Investigating the Effects of Interrupting Gender-Related Schematic Encoding and Memory Recall in an Adult Population

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Abstract

Schema theory accounts for the incompleteness and distortions in memory. Theories suggest a person's prior knowledge can influence their encoding and retrieval abilities. Concerning gender-schemas, someone's stereotypical gender biases can influence their schematic encoding and memory recall. These theories were tested in the current study by assessing participants recall of events and gender biases at explicit and implicit levels. Explicit recall was assessed through a questionnaire regarding a passage of text previously presented to participants, and implicit gender biases were assessed through an IAT. Within this study there were four conditions organised in a 2 x 2 design. Conditions consisted of informed and non-informed conditions and gender conforming and non-conforming conditions. Informed conditions were mediated through statements presented to participants prior to the study which told participants the true nature of the study – testing gender-related recall or told them their memory recall would be tested. Conforming conditions were given biographies where characters gender's consistent with stereotypical gender roles, with non-conforming conditions the opposite. Results found that when presented with non-conforming biographies, participants performed worse at recall and were more likely to recall gender inaccurate information. This effect was seen only when the participants were informed, indicating an effect of schema activation and priming on memory recall. Additionally, participants with higher IAT scores (more bias) performed poorer than those with lower scores when in non-conforming conditions. These findings support those found in the previous literature and add the finding that informing participants can influence their ability to recall accurate gendered information.

Introduction

Schema theory was originally proposed by Bartlett (1932) as a theory to account for the apparent incompleteness and distortions seen in memories. Schemas are cognitive structures that organise our event-related knowledge (Bartlett), or in more appealing terms, they refer to the general knowledge a person has about a particular domain (Alba & Hasher, 1983).

There are two different types of schemas; event and story schemas (Bartlett, 1932). Event schemas contain knowledge about the subject of a story whereas story schemas contain knowledge about the abstract structures of typical stories (Bartlett). Schemas can be formed for almost any event in a person's life (Yanowitz, 2006). Gender-schemas specifically, are cognitive structures that organise our gender-related knowledge, beliefs and attitudes (Cherney, 2005). Gender-schemas can influence people's behaviours, attitudes and importantly their memory (Cherney, 2005). Cohen's (1996) theoretical explanation of schemas emphasised the role that past experiences and previous knowledge plays in our memory recall. Essentially, Cohen states that what we remember is heavily influenced by what we already know. Linking this to gender-schemas, what we remember about a situation can be heavily influenced by the gender stereotypes that we hold.

When a new experience is encoded it is not simply copied into our memories, instead, new experiences are actively constructed using previously held general information in a schema and fitting this with the new information that is being processed (Alba & Hasher, 1983). This active construction is done using the following processes; Selection – information relevant to the schema is remembered better than irrelevant information, Interpretation – memories can become distorted to fit with the schema, and finally, Retrieval – schemas can aid in the recall of events (Alba & Hasher).

Support for the Selection process come from studies conducted by Brewer and Treyens (1981), who asked participants to recall items that were either schema-expectant (in-fitting with the schema of the environment) or salient (not in-fitting with the schema of the environment). Results showed that participants remembered schema-expectant items easier than salient ones, thereby supporting the selection process outlined by Alba & Hasher (1983) that schema-relevant information is remembered better than irrelevant information. Additionally, research has found that if a person has a vast knowledge of a domain, then they are better at recalling stimuli than someone who has little previous knowledge of the domain (Chiesi, Spilich, & Voss, 1979). The process of selection therefore posits that when a person has a stereotypically gender-biased schema, information fitting with previous knowledge about stereotypical gender roles will be better remembered than information that contradicts these stereotypical roles.

Regarding the process of Interpretation, errors made are referred to as constructive errors as the person adds in aspects that were not there when the information was presented (Alba & Hasher, 1983). Studies by Schweller, Brewer & Dahl (1976) noted the tendency of people to change sentences to ones that better fit with their interpretation of the sentence, for example, people will often report a paratrooper as 'jumping out of a plane' when the sentence actually read 'walked out of the door'. This is because they are interpreting the sentence to fit with what they would

schematically expect rather than what was presented (Alba & Hasher). The process of Retrieval can also be seen here, where if the information presented fits the schema, then the schema could fill in any gaps in memory (Alba & Hasher). Linking this to gender-schema recall, people could either accurately add in forgotten gendered aspects, or potentially inaccurately recall information by inaccurately attributing a masculine act to a man when in reality it was presented as being conducted by a woman.

This process of schematic encoding and retrieval can be influenced by the gender stereotypes that a person holds in their schemas (Alba & Hasher,1983). Gender stereotypes refer to the beliefs people hold about how men and women should behave (Myers, 2005). Women are stereotypically seen as less physically aggressive, more nurturant and more sensitive than men (Prentice & Carranza, 2002; Bem, 1981). Whereas men are often seen as more assertive, dominate and aggressive than women (Bem, 1981). Eagly's (2000) social role theory mentions that gender stereotypes reflect current occupational and societal trends (Eagly, Wood & Diekman, 2000). This social role theory helps to describe how the personal qualities mentioned are consistent with occupational qualities. For example, nurturing roles such as social workers, teachers and nurses are primarily occupied by women (Myers, 2005), whereas leadership roles such as being a doctor or executive are more often occupied by men (NHS Digital, 2018). Furthermore, female electoral candidates are perceived as more likely to help the poor and protect women's rights whilst male candidates are perceived as being more likely to handle crime and foreign affairs (Sanbonmatsu, 2002). Because of the notion that gender stereotypes reflect the social and occupational climate of the time (Eagly, Wood & Diekman), it is helpful to assess gender stereotype differences in the previous decades.

