Increased Eyewitness Accuracy Through Live Encoding and Recognition Mediums.

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Abstract

Purpose. Research in the sphere of eyewitness testimony aims to explore the merits of varying methods of facial recognition in identification. This study aimed to establish whether *live* Encoding and Recognition mediums result in higher facial identification accuracy than still Encoding and Recognition mediums. This study examined the effect of face variability, a feature of *live* encoding and recognition mediums, on eyewitness identification accuracy, aiming to use the results to critique eyewitness recognition research and practice.

Methods. Data was collected under eight different Encoding and Recognition medium conditions. The research participants (N=138) unknowingly encoded the face of the target *live* or by viewing a stills photo, and were then required to identify the target through either a *live* medium or stills medium line-up. Groups were randomised to different conditions, and were split to view line-ups with either the target present or with the target absent.

Results. For the measure of accuracy, a logistic regression was conducted**.** Encoding medium and Recognition medium were not significant but the interaction effect of Encoding medium by Recognition medium was significant and indicated a significant interaction between *live* Encoding medium and *live* Recognition medium. For the measure of confidence, A factorial ANOVA was conducted. This indicated a significant interaction effect ($p = .025$) for Encoding by Recognition mediums with a small effect size. Post-hoc analyses indicated that *Live* Encoding medium and *live* Recognition medium showed significance ($p = .012$) compared to still Encoding medium and *live* Recognition medium.

Conclusion. This study found that *live* Encoding medium and *live* Recognition medium will result in higher accuracy of eyewitness identification. Therefore, the results of this study provide enough evidence to re-evaluate the ways in which facial recognition research is conducted and to review policies on conducting eyewitness line-ups used in practice.

Keywords: facial recognition, eyewitness, face variability, live line-up, live encoding medium, live recognition medium

Increased Eyewitness Accuracy Through Live Encoding and Recognition Mediums.

It is widely agreed that eyewitness testimony contributes substantially to securing a fair verdict in a criminal trial. However, eyewitness testimony has a reputation for being vulnerable to a myriad of potential issues in terms of its reliability and accuracy (Clark, 2012; Fitzgerald & Price, 2018; Frenda, Nichols, & Loftus, 2011). This critique is primarily informed by the results of empirical studies, which illustrate the unreliability and inaccuracy of eyewitness testimony. As the practice of eyewitness testimony is grounded in academic theory, these studies play an integral role in informing best practice and consequently ensuring that justice is served (Frenda et al., 2011; Memon, Mastroberardino, & Fraser, 2007). Historically, live line-ups were used to aid in the conviction of criminals. This practice has fallen out of use in many parts of the world. However, there is little evidence for this change in practice away from live line-ups (Colloff et al., 2018). There is a disjunct between what is commonly practiced, and what is commonly researched in the field of eyewitness testimony.

The aim of eyewitness research is to develop and investigate methods of recognition that can increase positive identification of criminal suspects, and in turn reduce false identification of innocent suspects (Clark, 2012). One of the key insights from a review of the literature on facial recognition studies that this research addresses, is the conclusion that the different mediums used in encoding and recognition of faces, produce varied results – both in physical cues and accuracy (Cutler, Berman, Penrod, & Fisher, 1994; Egan, Pittner, & Goldstein, 1977; Fitzgerald & Price, 2018). This is arguably due to the fact that eyewitness studies are often conducted in a very controlled environment, to reduce as many confounds as possible in an attempt to deliver specific data. For example, photos are cropped to remove the hair and neck in order to have respondents focus solely on the face (Burton, 2013). This however does not represent the ‘real world’ and thus in some cases the generalisability of these studies is limited (Burton, 2013; Carol & Schreiber Compo, 2018; Memon et al., 2007).

In a research environment where highly controlled identification test media are used, a number of the elements that would be present in a corresponding live environment are lost, and this can skew the results (Burton, 2013; Sinha, Balas, Ostrovsky, & Russell, 2006). This creates a situation where the identification test media used to measure facial recognition, such as video or photos, is the determining aspect of the accuracy of facial recognition, instead of the face itself. In a live viewing environment there are many identifying physical features that are visible to the individual, including facial features, height, gait, build, posture, voice, hair style and colour, and skin colour. However, when selecting a medium other than a live line-up for identification/recognition, many of the cues that could assist in accurately identifying a face might be excluded (Cutler et al., 1994). In a live line-up, witnesses are asked to identify suspects from a group of people assembled in a line from behind a two-way mirror. This allows for exposure to a range of possible cues that are likely not present in other media such as still photographic images. This procedure is still seen as the South African benchmark in eyewitness identification and is still used by police and preferred by the courts (Cutler et al., 1994; Tredoux & Chiroro, 2005). In South Africa, it is a requirement of the law that live line-ups be used when eyewitnesses are identifying perpetrators, only in extreme cases when this is not possible are photo line-ups allowed (Tredoux & Chiroro, 2005).

Additionally, faces are encoded holistically in real life, and in the case of unfamiliar faces, external features such as hair are part of this encoding process. However, as mentioned, these external features are removed by some researchers in facial recognition studies (Burton, 2013; Sinha et al., 2006). Eyewitness studies aim to isolate the face as an object of recognition, based on the premise that context in which the face exists is not meaningful or relevant. This is a problematic premise and is challenged by the research on the role of face variability in facial recognition. Face or facial variability, which includes the face being viewed from – for instance – various angles, under different lighting conditions, images taken with different cameras, and with minor changes of appearance, plays an important part in how we encode faces and later recognise them. In order to achieve real world applicability, the need for better representation of face variability in facial recognition studies has been identified as absolutely critical (Burton, 2013; Ritchie & Burton, 2017).

For the outcomes of facial recognition studies to have applied value, they need to be tested and generate results that simulate the practice of facial recognition in the 'real world'. This can be achieved by the study better representing the live viewing environment, for example viewing actual people instead of images or videos. Should this more realistic recognition methodology be achieved, it will lead to increased positive identification, while avoiding confounds such as highly controlled images with low face variability (Clark, 2012; Memon et al., 2007).

More recent research supports the idea that live viewing, such as line-ups, should be the benchmark in research studies on facial recognition, suggesting that factors other than the face itself can impact the accuracy of the facial recognition process. For example, gait - an individual's manner of walking - can impact how faces are encoded, leading to better identification when the subject is at a distance, and as well as leading to faster identification (Hahn, O'Toole, & Phillips, 2016; Pilz, Vuong, Bülthoff, & Thornton, 2011). By simulating a live viewing environment, including cues such as the voice of the suspect, the accuracy of facial recognition is further increased (Joassin et al., 2011; O'Mahony & Newell, 2012). Both of these elements (gait and voice), which are present in live encounters, are often removed or controlled for in facial recognition studies. Therefore, the methods used in experimental conditions may be underestimating the accuracy achievable with live line-ups (Burton, 2013).

Increased Eyewitness Accuracy

Studies conducted on the recognition of familiar and unfamiliar faces have illustrated an interesting element of facial recognition, namely, the faces of people we know or even those of celebrities are easier to recognise. This is not only due to the number of times that we have seen them, but largely due to the various angles from which they are seen during each viewing, which results in a higher degree of facial variability (Burton, 2013; Ritchie & Burton, 2017; Sandford & Burton, 2014). Seeing a single and static two-dimensional photograph of an unfamiliar face, and then having to accurately identify that face by looking at another photograph, is far more difficult than identifying a familiar face of someone we know or a celebrity from a photograph. This is especially the case when that photograph has been highly controlled to exclude what are considered extraneous details like hair. (Burton, 2013; Ritchie & Burton, 2017). Familiar faces are more easily identifiable, precisely because information is encoded in the context of everyday lives and with high face variability, which consequently enables us to better identify a familiar face, although we only recognise them from a single, static point of view (Burton, Kramer, Ritchie, & Jenkins, 2016). Therefore, it is argued that when unfamiliar faces are used in experiments, it is more difficult to make an accurate identification due to the low face variability (Burton et al., 2016). Further, when viewing a familiar face, the familiar face can be deformed through affine shears, perspective distortions, etc. and have little effect on the ability or time it takes to identify the face (Hole, George, Eaves, & Rasek, 2002). It is thus clear how important high face variability is in facial recognition. It is part of the process that makes representations and encodings of familiar faces invariant to transformations.

