**Detecting fabricated autobiographical memories: an examination of cognitive processes**

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Detecting memories is important….legal settings where memory is the only or primary evidence…despite myriad of research, and a recent turn towards cognitive lie detection, little known about cognitive processes underpinning deception. We present four studies which firstly aim to identify which types of cognitive load are more important / detrimental to lie detection and secondly offer a new approach to lie detection which, rather than using verbal and non-verbal cues from the rememberer as cues to deception, uses performance on a secondary task to distinguish truth from deception. However, here we only include studies that have assessed deceit that is memory-based, rather than that which assesses false opinions, beliefs or has investigated lying by omission. IFAMS = These ‘memories’ can be defined as those which are wholly or partially untrue, with the rememberer being aware of the falsehoods (as opposed to false memories which may contain untrue information, but which is believed to be true by the remember).

**Cognitive Load**

It has been proposed that lying is more cognitively demanding than telling the truth (Zuckerman, DePaulo & Rosenthal, 1981). This increased demand has been hypothesised to arise from the additional cognitive tasks required when lying as compared to telling the truth, and include generation of the deceitful narrative, increased self- and other-monitoring DePaulo et al., 2003), particularly regarding perception of the lie and behaviour and language control, as to give the impression of telling the truth (Vrij, Fisher, Mann & Leal, 2006). Because of the need to manage more cognitively demanding tasks when lying as compared to truth telling, liars will have fewer cognitive resources remaining to manage other tasks, such as maintaining a coherent and fluent narrative and managing behaviour, and therefore we would expect to see an amplification of verbal and non-verbal “tells” for liars as compared to truth tellers, leading, in turn, to easier detection of lies and liars (Vrij, Mann, Leal & Fisher, 2010).

This proposal has received some attention in the literature, with researchers employing a variety of techniques to increase cognitive load in experimental deception deception detection studies. Vrij, Mann, Fisher, Leal, Milne & Bull (2008) utilised reverse order event recall to increase cognitive load. Employing a 2x2 design, Vrij et al., (2008) asked participants to report a staged event, either truthfully or deceptively, and in reverse or original temporal order. Findings showed that reverse order recall yielded more cues to deception than recall in the original temporal order, for instance participants instructed to lie in reverse order mentioned fewer auditory details, more cognitive operations, had more speech hesitations, displayed fewer leg and feet movement, amongst other cues behavioural and linguistic cues, than participants instructed to tell the truth in reverse order.

Relatedly, Vrij, Mann, Leal & Fisher (2010) employed maintenance of eye gaze during event recall to increase cognitive load on truthful and deceptive interviewees. Rationale for this instruction was drawn from work by Doherty-Sneddon, Bruce, Bonner, Longbotham, & Doyle (2002); Doherty-Sneddon & Phelps (2005) and Glenberg, Schroeder, & Robertson (1998), who showed that gaze aversion is utilised during normal interactions to manage cognitive load, such that averting the gaze gives the individual opportunity to focus on the upcoming interaction. The authors found that their data partially supported their hypotheses, with liars in the gaze maintenance condition including fewer spatial details in their account and recalling their story with less reference to the original temporal order, as compared to truth tellers.

A further study which has assessed cognitive load and deception detection was reported by Justice, Morrison & Conway (2017). The authors investigated the proposal that the generation of intentionally fabricated autobiographical memories (IFAMs), i.e. those that are known by the rememberer to be untrue, is more cognitively demanding than the generation of memories believed to be true (autobiographical memories: AMs) and, specifically, that IFAM generation utilises more executive control processes more than AMs, and attribute this difference partly due to their 2012 findings, which showed that fabrication involves an additional ‘editing’ process as compared to truth telling. In their study, participants generated IFAMs and AMs to neutral cue words whilst completing a secondary concurrent memory load task (holding in mind an 8-digit sequence) that drew on central processing capacity. Findings showed that performance on the secondary task was attenuated more during IFAM generation than during AM generation. Results suggest that identifying differences between true and fabricated memories, at least in their generation phase, might best be achieved indirectly, by evaluating performance on a related concurrent task. This is novel since all previous research has evaluated the truthfulness of an account based on either the rememberers verbal or non-verbal cues.

However, whilst these studies have been partly successful in discerning both verbal and non-verbal differences between true and deceptive accounts whilst employing an additional cognitive load manipulation, they limited information has been gathered regarding the cognitive processes involved or recruited by their manipulations. This has been noted and discussed by Walczyk (2016), who proposes that future work should centre on understanding cognitive processes involved in generating both truthful and deceptive accounts, rather than manipulating and qualifying the findings.