The Bem Sex Role Inventory (BSRI) (Bem, 1977) provides a representation of gender stereotypes in the 1970s. The inventory was created by giving criterion that a person marked themselves against which was then attributed to either masculine or feminine characteristics (Bem, 1977). This process resulted in a list of typically feminine and masculine characteristics that could then be used as an inventory in future studies. Feminine characterises mentioned were; affectionate, cheerful, childlike, compassionate, does not use harsh language, eager to soothe hurt feelings, feminine, flatterable, gentle, gullible, loves children, loyal, sensitive to the needs of others, shy, soft-spoken, sympathetic, tender, understanding, warm, and yielding. Whereas the masculine characteristics mentioned were; acts as a leader, aggressive, ambitious, analytical, assertive, athletic, competitive, defends own beliefs, dominant, forceful, has leadership abilities, independent, individualistic, makes decisions easily, masculine, self-reliant, self-sufficient, strong personality, willing to take a stand, and willing to take risks (Bem, 1997).

Bem's (1977) inventory has been widely used since its creation to investigate perceptions of gender characteristics over the years. Studies by Harris (1994) found that near the turn of the century, all the masculine and feminine characteristics still met the criteria outlined in the BSRI. This was supported closer to the turn of the century (Holt & Ellis, 1998; Auster & Ohm, 2000) where all the feminine characteristics still met the criteria, however Auster and Ohm (2000) found that the only half of the masculine characteristics matched those outlined by Bem (1977). Furthermore, Twenge's (1997) studies found that women's scores of masculine traits

on the BSRI were positively correlated with year of publication, meaning that as the years went on, women assessed themselves as having more masculine characteristics (Bem, 1977). Studies conducted by Twenge also found that the sex differences between characteristics on the BSRI had decreased from the 70s to the 90s. This change in the characteristics matched to men and women over the decades can be used to infer that the social gender climate of our society is changing, and that what is typically expected of men and women's occupational and societal roles could be changing (Haines, Deaux & Lofaro, 2016).

This notion that gender roles and occupational expectancies is changing (Holt & Ellis, 1998; Auster & Ohm, 2000; Twenge, 1997; Haines, Deaux & Lofaro, 2016) and the theory that gender stereotypes can influence our memory recall (Alba & Hasher, 1983) is the overarching experimental field in this study. More specifically, this study aims to look at the effects of interrupting gender-schemas and the effect of this on participant's subsequent memory recall of events. Furthermore, gender biases will be assessed both explicitly through memory recall tasks and implicitly through an Implicit Associations Task (IAT), which measures automatic conceptual associations to identify underlying biases/prejudices (Greenwald, Mcghee & Schwartz, 1998), which can be investigated regarding their subsequent effects on the memory recall tasks.

The previous experimental focus on gender-schema research is primarily based on the behavioural and societal effects of stereotyping, rather than on the effect stereotyped gender-schemas can have on memory (Oakes, Haslam, & Turner, 1994). Research that does investigate gender-related memory has a strong developmental focus with studies looking into the assignment of gender roles to toys, and how gender schemas develop across varying age groups (Schau & Scott, 1984; Martin & Ruble, 2004). There is a lack of studies that investigate the effect of stereotyped gender-schemas on adult's memory recall. In this study, advancing on the theoretical frameworks of schemas and memory outlined previously, gender-schema related recall will be studied using fictional stereotypical characters in a passage of text. These characters will take on the roles of Doctor, Nurse, Secretary and Inspector, which all have clear stereotypical genders (White, Brown & White, 1989).

In general, people rely on categorisation strategies such as stereotypes to make assumptions efficient (Kaplan, Wanshula & Zanna, 1993). The use of these strategies is seen even more when people are asked to make decisions in a time pressured environment (Kaplan, Wanshula & Zanna). This reliance on stereotypes when time is pressured will be exploited in the current study through the use of an implicit associations test (IAT) with timed responses. An IAT assesses implicit stereotypes by measuring the automatic association of one concept to another (Greenwald, Mcghee & Schwartz, 1998), for example, 'Nurse' with 'Female' or 'Doctor' with 'Male'. The timed responses from an IAT will show the implicit levels of association between the two concepts, where a faster categorisation time implies a stronger connection between concepts and a slower reaction time, a weaker connection (Greenwald, Mcghee & Schwartz).

An IAT will be used in this study because stereotypes can continue to bias perceptions of characters at an implicit level without needing to be voiced explicitly

(Kunda & Spencer, 2003). Furthermore, implicit stereotypes can persist long after being explicitly voiced (White & White, 2006). This means that occupational gender stereotypes, such as those included in the passage, may persist longer implicitly, even when the participants do not show any explicit bias.

In this experiment, explicit biases along with memory recall will be assessed through the use of a questionnaire after presentation of a passage of text and implicit biases will be assessed later on in the experimental process through the use of an IAT. For this experiment, there will be conditions where the participants are given gender conforming materials and conditions where they are given gender non-conforming materials prior to the questionnaire phase, this will act as the schema interruption manipulation for the study, whereby the stereotypically non-conforming gender roles are thought to interrupt the schematic processes of encoding and retrieval (Alba & Hasher, 1983).