As stated above, mimicking and better representing the real-life viewing environment by exposing witnesses to considerable face variability is very important for the encoding of faces, but the necessity of variability in size, movement etc, of faces may be just as important for face *recognition* (Lander & Chuang, 2005; Pilz et al., 2011). However, the relationship between facial variability and recognition has not been as well-explored as the relationship between facial variability and encoding. Research that has been conducted exploring the former relationship has found that the types of movement that the face exhibits, has different effects on facial recognition. Rigid movement, such as nodding or turning of the head, allows a face to be seen from various angles, and increases facial recognition, but emotional movements, such as smiling or frowning, have a significant effect on subsequent recognition accuracy than rigid movements (Knight & Johnston, 1997; Lander & Chuang, 2005; Sinha et al., 2006). Conversely, little research has been conducted on the angle of encoding of the target's face and the consequent impact this could have on the identification behaviour of the witness where face variability is low. In live mediums the recognition angle can be matched to the encoding angle (Colloff et al., 2018). In addition, a study utilising facial recognition software found that facial variability through the use of dynamic images such as video or gifs produced significantly greater recognition accuracy than when using static, two-dimensional images (Zhao & Pietikainen, 2007). This further provides evidence suggesting that increasing face variability through the use of dynamic content increases facial recognition accuracy. Therefore, it can be hypothesized that the accuracy of facial recognition would increase through the use of live Encoding and Recognition mediums. Viewing an encoding event in person, as well as a live line-up, which is presumably the most dynamic form of visual engagement, will then result in even higher levels of accuracy being achieved.

A number of studies have been conducted in ways that better represent natural viewing environments, making use of a combination of videos, dynamic images, and sequenced images to test how movement and variability impacts the accuracy of recognition. A study conducted in 1986, consisting of six conditions, alerted researchers in the field to the importance of variability on both encoding and recognition (Schiff, Banka, & de Bordes

Galdi, 1986). To better represent the viewing environment, static and dynamic sequences were used. The researchers found dynamic images used for recognition to be significantly better for recognition than still photographic images. However, the study did not include live mediums in either the encoding or recognition conditions. Similar follow-up studies have been conducted and these studies have advanced research on the effect of face variability on facial recognition, but none have attempted to examine the difference on recognition accuracy between encoding of live events and events presented in video or dynamic images (Egan et al., 1977; Knight & Johnston, 1997; Lander, Christie, & Bruce, 1999; Lander & Chuang, 2005; O'Toole, Roark, & Abdi, 2002; Westhoff & Troje, 2007).

Rationale and Specific Aims

This omission of live methodology is troubling, given what the literature on facial recognition shows us, specifically that whether variability is obtained through video or dynamic images, the need to include face variability, in the encoding medium as well as the recognition medium, is an important aspect of facial recognition research. Although the methods used in the studies cited above do better represent the natural viewing environment to a certain extent, it is not clear how large an effect the combined factors mentioned - highly controlled images, removing of data used to encode unknown faces, and reducing face variability in recognition conditions - can have on the accuracy of facial recognition. This is especially important for facial recognition research where the typical experimental procedure is to show participants a video and then to test recognition with a still image line-up (Burton, 2013; Ritchie & Burton, 2017).

The main aim of this study was to test whether recognition in a live condition with high face variability would result in higher eyewitness accuracy. The current study also aimed to contribute to the literature on the methods used in facial recognition research in order to inform research practice, which will ultimately result in more accurate eyewitness testimony. The first question this study set out to address is whether there is a significant difference in facial recognition accuracy when the *encoding* of faces occurs in a live 'real world' event with high face variability, or seen on two-dimensional still photographic images with low face variability, and furthermore when the *recognition* of faces occurs in live or two-dimensional still images each with varying degrees of face variability. This is an important question to explore, as South African law requires live line-ups to be used in order for eyewitness identification to be admissible in court, and thus the results could inform both future research and practice (Tredoux & Chiroro, 2005).

The second question this study aimed to address was whether there was a significant difference in the confidence of identification decisions depending on the Encoding and Recognition medium. Confidence of the identification decision can be considered a proxy for accuracy, which is why it was included (Pryke, Lindsay, Dysart, & Dupuis, 2004; Tredoux & Chiroro, 2005) At the outset of this study, I theorised that if I could establish that there is a significant difference in facial recognition accuracy between the conditions explained above, then I will have supported the hypothesis of the positive effect of facial variability in a live experimental context.

Method

I wanted to determine whether witnesses who viewed a live Encoding medium would do better (increased accuracy) in a recognition task than witnesses who saw a still Encoding medium. Moreover, I wanted to see whether their recognition performance was improved further by viewing a live Recognition medium in contrast to viewing stills Recognition medium. Due to the logistics involved in running live Encoding and Recognition mediums, making use of them in research is often impractical. Through the course of this study the challenges and obstacles in using a live condition became abundantly clear but were overcome nevertheless.

Design and Setting

I used a 2 (Encoding medium: live presentation vs still image presentation) X 2 (Recognition medium: live presentation vs still image presentation) X 2 (Perpetrator/Target presence: target absent vs target present) Between-Subjects design to investigate the possible interaction between Encoding and Recognition conditions, as well as possible main effects of Encoding and Recognition conditions on identification accuracy as well as confidence of identification decision.

The study was conducted at the University of Cape Town's (UCT's) Upper Campus during undergraduate psychology tutorial sessions. Initially participants were not aware that they were participating in a study on facial recognition; this was done to more accurately represent incidental learning. Incidental learning is where witnesses are unaware and not primed to pay extra attention to encoding faces (Andrews, Burton, Schweinberger, & Wiese, 2017; Andrews, Jenkins, Cursiter, & Burton, 2015). Participants were given the impression that they were participating in general memory research not specific to faces.

For the encoding event I staged a scenario in which a target acted as though she was part of the research team and had lost the laptop required for the memory research. In the encoding event the target wore makeup and a knitted cap to conceal her hair colour and every day, non-descript clothing (see Appendix A). In the live line-ups all confederates wore white T-shirts with their hair in a high ponytail, no makeup or jewellery, and blue jeans.

Target-present (TP) line-ups included the target in the second position, whereas target-absent (TA) line-ups the second position was substituted with a foil.

In eyewitness research a hit is a positive identification of the target in a target present line-up. A false alarm refers to the identification of a foil in a line-up when the target is present, in other words, falsely identifying an innocent individual. A correct rejection is when the target is absent in the line-up and the "not present" identification option is selected (Egan et al., 1977).

Participants

Sample size. A priori determination of sample size was made for a 4-group factorial ANOVA as well as a logistic regression, medium effect size (f= .25) was selected as an average of the effect sizes indicated by the literature, alpha = .05, power = .80. In total there were 139 participants but one was removed for knowing a foil. After the one participant was removed, N=138 provided power of .83 for both analyses.

Inclusion criteria. Participants were all undergraduate students at UCT with normal or corrected-to-normal vision. No other criteria were necessary. No identifying or demographic information was collected other than student numbers to assign SRPP[1] points. The sample was heterogenous and consisted of both male and female participants from apparently diverse racial backgrounds.

