	Sphericity Assumed	64.004	1	64.004	.266	.609	.006
	Greenhouse-Geisser	64.004	1.000	64.004	.266	.609	.006
	Huynh-Feldt	64.004	1.000	64.004	.266	.609	.006
	Lower-bound	64.004	1.000	64.004	.266	.609	.006
Error (TaskType)	Sphericity Assumed	9869.107	41	240.710			
	Greenhouse-Geisser	9869.107	41.000	240.710			
	Huynh-Feldt	9869.107	41.000	240.710			
	Lower-bound	9869.107	41.000	240.710			
Score	Sphericity Assumed	63189.958	3	21063.319	106.619	<.001	.722
	Greenhouse-Geisser	63189.958	1.811	34886.654	106.619	<.001	.722
	Huynh-Feldt	63189.958	1.936	32632.443	106.619	<.001	.722
	Lower-bound	63189.958	1.000	63189.958	106.619	<.001	.722
Score * MeaningfulSpeechDistractibility	Sphericity Assumed	726.860	3	242.287	1.226	.303	.029
	Greenhouse-Geisser	726.860	1.811	401.293	1.226	.296	.029
	Huynh-Feldt	726.860	1.936	375.364	1.226	.298	.029
	Lower-bound	726.860	1.000	726.860	1.226	.275	.029

Error (Score)	Sphericity Assumed	24299.472	123	197.557			
	Greenhouse-Geisser	24299.472	74.263	327.208			
	Huynh-Feldt	24299.472	79.393	306.066			
	Lower-bound	24299.472	41.000	592.670			
TaskType * Score	Sphericity Assumed	1861.818	3	620.606	7.072	<.001	.147
	Greenhouse-Geisser	1861.818	1.660	1121.433	7.072	.003	.147
	Huynh-Feldt	1861.818	1.764	1055.547	7.072	.002	.147
	Lower-bound	1861.818	1.000	1861.818	7.072	.011	.147
TaskType * Score * MeaningfulSpeechDistractibility	Sphericity Assumed	58.565	3	19.522	.222	.881	.005
	Greenhouse-Geisser	58.565	1.660	35.275	.222	.760	.005
	Huynh-Feldt	58.565	1.764	33.203	.222	.773	.005
	Lower-bound	58.565	1.000	58.565	.222	.640	.005
Error (TaskType * Score)	Sphericity Assumed	10793.424	123	87.751			
	Greenhouse-Geisser	10793.424	68.069	158.567			
	Huynh-Feldt	10793.424	72.318	149.250			
	Lower-bound	10793.424	41.000	263.254			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	77199.505	1	77199.505	184.551	<.001	.818
MeaningfulSpeechDistractibility	486.114	1	486.114	1.162	.287	.028

Error	17150.679	41	418.309			

Appendix 91: Correlation Matrix for Distractibility in the Meaningful Speech Condition and the Mean Solution Rate and Mean Solution Time Scores for the CRATs and Rebus Puzzles.

Variable	n	1	2	3	4	5
1. Mean Solution Rate Scores (CRATs)	59	-				
2. Mean Solution Times (CRATs)	52	.86**	-			
3. Mean Solution Rate Scores (Rebus Puzzles)	59	.60**	.32*	-		
4. Mean Solution Times (Rebus Puzzles)	52	.63**	.46**	.82**	-	
5. Distractibility	59	.27*	.25	.22	.09	-