Within this study, the hypotheses are that; when participants gender schemas are interrupted by non-conforming gender information, their recall of events will be poorer than participates who were presented with information that is in fitting with stereotypical norms. Additionally, participants that are presented with non-conforming gender roles will inaccurately recall aspects of the story that are more fitting with their gender-schemas. Finally, participants who achieve a high IAT score (more implicit bias) will do worse in the non-conforming conditions than those with a lower IAT score.

Methodology

Participants
134 Participants were recruited from a volunteer sample of undergraduate psychology students from the University of Plymouth. Due to technical issues, 7 sets of data were discounted from the sample, leaving 127 viable data sets. These remaining participants were to the male/female ratio of 19:108 and had an age range of 18 – 53 years (M_{age}= 21.68 years, SD= 7.6). A further 6 data sets were excluded from the memory recall analysis for methodological issues.

Materials
Upon arrival, all participants were presented with a brief informing them of the nature of the study, and a subsequent consent form to sign if they were happy to participate. This consent form informed the participants of their right to withdraw from the study at any time during or after completion and that all their data would be kept anonymous throughout.

In this 2 x 2 design, participants were unknowingly assigned to a condition from 1-4. Conditions 1 and 2 were uninformed of the true nature of the study whilst conditions 3 and 4 were informed, this was mediated by either an informed or non-informed statement being presented to participants prior to starting the study. Both informed and non-informed conditions consisted of non-conforming sub-conditions (2, 3) where a character's gender in a passage presented did not conform to gender normative stereotypes, and conforming sub-conditions (1, 4) where the genders did conform to normative stereotypes. The 2 x 2 design and numbered conditions can be

seen in the table 1 below.

Table 1 *Conditions and sub-conditions and corresponding numbers*

	Non-informed	Informed
Conforming	1	4
Non-conforming	2	3

Participant numbers for each condition were as follows; Non-Informed – Conforming (n=33), Non-Informed – Non-Conforming (n=31), Informed – Non-Conforming (n=30) and Informed – Conforming (n=27).

The participant's condition gave their subject code, for example; 15-1 would represent participant number 15 in who was in condition 1. This subject code acted as a form of anonymously ordering the data for analysis.

Participants were seated in a private room, consisting of a computer, keyboard and a pen. Throughout testing several different rooms were used and all were made sure to consist of the same environment.

The information concerning the nature of the study was presented to all participants in statements read prior to starting the experiment. For conditions 1 and 2 (non-informed) participants were told that the nature of the study was testing short term memory recall. In conditions 3 and 4 (informed) participants were told that the study was testing stereotyping effects on memory schemas. For these informed conditions, participants were asked to not make gender stereotype assumptions about the characters they were about to read about in a short passage.

This short passage of text detailed the experience of a mother and son in hospital. The passage was printed in black text onto white paper. The story consisted of four main characters; a Doctor, Nurse, Secretary and an Inspector. Throughout the text, character's actions conformed to the gender normative stereotypes of their stereotypical roles, for example, the Doctor and Inspector (stereotypically male roles) acted in accordance to male gender norms and the Nurse and Secretary (stereotypically female roles) acted in a more feminine manner. This passage was uniform and given to all participants in all conditions.

Biographies of the characters were presented after the passage, stating their gender and hobbies. The biographies were also printed in black text onto white paper and were stapled to the page with the story on. These biographies were condition specific, meaning that conditions 1 and 4 were given biographies of characters conforming to gender stereotypes, such as the Doctor being male and the Nurse being female and them adhering to gender stereotyped hobbies. Conditions 2 and 3 were given non-conforming biographies, where the Nurse would be male and the Doctor female, and they would not conform to gender stereotyped hobbies. All biographies were presented alongside a picture of the character.

Upon completion of reading the passage, it was removed from the participants room, and they were asked to input their age and gender into boxes presented on the

screen. Participants then started the computerised questionnaire. The questionnaire consisted of 30 questions regarding different aspects of the story. Questions in the questionnaire were presented in black text on a white screen. Questions were presented one at a time with a blank space below for the participants to type their answers. Unbeknown to the participants, their responses were timed. After completing all questions, they were moved on to the final computer task.

This final task was an IAT with all instructions on how to complete it given to participants on the screen. They were instructed to use keys 'i' and 'e' for the task of assigning words presented into a category. Category headings of either 'career', 'family', 'MALE' or 'FEMALE' were to appear in either the left or right corners of the screen. Furthermore, participants were instructed to use spacebar to proceed from one trial to the next. If they wrongly assigned a word to a category, a red 'x' would appear on the screen and participants would not be able to proceed to the next word until it was correctly assigned the right category. Following theses instructions, participants were given 2 practice trials before beginning the assessed trials, which would be timed.

The initial practice trial used the categories 'career' and 'family' with 'career' presented to the left and corresponding to key 'e' and 'family' presented on the right corresponding to key 'i'. Both category words were written in red text. Once participants had completed this practice trial they were moved on to the next practice trial using the categories 'MALE' and 'FEMALE' with 'MALE' presented to the left side of the screen corresponding to the key 'e' and with 'FEMALE' presented to the right and corresponding to the key 'i'. Category words were written in purple text.