Random assignment. Firstly, the individual tutorial groups were randomly assigned to a condition using a randomization calculation on Microsoft Excel (see Appendix B) e.g. live Encoding medium and live Recognition medium (live/live) or still Encoding medium and live Recognition medium (stills/live). Each participant randomly received a number, each number was randomly assigned to either target absent (TA) or target present (TP). In total, there were 139 participants in the study, which is adequate to obtain the desired statistical power.

Data Management. No identifying or demographic information was collected other than student numbers to assign student research participation programme (SRPP) points.

One course convener was not properly consulted, due to an oversight on my behalf. The convener was annoyed that I had not discusses the matter with them, but the issue was resolved.

Participant's identifying information is stored separately from the data and only identifiable by a previously assigned unique identifier. All data collected are stored behind lock and key and/or are password protected files.

Measures

Live recognition measures. During the viewing of the live line-up, participants were asked to identify the perpetrator/target on an identification form (see Appendix C). Participants could select numbers 1 – 5 (which matched the numbers held by the confederates in the line-up), or could select "not present" and/or "don't know".

Still recognition measures. Participants were asked to identify the perpetrator on an identification form. The form had a still image line-up with the same five confederates participating in the live conditions. Participants were could select numbers 1 – 5 that matched the numbers beneath each photo or could select "not present" and/or "don't know". TA participants received the paper line-up identification (see Appendix D). form without the perpetrator present whereas TP participants received the paper line-up identification form (see Appendix E). with the perpetrator present.

Confidence measure. In order to measure confidence, participants were asked to rate the confidence of their identification decision, but only after their recognition decision was made. The study did not allow for participants to review and change their initial identification response, in order to ensure that their perceived level of confidence did not influence their identification decision.

Participants had to indicate on a line between 50% to 100% how confident they were in their decision by drawing a line and writing in a percentage above the line (see Appendix F). The chosen range of 50% to 100% was given as all selection had to have some measure of confidence (Selmeczy & Dobbins, 2017).

Procedure

I conducted this study after receiving ethical approval by the department of psychology research ethics committee (see Appendix G). The participants were assigned numbers according to the random assignment outlined above. The two Encoding mediums, two Recognition mediums and target presence were combined factorially 2 (Encoding medium: live presentation vs still image presentation) X 2 (Recognition medium: live presentation vs still image presentation) X 2 (Target absent vs Target present).

Sampling Frame. Participants were recruited through the use of convenience sampling by making use of undergraduate psychology tutorial sessions. Tutorial conveners and course conveners were approached for permission to do data collection during tutorials.

Arrival. Upon arrival at the tutorial venue participants were asked if they would consent to participate in the study and be rewarded 2 SRPP points for their participation. Only those that consented were asked to complete the informed consent form (Appendix H) and included in the study. Each participant was given a number and signed consent forms were collected. Participants were briefed on the decoy research study and aims (see Appendix H). Participants did not know they were taking part in an eyewitness study, to better simulate incidental learning, and thought that they were participating in a study on the length of exposure to a stimulus and memory recall.

Encoding medium: Live. Once participants were briefed on the decoy study the perpetrator entered the lecture venue, asking the main researcher where her laptop was. A scripted 20 second interaction took place between the researcher and the target (see Appendix I). Once the perpetrator left, apologies were made, and the researcher and research assistants also left the venue. Thirty minutes later after the tutorial was completed, the researchers returned and moved on to the applicable recognition condition (see below).

Encoding medium: Still image presentation. Once participants were briefed on the decoy study a scripted 20 second dialogue was read to the participants outlining the same event as in the live encoding. A photo of the target (see Appendix A) printed to match the size of the face of the perpetrator, was shown to the participants for 20 seconds. Once this was done, the researcher and research assistants left the venue. Thirty minutes later the researchers returned and moved on to the applicable recognition condition (see below).

Distractor task. The tutorial attended by the participants provided a sufficient distractor task ensuring participants were occupied for 30minutes. This is done to simulate the 'real world' where eyewitnesses seldom if ever have the opportunity to view a line-up straight after the encoding event (Carol & Schreiber Compo, 2018; Christie & Bruce, 1998; Pansky & Nemets, 2012).

Recognition medium: Live. This condition took place in the same venue as the encoding event. Participants were briefed on the procedures to follow as outlined in the Identification form (see Appendix C). They were required to identify the target that they saw in the encoding events. TP line-ups were controlled to consist of the target and four foils all of similar height, build and complexion. TA line-ups were controlled to consist of the same four foils, plus an additional foil of similar height, build and complexion. Hair colour was controlled by using a knitted cap in the Encoding medium, so there was no need to control hair colour in the line-up. Before the line-up entered the venue, those randomly assigned to TP were asked to leave the venue and were escorted by a research assistant to another venue where the line-up could not be seen. The TA line-up then took place and once completed, all confederates left the venue to a location where they could not be seen by participants. The TA participants then left the venue and the TP participants returned. The TP line-up then took place. Both TA and TP line-ups started with all confederates facing forward for 30 seconds, then turned to face right for 30 seconds, then left for 30 seconds, and ended facing forward.

This was done to emulate what the South African Police Service might do (Tredoux & Chiroro, 2005), as witnesses are allowed to request to view the target from multiple angles. This procedure allows for increased face variability available in live Recognition mediums. Participants were given as much time as they needed to make a recognition decision.

Recognition medium: Still image presentation. This condition took place in the same venue as the encoding event. Participants were briefed on the procedures to follow as outlined in the Identification form (see Appendix D & E). TA participants were shown five photos of the foils as in the live event and TP were shown photos of the same target and foils as in the live event. There was only one photo of each foil and the target that participants could view. In the photo the confederates were facing the camera directly. Participants were given as much time as they needed to make a recognition decision.

Debriefing. Once the recognition condition was completed, participants were verbally debriefed as to the actual purpose of the study and the reasons why it was necessary to deceive them. Participants were also given a debriefing form (see Appendix K) with information and contact details should they wish to have more information.

The research utilised deception to control the way in which faces are recognised in an attempt to simulate a 'real world' environment. By deceiving participants as to the true aim of the study, they were not be primed to pay special attention to faces when encoding. The debriefing session fully disclosed the aim of the research and participants were given the opportunity to ask clarifying questions.

Significance and Contribution of the Study

The study aimed to contribute to the literature on facial recognition, specifically adding value through the combination of live and still Encoding mediums, as well as live line-up and still image presentation line-up for Recognition mediums. The combination of these conditions has only been conducted recently in facial recognition studies (Fitzgerald & Price, 2018). Most studies in this field utilise videos and/or still image presentations to test facial recognition hypotheses and could be ignoring a very important aspect of facial recognition, which is the effect of live Encoding and Recognition mediums on recognition accuracy. This study could contribute to a better understanding of which conditions to include or exclude when doing facial recognition research. Furthermore, this study could make a possible contribution to increase the ecological validity of facial recognition research through better representing the ‘real world’, which would consequently inform eyewitness testimony procedures. Most importantly, this research is directly relevant to practice in South Africa where live line-ups are usually the only form of eyewitness testimony admissible by law as mentioned above (Tredoux & Chiroro, 2005). This research serves to affirm this practice, and offers reason to continue this practice, despite any challenges that might exist in the execution of live line-ups.

Results

In the data, one case was removed due to a participant knowing one of the foils and consequently invalidating the line-up test. All data were entered into Microsoft Excel and initial descriptive statistics were computed. I then analysed the accuracy of recognition in the Encoding and Recognition mediums using a logistic regression. Once this was completed, I conducted a factorial ANOVA, with SPSS, to analyse the confidence of identification decisions. Table 1 below shows the frequency of responses for all combinations of Encoding and Recognition mediums.

Increased Eyewitness Accuracy

Table 1.