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Appendix 92: Standard Multiple Regression, Predicting the Mean Solution Rate Scores for the Rebus Puzzles, Using Distractibility in the Meaningful Speech Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.218[a]	.048	.031	4.31937

a. Predictors: (Constant), MeaningfulSpeechDistractibility

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	53.131	1	53.131	2.848	.097[b]
	Residual	1063.445	57	18.657		
	Total	1116.576	58			

a. Dependent Variable: RebusPuzzleMeanSolutionRateScores

b. Predictors: (Constant), MeaningfulSpeechDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.935	1.854		1.583	.119
	Distractibility	1.911	1.133	.218	1.688	.097

a. Dependent Variable: RebusPuzzleMeanSolutionRateScores

Appendix 93: Standard Multiple Regression, Predicting the Mean Solution Times for the Rebus Puzzles, Using Distractibility in the Meaningful Speech Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.137[a]	.019	-.001	3.10215

a. Predictors: (Constant), MeaningfulSpeechDistractibility

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.205	1	9.205	.957	.333[b]
	Residual	481.166	50	9.623		
	Total	490.370	51			

a. Dependent Variable: RebusPuzzleMeanSolutionTimess

b. Predictors: (Constant), MeaningfulSpeechDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.169	1.346		3.098	.003
	Distractibility	.842	.861	.137	.978	.333

a. Dependent Variable: RebusPuzzleMeanSolutionTimes

Appendix 94: Results from the Standard Multiple Regression Analyses of the Mean Solution Rates for the CRATs, Using Distractibility in the Meaningful Speech Condition

	t	**p**	**β**	**F**	**df**	**p**	**adj. R^2**
Overall Model				8.21	1, 57	.01	.11
Distractibility	2.87	.01	.36				

The dependent variable for this regression was the mean solution rate scores for the CRATs

Appendix 95: Standard Multiple Regression, Predicting the Mean Solution Times for the CRATs, Using Distractibility in the Meaningful Speech Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.254[a]	.065	.046	62.96491

a. Predictors: (Constant), MeaningfulSpeechDistractibility

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	13712.456	1	13712.456	3.459	.069[b]
	Residual	198229.004	50	3964.580		
	Total	211941.460	51			

a. Dependent Variable: CRATMeanSolutionTimes

b. Predictors: (Constant), MeaningfulSpeechDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	32.033	28.744		1.114	.270
	Distractibility	32.696	17.581	.254	1.860	.069

a. Dependent Variable: CRATMeanSolutionTimes

Appendix 96: A Two-Way 2 (Task Type: CRATS & Rebus Puzzles) x 4 (Score: Solution Rate, Solution Time, Solution Strategy & Confidence) Mixed ANOVA with Repeated Measures of Distractibility in the Meaningless Speech Condition

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TaskType	Sphericity Assumed	537.187	1	537.187	2.246	.142	.052
	Greenhouse-Geisser	537.187	1.000	537.187	2.246	.142	.052
	Huynh-Feldt	537.187	1.000	537.187	2.246	.142	.052
	Lower-bound	537.187	1.000	537.187	2.246	.142	.052
TaskType * MeaninglessSpeechDistractibility	Sphericity Assumed	125.975	1	125.975	.527	.472	.013
	Greenhouse-Geisser	125.975	1.000	125.975	.527	.472	.013
	Huynh-Feldt	125.975	1.000	125.975	.527	.472	.013
	Lower-bound	125.975	1.000	125.975	.527	.472	.013
Error (TaskType)	Sphericity Assumed	9807.135	41	239.198			
	Greenhouse-Geisser	9807.135	41.000	239.198			
	Huynh-Feldt	9807.135	41.000	239.198			
	Lower-bound	9807.135	41.000	239.198			
Score	Sphericity Assumed	60370.127	3	20123.376	102.339	<.001	.714
	Greenhouse-Geisser	60370.127	1.815	33268.841	102.339	<.001	.714
	Huynh-Feldt	60370.127	1.940	31115.027	102.339	<.001	.714
	Lower-bound	60370.127	1.000	60370.127	102.339	<.001	.714
Score * MeaninglessSpeechDistractibility	Sphericity Assumed	840.249	3	280.083	1.424	.239	.034
	Greenhouse-Geisser	840.249	1.815	463.046	1.424	.247	.034
	Huynh-Feldt	840.249	1.940	433.068	1.424	.247	.034
	Lower-bound	840.249	1.000	840.249	1.424	.240	.034