After completion of the practice trials, trials 3 and 4 contained the categories 'career' and 'FEMALE' simultaneously on the left of the screen and categories 'family' and 'MALE' concurrently on the right of the screen. Category headings maintained their text colour from previous trials. Trial 5 saw the categories 'career' and 'family' switch sides so that now 'family' was presented on the left with the corresponding 'e' key, whilst 'career' was now corresponding to the 'i' key and was presented on the right. Trials 6 and 7 then maintained this switch for the 'family' and 'career' categories whilst the 'FEMALE' and 'MALE' categories stayed on their respective sides.

Once the final trial (7) had been completed, a message came onto the screen thanking the participant for their participation and told them to seek the researcher. After this, the computer programme shut down. Once the participants had left their cubicles they were given a debrief form which was printed on white paper in black text. The form told all participants, regardless of condition, about the true nature of the study. Participants were told by researchers that should they have any further questions regarding their participation or the study, that they could contact the researchers via their emails given on the bottom of the debrief form.

Procedure
As participants arrived at the testing labs, they were greeted by the researchers and walked to a cubicle. Once seated, they were told to read through the brief and to sign the consent form if they were happy to participate. Whilst the participants read the

brief their cubicle door was closed, and the researcher waited outside. Participants were instructed to knock on the door once they had signed the consent form.

After the participant knocked on the door, the researcher entered and read aloud the statement regarding the nature of the study, corresponding with whatever condition the participant was in (informed/non-informed). After this, researchers presented participants with the story and biographies and instructed them to take as long as they needed to read through the passage and the biographies and then to knock on the door once finished. The researcher asked if the participant had any questions and once any were answered, they then left the room.

When the participant had finished reading the passage and the biographies and had signalled this via knocking on the door, the researcher entered again, removed the story and biographies and asked the participant to input their age and gender to the boxes on the screen. Once completed, the researcher explained that there would be questions presented at the top of the screen and that there would be a blank space for their answer's underneath. Following this, the researcher explained that upon completion of the questionnaire, that another computer task would follow but that all instructions for that one would be presented on the screen. Before starting the questionnaire programme, researchers asked if the participant had any questions, and once answered, the researcher began the programme and left the room, instructing the participant to knock again when they had finished.

As the participants finished the computer tasks and knocked on the door, they were verbally thanked for their participation, were handed a debrief form and told they could leave.

Results

To test the hypothesis that interrupting a person's schema leads to a poorer recall of events, a two-way ANOVA was conducted. This ANOVA examined the effect of Non-Conforming/Conforming (NCC) gender roles and Non-Informed/Informed (NII) understanding of the task on questionnaire (Q) score. The statistical analysis demonstrated that there was no significant effect of Non-Conforming/Conforming conditions on Q Score, $F(1, 117) = 2.455$, $p=.120$, nor was there an effect of Non-Informed/Informed conditions on Q score, $F(1, 117) = 1.730$, $p=.191$ (Figure 1). However, there was a statistically significant interaction between NCC and NII on Q Score $F(1, 117) = 4.517$, $p = .036$, which can be seen in Figure 1.
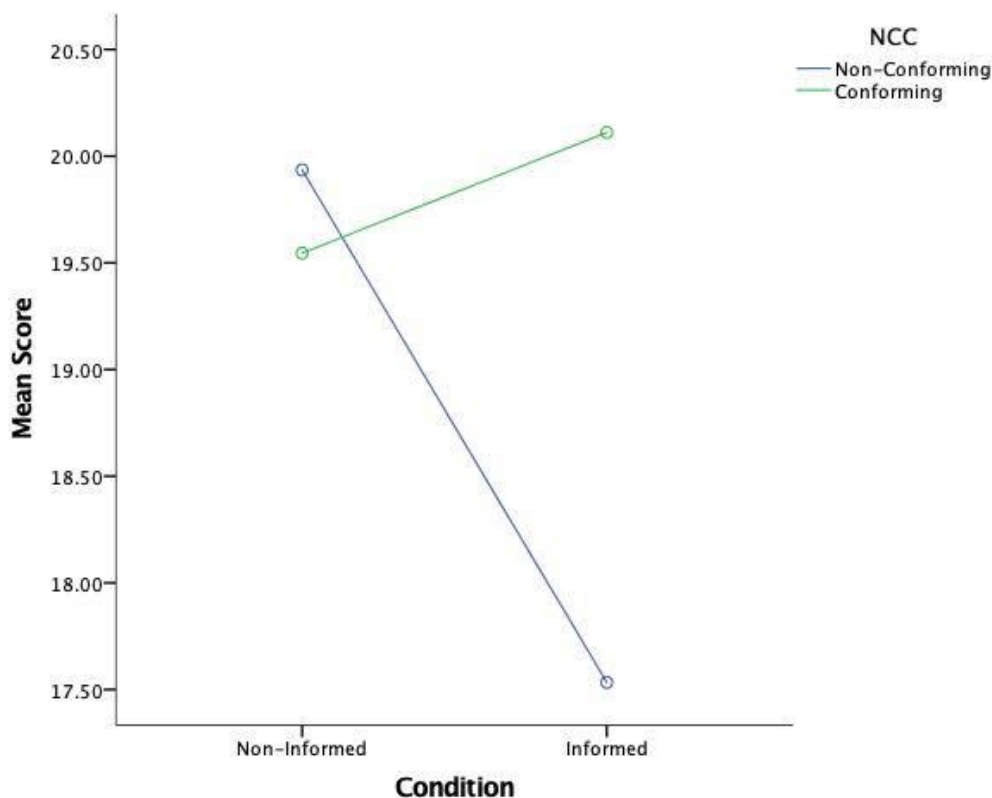
Figure 1. Graph Showing the Estimated Mean Score for Each Condition and Their Interaction.