Response frequency

	Live Encoding	Still Image Encoding	Total
Live Recognition	24	36	**60**
Still Recognition	44	34	**78**
Total	**68**	**70**	**138**

Comparing Accuracy Across Conditions

To test the hypothesis of accuracy varying according to medium of presentation across encoding and recognition, I conducted a logistic regression. The dependent variable was accuracy, and it was dichotomous. The category of accuracy was collapsed to include correct identifications as well as correct rejections. In a TP line-up there are four possible decisions that can be made: A correct identification (hit), a false identification (false alarm), saying the target was not present (incorrect rejection) or not making any decision (don't know). In a TA line-up there are three possible decisions that can be made: A false alarm, a correct rejection, the correct answer for a TA line-up, or no decision. The predictors were entered hierarchically, starting with Encoding medium (live vs still), then recognition medium (live vs still) and finally the interaction of Encoding and Recognition mediums.

The data in Table 2 suggests that participants in the live Encoding medium and live Recognition medium were most accurate in identifying the target correctly as well as identifying that the target was absent. The lowest accuracy for identification and correct rejection was live Encoding medium and stills Recognition medium. This is also graphically displayed in Figure 1.

Table 2.

Proportion Recognition Accuracy as a function of Encoding and Recognition Mediums

Dependent Variable: Accurate

Recognition	Encoding	Proportion	N
Stills	Stills	.53	34
	Live	.41	44
Live	Stills	.44	36
	Live	.71	24

In the null model of the analysis (see Appendix L), gives a baseline to compare the predictive capabilities of the model to when predictors are included and will be discussed below. Overall the null model in correctly classifies 50% of correct responses when all are assigned to the group ‘correct’.

The classification table below in Table 3 indicates that the model predicts group membership better than chance for both incorrect and correct although only slightly better for ‘correct’ but fairly better for ‘incorrect’. Overall of the prediction model = 58.7 which is better than the null model = 50%.

Table 3.
Classification Table[a]

			Predicted		
			Accurate		
	Observed		Incorrect	Correct	% Correct
Step 1	Accurate	Incorrect	46	23	66.7
		Correct	34	35	50.7
	Overall Percentage				58.7

Encoding medium and Recognition medium were not significant but the interaction effect of Encoding medium by Recognition medium was significant, Wald = 4.84, $p = .028$, $\beta = 1.60$, SE = .73, Exp(B) = 4.93. Looking at Table 4 below we can see that for Encoding by Recognition medium the coefficient is significantly different from zero ($\beta = 1.60$) and thus confirms that the predictor is making a significant contribution to the prediction of responses. The plot below in Figure 1 visually displays the interaction of Encoding by Recognition medium clearly. We can see that the significant interaction seems to be mainly due to the big difference between the accuracy proportion for the live Encoding medium by live Recognition medium interaction vs live Encoding medium and stills Recognition medium. The effect sizes given by Cox & Snell R Square = .05, Nagelkerke R Square = .06 as well as R_L^2 (6.32/191.31 = .03) are fairly small. For logistic regression it is better to use β (1.60), the odds ratio (4.93) and confidence intervals (1.19; 20.45) to establish the effect size.

Table 4.
Variables in the Equation

								95% C.I.for EXP(B)	
		B	S.E.	Wald	*df*	*p.*	Exp(B)	Lower	Upper
Step 1[a]	Encoding	-.49	.46	1.11	1	.292	.62	.25	1.52
	Recognition	-.34	.48	.50	1	.478	.71	.28	1.82
	Encoding by Recognition	1.60	.73	4.84	1	.028	4.93	1.19	20.45
	Constant	.12	.34	.12	1	.732	1.13		

Note. Variable(s) entered on step 1: Encoding, Recognition, Encoding * Recognition.

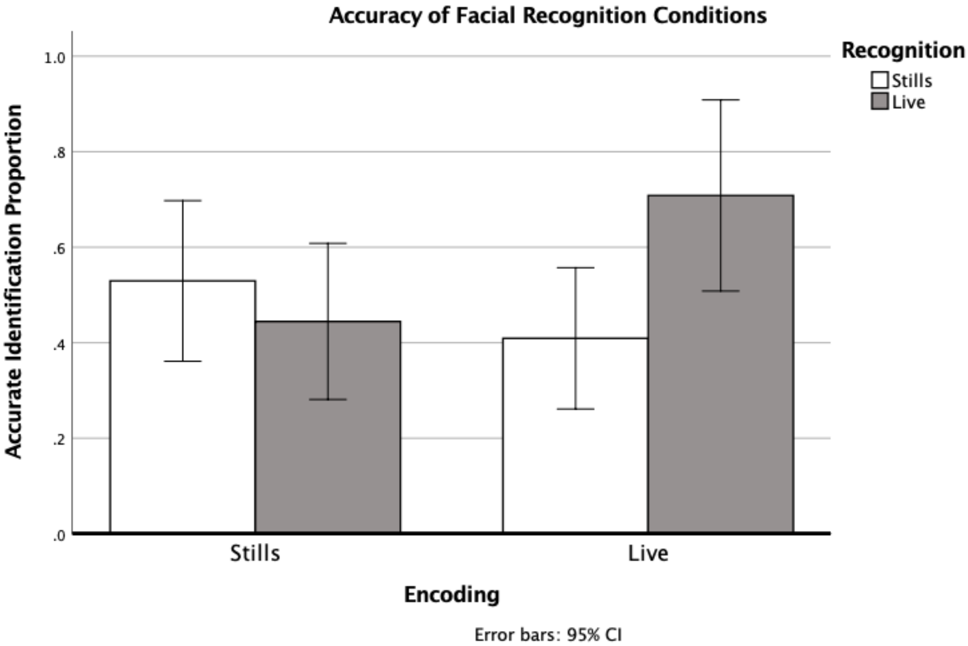

Figure 1. Proportions of accurate identification for live and stills mediums.

The next analysis was done for the confidence measurement, which could be considered a proxy for accuracy. As mentioned above, confidence is a continuous variable ranging from 50 to 100. This measure was used as a way to establish how confident participants were in relation to their identification decision.

Confidence of Identification Decisions

Descriptive Statistics. Table 5 reports the mean confidence scores of each set of test mediums. The data in Table 5 suggests that participants in the live Encoding medium and live Recognition medium were most confident in their identification decision. The lowest confidence was live Encoding medium and stills Recognition medium. This is also graphically displayed in Figure 2 below.

Table 5.

Mean Confidence Score of Test Mediums

Dependent Variable: Confidence

Recognition	Encoding	Mean	SD	N
Stills	Stills	80.21	17.37	34
	Live	73.80	16.81	44
Live	Stills	77.86	12.79	36
	Live	84.08	16.70	24

Increased Eyewitness Accuracy

In this analysis I compared means over factors (confidence, live Encoding, still Encoding, live Recognition and still Recognition) and the interaction, using a factorial ANOVA. All assumptions for ANOVA were met (see Appendix M). From the Test of Between-Subjects Effects in Table 6, we can see that there were no significant main effects. There was however a significant interaction effect [F (1,134) = 5.14, p = .025] for Encoding by Recognition with a small effect size (η^2 = .04).

Table 6.

Tests of Between-Subjects Effects of Encoding and Recognition Mediums

Dependent Variable: Confidence

Source	Type III Sum of Squares	*df*	Mean Square	F	*p*.	Partial Eta^2	Observed Power[b]
Encoding	.29	1	.29	<.01	.973	<.01	.05
Recognition	518.93	1	518.93	2.03	.156	.02	.29
Encoding * Recognition	1312.55	1	1312.55	5.14	.025	.04	.61
Error	34240.86	134	255.53				
Total	880501.00	138					
Corrected Total	36066.04	137					

Note. R Squared = .051 (Adjusted R Squared = .029)

Means Plot. Figure 2 reports the cell means for the factorial design, and it is clear that there is a strong disordinal interaction. The disordinal nature of the interaction would suggest that focus should be placed on the interaction rather than the main effects.