Error (Score)	Sphericity Assumed	24186.082	123	196.635			
	Greenhouse-Geisser	24186.082	74.399	325.085			
	Huynh-Feldt	24186.082	79.549	304.039			
	Lower-bound	24186.082	41.000	589.904			
TaskType * Score	Sphericity Assumed	1948.161	3	649.387	7.469	<.001	.154
	Greenhouse-Geisser	1948.161	1.664	1170.981	7.469	.002	.154
	Huynh-Feldt	1948.161	1.768	1102.020	7.469	.002	.154
	Lower-bound	1948.161	1.000	1948.161	7.469	.009	.154
TaskType * Score * MeaninglessSpeechDistractibility	Sphericity Assumed	157.433	3	52.478	.604	.614	.015
	Greenhouse-Geisser	157.433	1.664	94.628	.604	.520	.015
	Huynh-Feldt	157.433	1.768	89.055	.604	.530	.015
	Lower-bound	157.433	1.000	157.433	.604	.442	.015
Error (TaskType * Score)	Sphericity Assumed	10694.556	123	86.948			
	Greenhouse-Geisser	10694.556	68.212	156.785			
	Huynh-Feldt	10694.556	72.480	147.551			
	Lower-bound	10694.556	41.000	260.843			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	73613.062	1	73613.062	180.861	<.001	.815
MeaninglessSpeechDistractibility	949.209	1	949.209	2.332	.134	.054

Error	16687.585	41	407.014			

Appendix 97: Correlation Matrix for Distractibility in the Meaningless Speech Condition and the Mean Solution Rate and Mean Solution Time Scores for the CRATs and Rebus Puzzles

Variable	n	1	2	3	4	5
1. Mean Solution Rate Scores (CRATs)	59	-				
2. Mean Solution Times (CRATs)	52	.86**	-			
3. Mean Solution Rate Scores (Rebus Puzzles)	59	.60**	.32*	-		
4. Mean Solution Times (Rebus Puzzles)	52	.63**	.46**	.82**	-	
5. Distractibility	59	.33*	.28	.28*	.21	-

** Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Appendix 98: Results from the Standard Multiple Regression Analyses of the Mean Solution Rate Scores for the CRATs, Using Distractibility in the Meaningless Speech Condition

	t	**p**	**β**	**F**	**df**	**p**	**adj. R^2**
Overall Model				8.81	1, 57	.00	.12
Distractibility	2.97	.00	.37				

The dependent variable for this regression was the mean solution rate scores for the CRATs

Appendix 99: Standard Multiple Regression, Predicting the Mean Solution Times for the Rebus Puzzles, Using Distractibility in the Meaningless Speech Condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.268[a]	.072	.053	3.01691

a. Predictors: (Constant), MeaninglessSpeechDistractibility

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	35.282	1	35.282	3.876	.055[b]
	Residual	455.088	50	9.102		
	Total	490.370	51			

a. Dependent Variable: RebusPuzzleMeanTimes

b. Predictors: (Constant), MeaninglessSpeechDistractibility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.874	1.357		2.118	.039
	Distractibility	1.652	.839	.268	1.969	.055

a. Dependent Variable: RebusPuzzlesMeanTimes

Appendix 100: Results from the Standard Multiple Regression Analyses of the Mean Solution Times for the CRATs, Using Distractibility in the Meaningless Speech Condition

	t	**p**	**β**	**F**	**df**	**p**	**adj. R^2**
Overall Model				6.21	1, 45	.02	.10
Distractibility	2.49	.02	.37				

The dependent variable for this regression was the mean solution times for the CRATs

Appendix 101: Results from the Standard Multiple Regression Analyses of the Mean Solution Rates for the Rebus Puzzles, Using Distractibility in the Meaningless Speech Condition

	t	p	β	F	df	p	adj. R^2
Overall Model				4.95	1, 57	.03	.06
Distractibility	2.23	.03	.28				

The dependent variable for this regression was the mean solution rate scores for the Rebus Puzzles

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