This significant interaction was further investigated by two independent samples t tests (Table 2). To test the differences between the data sets for both groups in each the non-informed and informed conditions two Independent samples t tests were conducted. These tests were conducted to compare Q Score in Non-Conforming/Informed and Conforming/Informed conditions and the Non-Conforming/Non-informed and Conforming/Non-informed conditions. Both tests have been presented in the same table (2) for ease of understanding. There was a significant difference in Q Score for the Non-Conforming (M= 17.53, SD=3.70) and Conforming (M=20.11, SD=3.72) conditions in the Informed category; t(53)=2.621, p=.011. However, there was not a significant difference in Q Score for the Non-conforming (M=19.94, SD=3.72) and Conforming (M=19.55, SD=4.13) conditions in the Non-Informed category; t(62)=-.396, p=.693. These results suggest that the difference in scores seen in the ANOVA graph was not significant for the Non-Informed category, meaning there was no real difference between conditions, whilst there was a significant difference between conditions in the informed condition, implying an effect of informing participants on recall score.

Table 2: *Independent Samples t test for Mean Q Score for Both Non-Conforming and Conforming Conditions in both Informed and Non-Informed categories.*

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Score - Informed	Equal variances assumed				
	.124	.726	2.62	55	.011
Score – Non-Informed	.463	.499	-.396	62	.693

To test the hypothesis that a high IAT score can influence memory recall, a Pearson's Bivariate analyses was conducted. This test was used to assess the correlation between both DV's (IAT & Q Score) in each condition (Table 3). For the purpose of the results, only the statistically significant I/NC condition has been presented (Figure 2). In the I/NC condition, IAT and Q score have a statistically significant negative linear correlation; r = -.490, n = 30, p = .006, which has been illustrated below. This correlation supports the hypothesis that individuals who hold stronger stereotypical biases (High IAT) have poorer recall when presented with non-conforming gender stereotypes.

Table 3: *Bivariate Correlation (Pearson) Between IAT and Q Score for each Sub-Condition*

	NI-C	NI-NC	I-NC	I-C
Pearson Correlation	-.169	-.015	-.490**	.181
Sig. (2-tailed)	.346	.938	.006	.365

To assess the tendency of people to give descriptions of gender in their questionnaire answers, a descriptive statistics test was conducted (Table 4). This test analysed the number of gendered responses given in Q Data by participants in each condition. Results are as follows; Non-Informed – Conforming (M=5.73, SD=3.13), Non-Informed – Non-Conforming (M=4.13, SD=2.43), Informed – Non-Conforming (M=3.90, SD=2.51) and Informed – Conforming (M=5.67, SD=3.52). These results show that the average amount of gendered responses given by participants is higher in conforming conditions (I,4) than in non-conforming conditions.
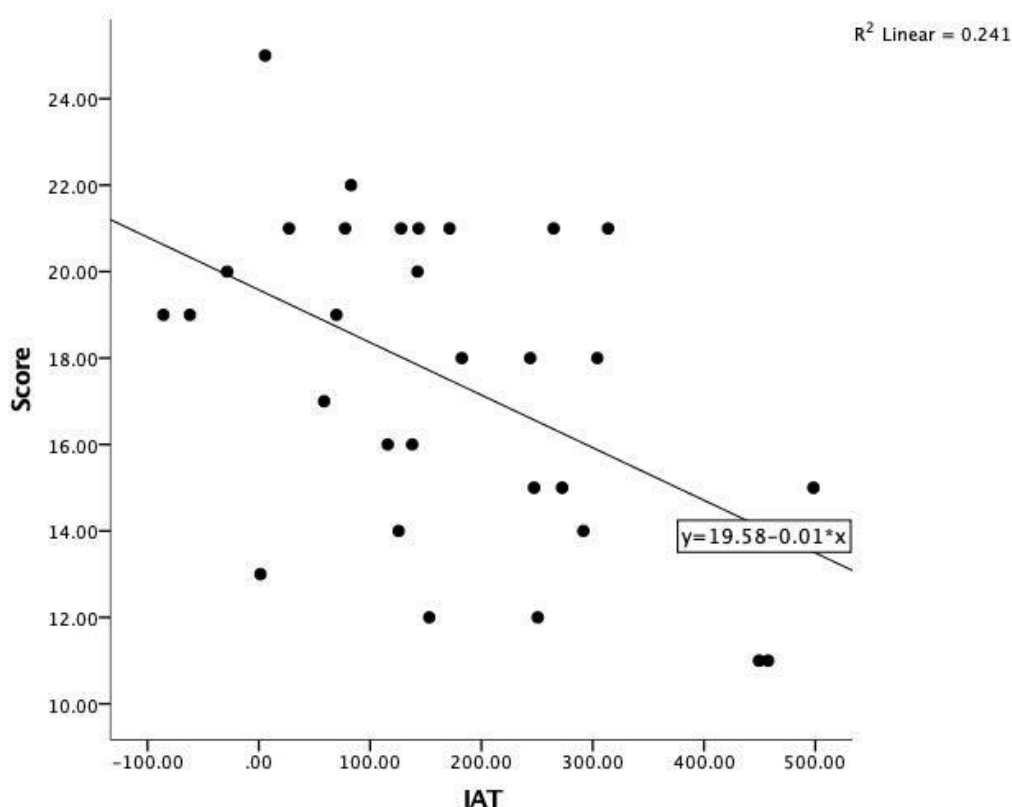
Figure 2. Graph Showing the Negative Correlation Between Q Score and IAT for the I/NC Condition