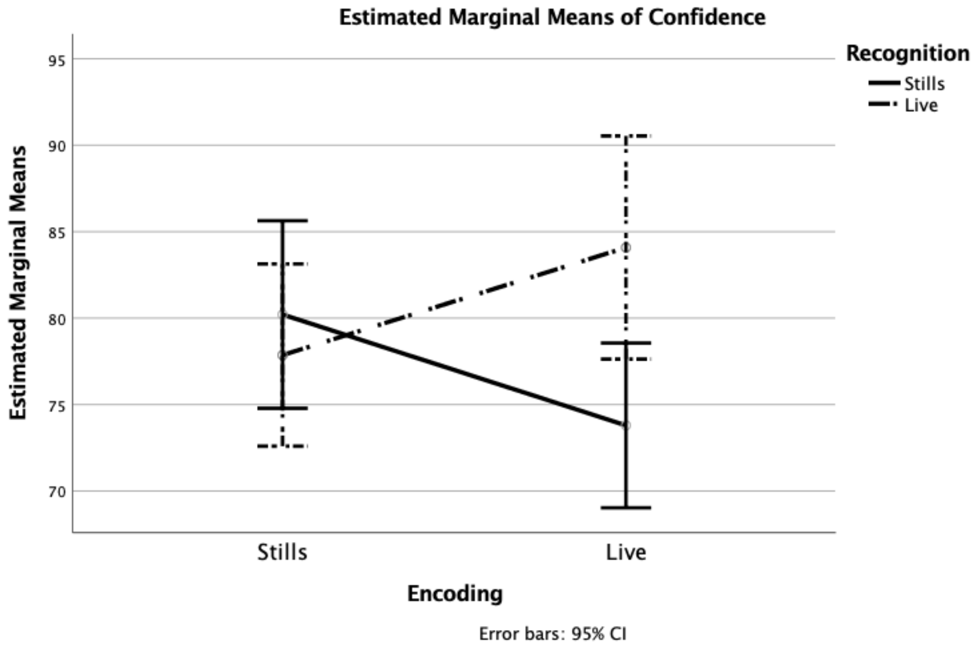

Figure 2. Means plot indicating the interaction effect of live and stills mediums on confidence.

Post-hoc Tests. Due to the disordinal interaction of Encoding by Recognition, a post-hoc test was done to investigate the interaction further. Table 7 indicates that there are no significant differences in the effect stills Encoding medium had on stills or live Recognition mediums for confidence. There are however significant differences in the effect recognition had on confidence of those who encoded live. Participants who encoded live and then who completed recognition in the live condition were significantly more confident (M = 84.08, SD 16.70) that those who completed recognition in the still condition (M = 73.80, SD = 16.81). When the Encoding medium was stills, then the difference between encoding a still image and recognising a live image was not significant (p = .541). When the Encoding medium was stills, then the difference between encoding a live image and recognising a stills image was not significant (p = .541). When the Encoding medium was live, then the difference between encoding a still image and recognising a live image was significant (p = .012). When the Encoding medium was live, then the difference between encoding a live image and recognising a stills image was significant (p = .012).

Table 7.
Pairwise Comparisons
Dependent Variable: Confidence

Encoding	(I) Recognition	(J) Recognition	Mean Difference (I-J)	S. E.	*p*.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
Stills	Stills	Live	2.345	3.823	.541	-5.216	9.906
	Live	Stills	-2.345	3.823	.541	-9.906	5.216
Live	Stills	Live	-10.288*	4.056	.012	-18.311	-2.265
	Live	Stills	10.288*	4.056	.012	2.265	18.311

Note. Based on estimated marginal means
*. The mean difference is significant at the .050 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Discussion

This study addressed two questions in the field of facial recognition studies. The first question was whether accuracy of facial recognition would increase in a live recognition condition as a result of the increase of face variability offered through a live medium. Variability in this context is manifested in a live event through more angles to view a face from, different lighting on the face when it moves, as well as possible facial expression and so forth.

This was pursued by examining the predictive abilities of a logistic regression model. Participant responses in the live Encoding medium and live Recognition medium were significantly more accurate than any of the other conditions. The results β = 1.60, OR = 4.93, CI = 1.19; 20.45 allow clear conclusions to be made, showing that the model is good at predicting the outcome of accuracy of positive identification and correct rejection. This is supported by the mean accurate score of the live Encoding medium and live Recognition medium that was 70.83 %, as well as the live Encoding medium and stills Recognition medium that had the lowest mean accurate score of 38.64 %. The live Encoding medium and live Recognition medium was almost twice as accurate as the live/stills condition.

The logistic regression analysis showed no significance in the main effect of encoding or recognition but found a significant interaction effect between Encoding and Recognition mediums. The analysis showed that live Recognition medium was better than stills Recognition medium but only when the Encoding medium was also live. It didn’t show the reverse though. The data shows that the accuracy of live Encoding medium and stills Recognition medium was the lowest of all four conditions. Both of these results are important from a practical point of view as the majority of encoding events in practice are live but some jurisdictions still make use of stills line-ups and not live line-ups (Fitzgerald & Price, 2018). This gives cause to question the accuracy of using still line-ups. The data shows that live line-ups are far superior to stills line-ups and supports the decision of South African courts to prefer live line-ups in eyewitness testimony.

The second question that this study aimed to address was whether there was a significant difference in the confidence of identification decisions, depending on the medium of encoding and recognition. A difference depending on conditions would support the core hypothesis, in that greater confidence is an indicator of an intentional selection choice in the recognition phase, and not the result of luck or coincidence, and is consequently a proxy for accuracy. This means that the greater accuracy evident in the live Encoding medium and live Recognition medium is not the product of randomness. There was an interaction effect on live Encoding medium by stills Recognition medium. There was also an interaction effect on live Encoding medium by the live Recognition medium. Those who encoded live and recognized live were significantly more confident in their identification decision and inversely, those who encoded live and recognized stills were significantly less confident than live/live.

Increased Eyewitness Accuracy

Many of the studies conducted on facial recognition research and eyewitness research make use only of video as an Encoding medium and an array of stills Recognition mediums. There are very few studies that have been conducted that make use of live Encoding mediums as well as live line-up in the recognition stage, mainly due to the logistic difficulty of running such studies. Intuitively, it makes sense that a live line-up would be more accurate, given what the research on facial variability has concluded, but of the studies that have run live events, most have found no significant difference between live and non-live conditions in recognition accuracy (Fitzgerald & Price, 2018). Consequently, most studies on facial recognition avoid live conditions due to this finding and the costs and logistical challenges of live mediums.

The data in the current study is not consistent with the research findings of the majority of previous facial recognition research that included a live condition in recognition (Fitzgerald, Oriet, & Price, 2015). As mentioned above, most studies show that the results are very similar regardless of which mediums are used (Clark, 2012; Cutler et al., 1994; Horry, Memon, Wright, & Milne, 2012). However, the data in this study shows that there is an increase in accurate identification as well as an increase in correct rejection when using live conditions in eyewitness research. As mentioned before in eyewitness line-ups, it is not only important to increase accurate identification of the target/perpetrator but also to use a test medium that reduces false alarms and increases correct rejections (Cutler et al., 1994; Egan et al., 1977). The data shows that overall live/live mediums does exactly this, increasing positive identification and increasing correct rejections.