The current paper, then, is an attempt to understand, in more detail which cognitive processes are most likely recruited and taxed during fabricated memory generation. Note that these studies differ from those conducted previously by Vrij et al. (2008; 2010) in that the cognitive load is introduced during the generation of the memory / fabrication rather than during the recall or verbalisation of the memory.

**Cognitive Load and Working Memory**

Study by Justice et al. (2017) utilised visual memory load. Perhaps this manipulation was successful in eliciting differences in performance because it taxes memory components i.e. two competing memory processed needed at once, and visual components. One defining aspect of autobiographical memory is its visual element (Conway, 2009 (Episodic Memory); Greenberg & Knowlton, 2014; Kosslyn ????).

**Experiment 1**

**Introduction**

Replication of Justice et al.’s (2017) study in which participants were presented with visual memory load

**Experiment 2: auditory cognitive load**

**Introduction**

Maybe memory but perhaps only visually presented. AB memories contain large amount of visual information, perhaps viewing and holding a number in mind that was presented visually is more detrimental to performance than a number which is presented aurally.

**Methods**

**Design**

2 (memory type: real, fabricated) x 2 (load: with, without) within subjects design. RT to memory recall was measured, and serial recall and non-serial recall accuracy were measured,

**Participants**

Thirty-five participants volunteered to participate ( xx (xx%) female). Aged between 18 to 58 years (M=\_\_\_\_, SD=\_\_\_\_\_). Participants either received a small payment or research credits.

**Materials and procedure**

The experiment was coded using Python 3.5.6. A cued recall procedure was used and figures 1, 2 and 3 show the presentation order. There were 32 neutral cue words (taken from Bradley and Lang, 1999), e.g. “hotel”, see appendix A. Cues were randomly assigned to each block, each with 8 trials. Presentation order was counterbalanced across participants and conditions; ensuring that all cues were used to generate both intentional fabricated autobiographical memories (IFAMs) and autobiographical memories (AMs), under both load and no load conditions. Participants were required to complete a 7-series digit span task (DST) (the secondary task) whilst recalling a AMs or IFAMs. Digit span’s were edited using Audacity 2.2.2.0 and had a 1000ms gap between digits, played at \_\_hz at (volume) using a headphone set.

Before each trial, depending on the condition, participants were presented with a screen displaying one of the following instructions: “TRUE MEMORY TRIAL” or “FABRICATED MEMORY TRIAL”. Cues would appear 1000ms after DST. Cues would appear on screen for 500ms. For each trial, participants were instructed to have the memory clearly pictured in their mind before proceeding, but to respond as quickly as possible. The only constraint was that the memory must be of one specific event, which last for minutes or hours, no longer than a day. Participants were instructed to ensure all fabricated events occurred in the past and to recall something that could have plausibly happened, but did not. For AMs they were instructed to bring to mind a memory that is associated with the cue that directly happened to them.

To proceed, participants were required to press the space bar. During DST block, digit recall screen appear directly after this. Participants were instructed to be as accurate as possible when entering the numbers and to remember the correct sequence that they had been originally presented. Participants were instructed to write approximately two to four sentences for each memory, including their emotional state during the memory, if possible. Finally they typed the approximate age they were when the event occurred. For IFAMs they were instructed to plausibly fabricate an age. For no load trials, see figure 1.

**Data cleaning**

A total of 541 memories were recalled across all 35 participants. However, 68 memories were removed from the dataset since they lacked (any) specificity, leaving 473 memories (approx. 13.5 memories per participant).

**Results**

**Experiment 4: non-memory cognitive load**

**Design**

2 (memory type: real, fabricated) x 2 (load: with, without) within subjects design. RT to memory recall was measured, and dot pursuit performance was measured using Euclidean distance from the target.

**Participants**

*Thirty-five* participants volunteered to participate ( xx (xx%) female). Aged between 18 to 58 years (M=\_\_\_\_, SD=\_\_\_\_\_). Participants either received a small payment or research credits.

**Methods**

The second block set required participants complete a pursuit tracking task (PTT), in which they were required to follow a dot as it moved in a circular motion (the secondary task) whilst recalling a AMs or IFAMs. PTT was coded using Python.. (spec) using a graphics tablet (spec) and stylist pen (spec).

Instructions were presented on a screen using a Lenovo…. (screen specs). Before the experiment began, participants completed a task in order to calibrate the PTT. During calibration, the dot travelled at 8 different speeds. The dot ascended up to a speed of … and then descended to its original speed. Participants were given the opportunity to have a break during the task. Once the task was calibrated participants could begin the main experiment.

For PTT, cues would appear on a screen 1000ms after it began and participants were instructed to continue with the task whilst they recall/generate a memory.