Table 4: *Descriptive Statistics for the Number of Gendered Responses in Each Condition*

	Group	N Statistic	Mean Statistic	Std. Deviation
	NI – C	33	5.73	3.13
Sum	NI – NC	30	4.13	2.43
	I - NC	30	3.90	2.51
	I – C	27	5.67	3.52

To assess if these differences in the amount of gendered responses given was significant or not, two Independent samples t tests were conducted to compare gendered Q Data in Non-Conforming/Conforming conditions and Non-Informed/Informed conditions (Table 5). Both tests have been presented in the same table (5) for ease of understanding. There was a significant difference in gendered Q Data for the Non-Conforming (M= 4.02, SD=2.45) and Conforming (M=5.70, SD=3.28) conditions; $t(109.275)=3.184$, $p=.002$. However, there was not a significant difference in gendered Q Data for the Non-Informed (M=4.97, SD=2.91) and Informed (M=4.74, SD=3.13) conditions; $t(119)=-.420$, $p=.675$. These results suggest that gendered Q Data is affected by only the influence of Non-Conforming/Conforming conditions, and not Non-Informed/Informed conditions.

Table 5: *Independent Samples t-test's for Gendered Q Data for Both NII and NCC Conditions*

		Levene's test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Sum	Equal variances assumed - NII	.816	.355	-.420	118	.675
	Equal variances not assumed - NII			-.418	114.5	.677
	Equal variances assumed - NCC	.617	.014	.318	118	.002
	Equal variances not assumed - NCC			.318	109.28	.002

To test the hypothesis that people will recall inaccurate information more fitting with their schemas, a compare means test was run on the percentage of correctly gendered responses (PCorrect) given in Q Data by participants in each condition. Results are as follows; Non-Informed – Conforming (M=.95, SD=.19), Non-Informed – Non-Conforming (M=.82, SD=.29), Informed – Non-Conforming (M=.87, Sd=.25) and Informed – Conforming (M=.99, SD=.07). These results show that the conforming groups give a higher mean percentage of correctly gendered responses (M=0.97) than the non-conforming groups (M=0.84). This supports the hypothesis that when in a gender non-conforming condition, participants recall more inaccurate information as fitting with their gender schemas.

Table 6: *Mean Score of PCorrect Gendered Responses for each Condition*

Group	Mean	N	Std. Deviation
NI-C	.95	33	.19
NI-NC	.82	30	.29
I-NC	.87	30	.25
I-C	.99	27	.07

Contrary to our ANOVA results where the NI-NC condition out-performed the I-NC condition on Q Score, when assessing the PCorrect for Gendered response recall, the I-NC condition out-performed the NI-NC condition. To see if these differences were significant or not, an independent samples t test was conducted to compare PCorrect Q Data for the effect of informing participants in Non-Conforming samples (I-NC & NI-NC). Another independent samples t test was run to assess any difference in the overall effect of conformity on participant's PCorrect Q Data by comparing all 4 conditions PCorrect Data. Both tests have been presented in the same table (7) for ease of understanding. There was a significant difference in PCorrect Q Data for the Non-Conforming (M=.84, SD=.27) and Conforming (M=.97,

SD=.02) conditions; t(92.874)=3.167, p=.002. However, there was not a significant difference in PCorrect Q Data for the Non-Informed (M=.82, SD=.29) and Informed (M=.87, SD=.25) conditions of Non-Conforming samples; t(58)=-.683, p=.498. Therefore, we confirm the null hypothesis of there being no significant effect of informing the participants in the Non-Conforming samples on their PCorrect Q Data.

Table 7: *Independent Samples t-test's for PCorrect Gendered Responses for NII and NCC Conditions*

		Levene's test for Equality of Variences		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
	Equal variances assumed - NII	1.340	.252	-.683	58	.498
Sum	Equal variances not assumed - NII			-.683	56.649	.498
	Equal variances assumed - NCC	31.118	.000	3.167	118	.002
	Equal variances not assumed - NCC			3.167	92.874	.002

Discussion

This study investigated the theory of memory schemas that was originally introduced by Bartlett (1932) and more specifically gender-schemas (Cherney, 2005) and their role in influencing our memory recall (Cohen, 1996; Alba & Hasher, 1983). The present study developed on these theories by testing the effect of interrupting schematic encoding and retrieval. This interruption was achieved through the use of the presentation of both gender conforming biographies and gender non-conforming biographies after the presentation of a passage of text. The passage of text told the story of 4 characters who assumed occupational stereotypical gender roles. After this, participants recall of events was tested and their implicit gender biases assessed.