A practical implication of this research would be in relation to the types of line-ups used by the police and the legislation that surrounds them. In South Africa, live line-ups are still preferred by the courts and stills line-ups are only accepted in extreme cases when no other option is available. The findings of this research supports the current preferred practice, and offers reason why it should continue, even though it is a costly as well as lengthy procedure to utilise (Fitzgerald & Price, 2018). The result of the live Encoding medium and stills Recognition medium, which had the lowest accuracy in both positive identification and correct rejection, could have much larger implications especially in countries such as the United States of America and parts of Australia, where stills line-ups are preferred over live line-ups (Fitzgerald & Price, 2018). These findings would give cause for those jurisdictions that make use of still image line-ups to review their current police procedure and policies on eyewitness line-ups, as their chosen method is not as accurate as it could be according to the data.

A further implication that this study could have, is on the findings of research conducted without the use of live conditions. This could give cause, to a certain degree, to critique the findings of previous facial recognition studies where face variability was absent in recognition conditions (Burton, 2013). If a live condition delivers a significantly different result to its stills counterpart, as the data indicates, it could mean that all facial recognition and eyewitness studies are at stake. This is because using live line-ups could deliver different results to that of stills line-ups. This however is not a certainty and would have to be tested empirically.

Limitations and Direction for Future Research

All efforts were made to ensure that the study was conducted in as sound a statistical design as possible.

A replication of this study is recommended to establish whether the same results can be obtained by using live Encoding and Recognition mediums. Once this has been done other variables can be added such as additional targets. Only one target was used due to a limitation on funding. With only one target the generalisability of the study is limited. When conducting the study with two targets, the results can be compared to see whether high accuracy was obtained through the Encoding and Recognition mediums or through uniqueness of targets. For future research two targets should be used and results compared to establish how generalisable the results are.

Randomisation to each condition was done at the group level and only TA and TP at the individual level as it was not logistically possible to randomly assign all 139 participants to the various conditions. Due to the limited funds available, the current randomisation method was the only reasonable way to ensure the needed sample size was obtained without having to run the study again if all participants did not arrive, thereby incurring additional costs. Future studies should endeavour to randomly assign participants, not only to TA and TP conditions, but also to the Encoding and Recognition mediums at individual level.

For future research a larger sample is advised to ensure sufficient power can be obtained to analyse the data to a more granular level.

Future research should also consider including more of the physical cues present in a live medium, such as gait, voice, facial expressions, build and height, as predictor variables to establish whether they significantly add to the model (Cutler et al., 1994).

The study design and funding did not allow for an exact replication of line-up procedures where only one participant views the encoding and recognition condition at a time. However, the study did control the viewing angle of each participant for the encoding and recognition of the live events. To achieve this, during encoding, the target was required to move to the front of the venue as quickly as possible and move her head and face around to ensure that multiple angles of her face were seen by all participants. During recognition, the confederates were required to turn to each side for participants to see different angles of their faces. Collecting data one participant at a time allows the standardisation of the viewing angle and distance from target for each participant. However, the costs of conducting data collection in this way would prove to be too much for this study, specifically the costs of employing the confederates over a long period of time.

The confederates were not actors, but rather volunteers drawn from the researcher's networks who were compensated for their time. The challenge with this is that the confederates, and in particular the target, might unduly influence the outcome of the live recognition event by appearing guilty, which would serve as a cue for participants to recognise them (Fitzgerald & Price, 2018).

Summary and Conclusion

The need for facial recognition procedures that deliver the most accurate identification, reduce false alarms, and increase correct rejections are of utmost importance to both eyewitness research and practice. This research found that live Encoding medium and live Recognition medium will result in higher accuracy of eyewitness identification. Therefore, the results of this study provide enough evidence to re-evaluate the ways in which facial recognition research is conducted and to review policies on conducting eyewitness line-ups used in practice. Additionally, the results provide cause to establish whether the benefits of increased accuracy through live Encoding and Recognition mediums outweigh the costs.

To my knowledge there are no recently published papers, and only one paper submitted for publication, comparing the effects of live conditions with other more commonly used encoding and recognition conditions. The data is clear that there is an interaction for both accuracy as well as confidence in live recognition conditions. This study makes clear the need for additional research that includes live conditions, and it supports unequivocally the shifting trajectory of eyewitness research into exploring the relevance of face variability in eyewitness recognition and identification.

Increased Eyewitness Accuracy

This study aimed to contribute to the strengthening of facial recognition research and to the practice of assisting eyewitnesses recognise accurately the perpetrators of crimes. This study, which challenged existing research in the field, emphasised the importance of live encoding and recognition mediums in eyewitness testimony, and successfully made this intended contribution.

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Appendices

Appendix A

Target Still Image

Appendix B

Randomisation Schedule

Group Randomisation

Tut Group	**Condition**
1	Live/Live
2	Stills/Stills
3	Live/Live
4	Stills/Stills
5	Live/Stills
6	Stills/Live
7	Stills/Live
8	Live/Live
9	Stills/Live
10	Live/Stills
11	Stills/Stills
12	Live/Stills

Stills/Stills

09h00		10h00		14h00	
Participant No	Target	Participant No	Target	Participant No	Target
1	TP	1	TA	1	TA
2	TA	2	TP	2	TA
3	TP	3	TP	3	TA
4	TA	4	TP	4	TP
5	TP	5	TP	5	TP
6	TA	6	TA	6	TP
7	TA	7	TP	7	TA
8	TA	8	TP	8	TP
9	TA	9	TA	9	TA
10	TA	10	TA	10	TA
11	TP	11	TP	11	TP
12	TA	12	TP	12	TA
13	TA	13	TA	13	TA
14	TP	14	TP	14	TP
15	TA	15	TA	15	TA
16	TP	16	TA	16	TP
17	TP	17	TA	17	TP
18	TP	18	TP	18	TP
19	TP	19	TA		

Appendix B Continued

Stills/Live					
08h00		11h00		13h00	
Participant No	Target	Participant No	Target	Participant No	Target
1	TP	1	TA	1	TP
2	TA	2	TA	2	TP
3	TP	3	TA	3	TA
4	TA	4	TP	4	TA
5	TA	5	TP	5	TP
6	TA	6	TP	6	TP
7	TA	7	TP	7	TP
8	TA	8	TA	8	TP
9	TP	9	TA	9	TA
10	TP	10	TP	10	TA
11	TP	11	TA	11	TP
12	TA	12	TP	12	TA
13	TP	13	TA	13	TA
14	TP	14	TA	14	TA
15	TA	15	TP	15	TA
16	TP	16	TA	16	TP
17	TA	17	TP		
18	TP	18	TP		

Appendix B Continued

Live/Stills					
09h00		12h00		14h00	
Participant No	Target	Participant No	Target	Participant No	Target
1	TA	1	TA	1	TA
2	TA	2	TP	2	TP
3	TP	3	TA	3	TA
4	TP	4	TA	4	TP
5	TP	5	TA	5	TA
6	TP	6	TP	6	TP
7	TP	7	TA	7	TA
8	TA	8	TA	8	TP
9	TP	9	TA	9	TA
10	TP	10	TP	10	TA
11	TA	11	TA	11	TP
12	TA	12	TP	12	TP
13	TA	13	TA	13	TA
14	TA	14	TP	14	TP
15	TP	15	TP	15	TA
16	TA	16	TP	16	TP
		17	TP	17	TP
		18	TP	18	TA
				19	TP
				20	TA

Live/Live					
10h00		12h00		12h00	
Participant No	Target	Participant No	Target	Participant No	Target
1	TA	1	TA	1	TA
2	TA	2	TA	2	TA
3	TA	3	TA	3	TA
4	TA	4	TA	4	TA
5	TA	5	TA	5	TA
6	TA	6	TA	6	TA
7	TA	7	TA	7	TA
8	TA	8	TP	8	TA
9	TP	9	TP	9	TP
10	TP	10	TP	10	TP
11	TP	11	TP	11	TP
12	TP	12	TP	12	TP
13	TP	13	TP	13	TP
14	TP			14	TP
15	TP			15	TP
16	TP			16	TP

Appendix C

Live Identification Form

Participant Number: ___________________

Instructions

You need to identify the person who, at the start of the tutorial, asked the researcher where her laptop was and accused them of losing it. While looking at the line-up, please take your time before deciding. The line-up members will be asked to face forward, right, left and then forward again. The person may or may not be present in the line-up. If you recognise the person as any of those in the line-up, make a cross X in the appropriate box in **Pen**. If you do not recognise the person or are unsure make a cross X in the appropriate box in **Pen.**

Please make sure that no one is able to see which person you have selected and turn your identification form over as soon as you have made your mark.

If you know anyone in the line-up, please notify the researcher

Perpetrator Number	1	2	3	4	5	Not Present	Do not Know
Identification Mark							

Appendix D

Target Absent Identification Form

Participant Number: ___________________

Instructions

You need to identify the person who, at the start of the tutorial, asked the researcher where her laptop was and accused them of losing it. While looking at the line-up, please take your time before deciding. The person may or may not be present in the line-up.
If you recognise the person as any of those in the line-up, make a cross X in the appropriate box in **Pen**. If you do not recognise the person or are unsure make a cross X in the appropriate box in **Pen.**
Please make sure that no one is able to see which person you have selected and turn your identification form over as soon as you have made your mark.

1

2

3

4

5

If you know anyone in the line-up, please notify the researcher

Perpetrator Number	1	2	3	4	5	Not Present	Do not Know
Identification Mark							

Appendix E

Target Present Identification Form

Participant Number: ________________

Instructions

You need to identify the person who, at the start of the tutorial, asked the researcher where her laptop was and accused them of losing it. While looking at the line-up, please take your time before deciding. The person may or may not be present in the line-up.
If you recognise the person as any of those in the line-up, make a cross X in the appropriate box in **Pen**. If you do not recognise the person or are unsure make a cross X in the appropriate box in **Pen.**
Please make sure that no one is able to see which person you have selected and turn your identification form over as soon as you have made your mark.


1


2


3


4


5

If you know anyone in the line-up, please notify the researcher

Perpetrator Number	1	2	3	4	5	Not Present	Do not Know
Identification Mark							

Appendix F

Confidence

On a Scale ranging from 50 – 100, where 50 is moderately confident and 100 indicates absolutely confident, how confident are you with the selection that you have just made?

Please draw a vertical line and enter a number between 50 and 100 below in the space provided

50%
Moderately
confident

75%
Confident

100%
Extremely
confident

Indicate on this line how confident you are in your decision. Make sure to indicate a line for where your confidence falls between 50% and 100%, and also include a value to accompany your confidence position

Appendix G

Ethical Clearance

UNIVERSITY OF CAPE TOWN

Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3417
Fax No. (021) 650 4104

30 May 2018

Calvyn Du Toit
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Calvyn

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your study, *Facial Recognition Research Methods: The Effects of Encoding Variation on Recognition Performance.* The reference number is PSY2018 -025

I wish you all the best for your study.

Yours sincerely

Lauren Wild (PhD)
Associate Professor
Chair: Ethics Review Committee

University of Cape Town
ΨPSYCHOLOGY DEPARTMENT
Upper Campus
Rondebosch

Appendix H

Informed Consent

University of Cape Town

Purpose

I am a UCT Psychology Honours student investigating the effect the length of exposure to a stimulus has on the quality of memory recall. What I aim to explore is how the amount of information you are exposed to affects the quality of memory recall.

Procedure

Should you decide to participate in this study, you will be shown multimedia resources, and then answer a set of questions about the resources. The study will take place within your tutorial. This should take you between 30-45min and you will be rewarded **2 SRPP** points.

Possible Risks

There is minimal to no risk associated with this study

Possible Benefits

If you complete this study you will be awarded **2 SRPP** points as well as participate in a unique study.

Voluntary Participation

Participation in this study is completely voluntary. You are free to refuse to answer any question without giving reasons for your refusal. Your decision regarding participation in this study will not affect your grades or academic career. If you decide to participate, you are free to change your mind and stop participation at any time without any negative consequences.

Confidentiality

All information collected during this study about you will be kept strictly confidential. All identifying information about you, such as your name, consent form and/or other identifying information will be kept in a separate secure locked location. There will be no link between the data gathered and these identifying documents. Identification is only needed for SRPP purposes. Should any reports or publications include data collected in this study, it will not identify you or any other participants.

Questions

Should you have any questions regarding the study, please notify myself or one of the research assistants. You can contact me at DTTCAL001@myuct.ac.za

If you have questions about your rights as a study participant, or any comments or complaints about the study, please contact:

Rosalind Adams at the UCT Department of Psychology.

Phone:021 650 3417

Email: rosalind.adams@uct.ac.za.

Appendix H Continued

I hereby confirm that I understand what is required from me in the study and all my questions have been answered. I understand the possible risks and benefits in taking part in the study. I hereby consent voluntarily to participate in this study.

____
Name of Participant

________________________________ ___________________________________
Signature of Participant Date

Appendix I

Scripted Dialog for Live Encoding Medium

Students are sitting in a lecture venue being addressed by a post grad student (PGS) about a research project when suddenly a student (target) enters the venue.

Target: Do you have my laptop? Where did you put my laptop?

PSG: I don’t have your laptop, I left it in the last venue we were in.

Target: You said you were going to take it.

PSG: I didn’t I told you I had to get to the next venue and that you need to take it.

Target: It’s not there! You said you were going to take it (Visibly upset)

PSG: I’m really sorry everyone. I have to leave and sort this out. I’ll be back shortly. Please hold on to your participant numbers.

The post grad student leaves the venue with the other student (target) to go and look for the missing laptop.

Appendix J

Scripted Narrative for Still Encoding Medium

Students are sitting in a lecture venue being addressed by a post grad student about a research project when suddenly a student enters the venue. She is frantically looking for her laptop and asks the post grad student where he had put her laptop. Do you have my laptop? No I don't, you said you were going to take it. I left it in the last venue we were in. It's not there she exclaims, you said you were going to take it. The student is visibly upset and angry with the post grad student. The post grad student addressing the class excuses himself and leaves the venue with the other student to go and look for the missing laptop.

Appendix K

Debriefing Form

Facial Recognition Research Method

University of Cape Town

Debriefing Form

Thank you for participating in the research. The purpose of this form is to explain the study to you and provide more information regarding the method used and the true aim of the research.

Name of participant

____

Principal Investigators
Calvyn du Toit
Honour Student
Department of Psychology
University of Cape Town
DTTCAL001@myuct.ac.za

Professor Colin Tredoux
Department of Psychology
University of Cape Town
Colin.tredoux@uct.ac.za

Purpose of the study

The study aims to contribute to the literature on the method of facial recognition research in order to inform research practice that will ultimately result in better eyewitness testimony. The question this study intends to answer is whether there is a significant difference in facial recognition accuracy when the *encoding* of faces occurs in a live 'real world' event with high face variability, or seen on two-dimensional still images with low face variability, and furthermore when the *recognition* of faces occurs in live or two-dimensional still images each with varying degrees of face variability.

Procedure followed during the research and the need for deception

During this research, you were made to believe that the research ended suddenly, to look for a laptop and was to continue. This was done to simulate a 'real world' experience of an event that would require a facial recognition account. The aim of the deception was to avoid priming you to pay special attention when encoding faces. There were four different conditions of which you would have participated in one. Encoding either happened in a live event or viewing stills images. The recognition part of the study could have been in either; a live line-up or a paper photo line-up.

Further requirements

Please do not disclose any details of the study to your friends or classmates as this will bias future participants and skew the data. Please ensure that you have included your name and student number on the consent form to ensure you receive the SRPP points.

Appendix K Continued

Signatures

As a representative of this study, I have explained to the participant, in detail, the purpose, the procedures, and any deception used in this research study.