Our results supported our main hypothesis that memory recall would be poorer in non-conforming conditions, as can be seen from the ANOVA data (figure 1). This finding supports Cohen's (1996) theoretical explanation of schemas, which emphasised the role that previous experiences and knowledge play in our memory recall. This theory is supported by our finding that the conforming conditions out performed non-conforming conditions on Q score. Interestingly, this effect was only seen when the participants were in an informed condition, where the differences in mean scores from the conforming and non-conforming groups was significantly different (See Table 2). When participants were not informed about the nature of the study, the non-conforming and conforming conditions did not perform significantly different from each other in their recall (See Table 2). This effect could be because when in the informed groups, participants are primed to expect either

conforming/non-conforming gender stereotypes in the passage of text. As a result, their focus when reading the text is the gender of the characters presented. Subsequently, when the non-conforming biographies are presented, participants who have strong gender biases (High IAT) became confused about the gender of the characters and had poorer recall. This effect of priming is not seen in the non-informed conditions, where the difference in Q score between conforming and non-conforming conditions was insignificant. This finding could reason that if an individual has not been told that their recall of gendered information is to be tested, then the non-conforming conditions are not subject to this schema activation and resulting confusion when given non-conforming biographies. This added finding from the current study, that informing participants of the true nature of the study can affect their subsequent memory recall, is therefore an addition to the theoretical framework surrounding schema theories.

The findings from this study also supported our second hypothesis that when participants were presented with the non-conforming biographies, their recall of events would be inaccurate and more fitting with their own gender-schemas. This hypothesis was based on the selection and interpretation theories outlined by Alba and Hasher (1983) that information relevant to schemas is remembered better than irrelevant information and that memories can become distorted to fit a schema. The gendered responses data in our results section, including the mean PCorrect data and the independent samples t tests, confirms this prior thinking and supports our hypothesis. These tests support our hypothesis and the previous theories (Alba & Hasher, 1983) because when in the non-conforming conditions, participants gave more inaccurately gendered information in their answers. Gendered information given was likely to be consistent with that held in their stereotyped gender-schemas.

Finally, our last hypothesis that participants who scored highly on the IAT would have poorer recall in the non-conforming conditions than those who scored low on the IAT was also supported by our findings. The Pearson Bivariate correlation highlighted this finding in the I/NC condition where as IAT scores got higher, participants Q scores got poorer. Brewer and Treyens' (1981) finding that people with gender-biased schemas are poorer at recalling schema salient information is therefore supported by our findings as those individuals who scored highly on the IAT (High gender-biased schemas) were worse at recalling the schema salient information presented in the non-conforming gender biographies.

Regarding future research in this area, it would be interesting to examine the effect of age on memory recall. In the current study, although participants of all ages were welcome to participate, being that it was conducted on a university sample, there was a lack of participants in the older age groups. Of the 127 participants recruited, only 13 were over the age of 30 years, meaning that due to the small n value, statistical analysis could not be conducted on their data to see any effect of age. It is probable that there will be an effect of age on the strength of influence of interrupting memory schemas on recall, as schema bias can be held implicitly even after no longer bring voiced explicitly (White & White, 2006). Because of this finding, it is possible that an older population would show greater difficulties when in the non-conforming conditions as they will have grown up during the decades where gender roles were more rigid and separate for males and females (Bem, 1977). This previous experience of living with separate gender roles is likely to leave them with

higher implicit levels of bias. Subsequently, this suggests that older participants would perform poorer than younger participants on their recall of events when in the non-conforming conditions. A replication of this current study with the methodology concerned with recruiting participants from varying age groups would be beneficial to assessing any differences in memory recall of gender-schematic events.

Additionally, further studies could be conducted across the world to see if these findings are culturally consistent. As an initial thought, one would expect that differences would be see in findings as different cultures have different stereotypical roles for men and women. For example, whilst in America and England, most doctors are men, in Russia most are women (NHS Digital, 2018). This difference in the stereotypical roles occupied by each gender would affect the results if the same study was conducted with the same materials. Here one would expect the non-conforming conditions to out perform the conforming conditions on their memory recall.

The reason why this field of research is so important for future study is the practical applications that can be drawn from these findings. The main practical application that can be seen is the task of memory recall in eye witness testimony accounts. Previous research regarding bank robbery schemas (Rae Tuckey & Brewer, 2003) has found that eye witnesses can use their schemas to preserve information about the crime that is consistent with their schemas, but that this is at the expense of schema-inconsistent information. This finding highlights the importance of identifying the weaknesses of using eye witness accounts as their schematic recall can be influenced by their previously held beliefs (Cohen, 1996). Formatting this to fit with gender-related schematic recall, is it possible that when an individual with high levels of implicit gender biases is asked 'who did you see running from the hospital?' it is possible that given our findings that people can recall inaccurate information that is in fitting with their schemas, the individual may reply that they saw a male doctor running from the hospital, when in reality it could have been a woman. The effects of this inaccurate recall and the repercussions this can have in the justice system are easy to see, which highlight why more research into this area is needed to identify the severity and prevalence of this inaccurate recall, and possible ways to ameliorate this.

Conclusions

Overall, this current study has confirmed the hypotheses of this experiment and several of the theoretical interpretations of memory schemas that exist in the literature. Importantly, this study has contributed the finding that informing participants that their gender-related recall will be tested, can have a significant effect on their ability to recall information when it interrupts with their gender-schemas. Participants who are informed that their gender-related recall will be tested, perform poorer when in the non-conforming condition than participants who are not informed that their gender-related recall will be tested and are in either the conforming or non-conforming conditions. Additionally, within the informed condition itself, those who are presented with gender non-conforming information perform significantly worse than those who are presented with gender conforming information. These findings would benefit from being empirically supported by the cultural and age studies mentioned, and as a result, the growing literature

surrounding gender-related schemas would help in practical cases such as that of eye-witness testimonies.

Acknowledgments

References

Alba, J.W. & Hasher, L. (1983) Is memory schematic? *Psychological Bulletin, vol. 93*, 203 – 231

Auster, C. J., & Ohm, S. C. (2000). Masculinity and femininity in contemporary American society: A reevaluation using the Bem Sex-Role Inventory. *Sex roles*, vol. *43*(7), 499-528.

Bartlett, F.C. (1932) *Remembering.* Cambridge: Cambridge University Press

Bem, S. L. (1981). Gender schema theory: A cognitive account of sex typing. *Psychological review*, vol. *88*(4), 354.

Bem, S. L. (1977). Bem sex-role inventory (BSRI). *The 1977 annual handbook for group facilitators*, 83-85.

Brewer, W.F. & Treyens, J.C. (1981) Role of Schemata in Memory for Places. *Cognitive Psychology, vol. 13*, 207-230

Cohen, G. (1996) *Memory in the Real World.* Psychology Press

Cherney, I. D. (2005). Children's and adults' recall of sex-stereotyped toy pictures: Effects of presentation and memory task. *Infant and Child Development*, *14*(1), 11-27.

Eagly, A. H., Wood, W., & Diekman, A. B. (2000). Social role theory of gender differences and similarities: A current appraisal. In T. Eckes & H. M. Trautner (Eds.), *The developmental social psychology of gender*, 123–174.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. (1998). Measuring individual differences in implicit cognition: the implicit association test. *Journal of personality and social psychology*, vol. *74*(6), 1464.

Haines, E. L., Deaux, K., & Lofaro, N. (2016). The times they are a-changing… or are they not? A comparison of gender stereotypes, 1983–2014. *Psychology of Women Quarterly*, vol. *40*(3), 353-363.

Harris, A. C. (1994). Ethnicity as a determinant of sex role identity: A replication study of item selection for the Bem Sex Role Inventory. *Sex roles*, vol. *31*(3-4), 241-273.

Holt, C. L., & Ellis, J. B. (1998). Assessing the current validity of the Bem Sex-Role Inventory. *Sex roles*, vol. *39*(11-12), 929-941.

Kaplan, M. F., Wanshula, L. T., & Zanna, M. P. (1993). Time pressure and information integration in social judgment. *Time pressure and stress in human judgment and decision making* (255-267). Springer, Boston, MA.

Kunda, Z., & Spencer, S. J. (2003). When do stereotypes come to mind and when do they color judgment? A goal-based theoretical framework for stereotype activation and application. *Psychological bulletin*, vol. *129*(4), 522.

Martin, C. L., & Ruble, D. (2004). Children's search for gender cues: Cognitive perspectives on gender development. *Current directions in psychological science*, vol. *13*(2), 67-70.

Myers, D.G. (2005) *Social Psychology*. McGraw-Hill Press, New York.

NHS Digital (2018). Narrowing of NHS gender divide but men still the majority in senior roles, retrieved from on 15/04/2019

Oakes, P. J., Haslam, S. A., & Turner, J. C. (1994). *Stereotyping and social reality*. Blackwell Publishing.

Prentice, D. A., & Carranza, E. (2002). What women and men should be, shouldn't be, are allowed to be, and don't have to be: The contents of prescriptive gender stereotypes. *Psychology of women quarterly*, vol. *26*(4), 269-281.

Rae Tuckey, M., & Brewer, N. (2003). How schemas affect eyewitness memory over repeated retrieval attempts. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, vol. *17*(7), 785-800.

Sanbonmatsu, K. (2002). Gender stereotypes and vote choice. *American Journal of Political Science*, 20-34.

Schau, C. G., & Scott, K. P. (1984). Impact of gender characteristics of instructional materials: An integration of the research literature. *Journal of Educational Psychology, 76*(2), 183-193

Schweller, K. G., Brewer, W. R, & Dahl, D. A. (1976). Memory for illocutionary forces and perlocutionary effects of utterances. *Journal of Verbal Learning and Verbal Behavior, vol. 75*, 325-337.

Twenge, J. M. (1997). Changes in masculine and feminine traits over time: A meta-analysis. *Sex Roles, vol. 36*, 305–325

White, M. J., Kruczek, T. A., Brown, M. T., & White, G. B. (1989). Occupational sex stereotypes among college students. *Journal of Vocational Behavior, vol. 34*, 289–298.

White, M. J., & White, G. B. (2006). Implicit and explicit occupational gender stereotypes. *Sex roles*, vol. *55*(3-4), 259-266.

Yanowitz, K. L. (2006). Influence of gender and experience on college students' stalking schemas. *Violence and Victims*, vol. *21*(1), 91.