____ ____________________
Signature of Person Obtaining Consent Date

I have been informed, in detail, about this study's purpose, procedures, and deceptions. I have been given the opportunity to ask questions before I sign. By signing this form, I am not waiving any of my legal rights.

____ ____________________
Signature of Person Consenting Date

Appendix L

Statistical Analysis

Logistic Regression

Table 8.
Iteration History[a,b,c]

Iteration		-2 Log likelihood	Coefficients Constant
Step 0	1	191.31	<.01

Note.
a. Constant is included in the model.
b. Initial -2 Log Likelihood: 191.309
c. Estimation terminated at iteration number 1 because parameter estimates changed by less than .001.

Table 9.
Classification Table[a,b]

Observed			Predicted: Accurate Incorrect	Predicted: Accurate Correct	Predicted: % Correct
Step 0	Accurate	Incorrect	0	69	.0
		Correct	0	69	100.0
	Overall Percentage				50.0

Table 10.
Variables in the Equation

		B	S.E.	Wald	*df*	*p.*	Exp(B)
Step 0	Constant	<.01	.17	.000	1	1.000	1.00

Table 11.
Variables not in the Equation

			Score	*df*	*p.*
Step 0	Variables	Encoding	.12	1	.733
		Recognition	1.06	1	.303
		Encoding by Recognition	5.04	1	.025
	Overall Statistics		6.18	3	.103

Appendix L Continued

Table 12.

Omnibus Tests of Model Coefficients

		Chi-square	*df*	*p.*
Step 1	Step	6.322	3	.097
	Block	6.322	3	.097
	Model	6.322	3	.097

Table 13.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	184.98[a]	.05	.06

Note. a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

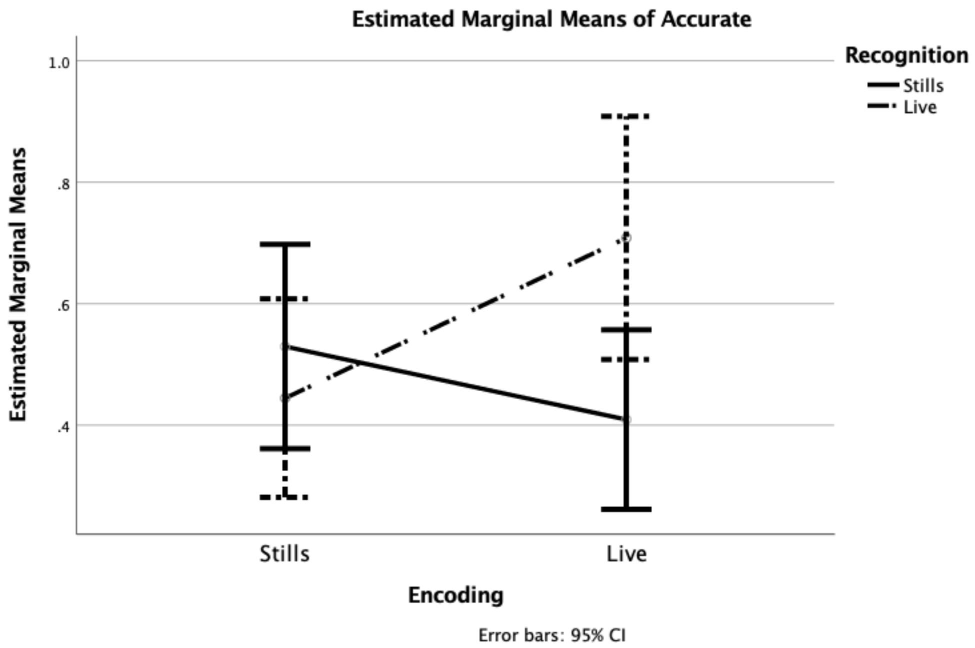

Figure 3. Means plot showing interaction of live and stills medium for accuracy.

Table 14

Proportion of Accurate Responses

		Live			Stills		
		Encoding	Accurate	% Accurate	Encoding	Accurate	% Accurate
Recognition	Live	24	17	70.83	36	16	44.44
	Stills	44	17	38.64	34	18	52.94

Appendix M

Assumptions

Normality. Analysis of the plots in Figure 4 shows that the data is not normally distributed and that there are some outliers and will proceed with caution.

Homogeneity of variance. However, Levene's test is not significant indicating the group variances are similar and assumption upheld.

Independence of observations. Each group had different people in them.

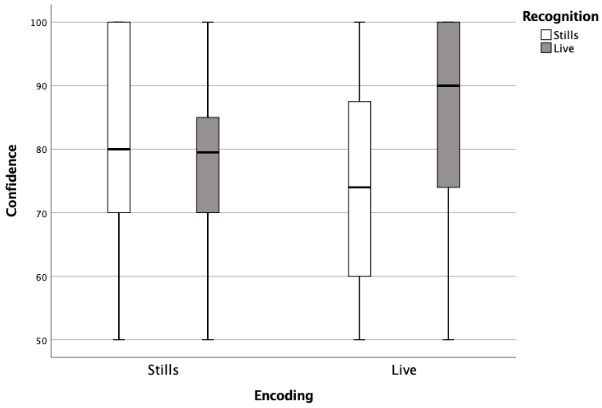

Figure 4. Box plot indicating data distribution.

Table 15

Levene's Test of Equality of Error Variances[a,b]

		Levene Statistic	*df1*	*df2*	*p.*
Confidence	Based on Mean	2.388	3	134	.072
	Based on Median	2.144	3	134	.098
	Based on Median and with adjusted df	2.144	3	128.875	.098
	Based on trimmed mean	2.395	3	134	.071

Note. Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Confidence

b. Design: Intercept + Encoding + Recognition + Encoding * Recognition

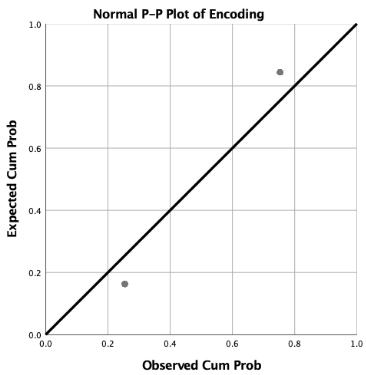

Figure 5.

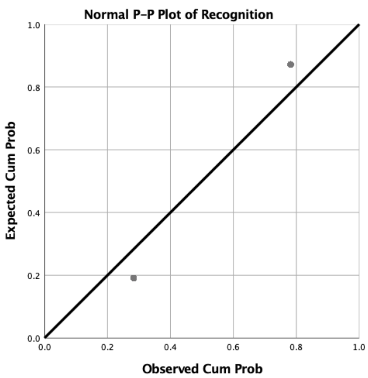

Figure 6.

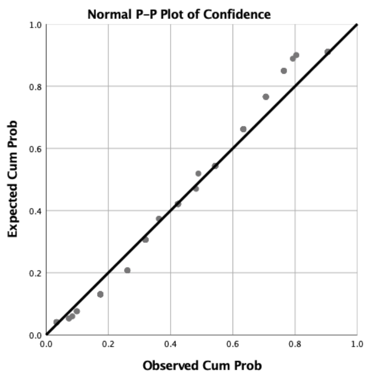

Figure 7.

Appendix N

Image Capture Release form

- Remove glasses, jewellery, earrings etc.
- Ensure neutral facial expression

Release of photographic images

Thank you for agreeing to be filmed and photographed for our lineup research. We may wish to use your image in talks when we present our research at scientific conferences, and in articles when we publish our research in scientific journals. We've attached an example image below:

I hereby give permission to Calvyn du Toit and Colin Tredoux to use my image in their line-up research and to reproduce my image for scientific talks and articles.

Name (print):

Signature:

Date:

Email address:

Calvyn du Toit
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