Producing Names with a Bizarre Voice Does Not Improve Memory for Face–Name Pairs

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Abstract

Most social interactions require correct identification of an individual's face and name; however, this can be a rather challenging task. The present study examined whether a mnemonic proposed by pop-culture can enhance memory for face–name associations. More specifically, we tested whether vocalizing names in an unusual voice can improve subsequent memory for an individual's face and name. The memory literature has examples of enhanced memory for items that require bizarre mental imagery as opposed to normal mental imagery, and separate evidence of enhanced memory for items that are said aloud, as opposed to items read silently. However, it is unclear whether bizarre production of names compared to regular production of names will lead to enhanced memory for faces, names, or face–name associations. In the present study, participants studied face–name pairs while vocalizing the names in a bizarre voice or a normal voice. Memory for face–name associations was tested using cued recall tests and a recognition test. The results suggest that using a bizarre voice disrupts memory performance compared to using a normal voice. Contrary to suggestions in pop-culture, the production of a bizarre voice appears to make it harder to associate face–name pairs during learning.

Keywords: Face–name associations; Bizarreness; Vocal productions

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Introduction

Social interactions depend on correctly identifying people. Although most people find it easy to recognize a familiar face (i.e., I know that person), many find it difficult to correctly recall their name. Matching names with faces can present a challenge because names are arbitrary: there is no inherent association between someone's name and their appearance (McWeeny et al., 1987). Names are sometimes not treated meaningfully, making it difficult to correctly recall a particular name for a given person (Cohen, 1990). Fortunately, there are many mnemonic strategies that can be implemented to help remember face–name associations. These mnemonic strategies include chunking (Gobet et al., 2001), the method of loci (McCabe, 2015), and the keyword method (McDaniel & Pressley, 1984). Some mnemonic strategies accepted by the general public, however, have not been tested empirically. The present work examines one such mnemonic: using a bizarre/vivid association with the items you are trying to remember, specifically to enhance memory for face–name associations.

It is common for the popular press to use findings from scientific literature and incorrectly interpret their implications, often exaggerating the results beyond what the scientific community would ever suggest. Research on memory is not immune to this misuse, with the media presenting ideas to help improve our learning for a variety of types of information, including face–name associations. For example, we may have heard that focusing on the person, repeating their name aloud, asking them a question, repeating their name silently, making a vivid association, or using their name in a conversation helps memory for their name in the future (e.g., Smith, 2013). Although these suggestions have a loose basis in memory-based research, few have been tested empirically. Without proper investigation, people may be led to use mnemonics that are not helpful, and in fact, may deter memory. One such technique, from the 2008 Hollywood movie "The House Bunny", suggests that upon meeting a person for the first time, by repeating aloud their name in a "bizarre" voice, the probability of remembering their name in future encounters is increased.

The memory literature has examined the use of bizarreness to enhance retrieval of to-be-remembered items. However, this research was in the context of imagery, not with face–name associations. These studies typically involve having participants form vivid/unusual mental images between pairs of items in which bizarre associations are formed for words (Einstein & McDaniel, 1986; Einstein & McDaniel, 1987; Einstein et al., 1989) or sentences (Merry, 1980; Wollen & Cox, 1981). For example, if the two images to be remembered were "dog" and "bicycle", the participant may be asked to picture "a dog on a bicycle" or "the dog rode the bicycle down the street" in their mind (Einstein et al., 1989). Memory for the bizarre and or/novel images is typically better compared to ordinary and/or common images, referred to as the bizarreness effect. The uncommon relationship between objects allows the images/sentences to be distinct and enhances our ability to remember them. It has yet to be determined if saying a newly encountered person's name aloud in a bizarre voice will benefit memory for face–name associations in the same manner.

Although the effect of bizarreness is still unclear, there is ample evidence to suggest that memory is enhanced when a word is said aloud, compared to when it is repeated silently in your head (MacLeod et al., 2010), providing some support for the prediction that repeating a novel person's name back to them aloud may enhance retrieval of that name at a later time. Memory enhancement following vocalization is seen in both recognition (MacLeod et al., 2010) and recall (Conway & Gathercole, 1987) memory tasks. This phenomenon is known as the production effect, and it is assumed to occur because the act of vocalizing during study provides a distinctive feature that helps with later retrieval (Forrin et al., 2012). Similar to the bizarreness effect, the mechanism thought to be driving the production effect is distinctiveness (Einstein & McDaniel, 1986).

Both the bizarreness effect and the production effect may reflect mnemonic strategies that are useful when implemented in a mixed list design (MacLeod et al., 2010; McDaniel et al., 2005). By this view, it is the contrast (i.e., silent study vs. common imagery) between trial types provided by a mixed design that offers the distinctiveness necessary for the production and bizarreness effects. In contrast, in a blocked design, each trial is not distinctively different from the next within a block, and thus memory for those items is not enhanced. In the everyday environment, this suggests that repeating names in a bizarre voice for every person you meet (i.e., similar to a blocked design) will not provide a memory benefit—if it enhances memory at all.

The present study uses a mixed design to examine whether vocalizing the name of a novel face–name pairing using a bizarre voice, compared to normal voice, enhances memory for that face–name pairing at a later time. During the encoding phase, participants were visually presented a name followed by a face; upon presentation of the face they produced the name aloud either in a normal voice or a bizarre voice. The bizarre voice, which drew inspiration from the Hollywood movie "The House Bunny", involved using a throaty gravelly tone. Participants practiced this unusual voice before the start of the memory task. After each encoding phase, participants attempted cued recall for the name, given the face as a cue. After three blocks of encoding–recall phases, a final recognition phase for the faces was completed.

Based on the scene from The House Bunny, we predicted better cued-recall following encoding using a bizarre voice than with a normal voice. We had no a-priori directional predictions regarding recognition performance, but if encoding using a bizarre-voice improves the quality of the memory trace in both the semantic unit and the face unit (O'Mahony & Newell, 2012), we predict to see improved recognition for faces encoded using the bizarre-voice only. Eye movements were recorded during encoding, retrieval, and recognition for exploratory purposes and no explicit predictions were made.

Methods

Participants. Undergraduate students (60 females; 56 right handed; 45 right eye dominant) between the ages of 17 and 22 (M = 18.9; SD = 1.3) participated in the experiment. All participants had normal vision or corrected-to-normal vision (i.e., wore glasses or contacts). Participants enrolled in the study through the McMaster psychology research participation system (SONA) and received course credit (1.0) for their participation. Participants were not restricted based on race, but it was required that they were raised in Canada so we could expect they had sufficient exposure to Caucasian faces. Each participant provided informed consent. The study was cleared by the McMaster Research Ethics Board and conformed to the Tri-Council Statement on Ethical Conduct of Research Involving Humans (TCPS2; Canada).

Apparatus. The experiment was created using Experiment Builder© Version 1.10.1241 provided by SR Research Limited©, and was displayed on a BENQ ZOWIE XL-series 24" monitor with a resolution of 1600 x 1024. A DELL Optiplex GX260 computer was used to collect eye movement data using an Eyelink II head-mounted eye tracking system (version 1.1). Participants' verbal responses were recorded throughout the experiment using a microphone by Blue Microphones, and Sound Recorder (Windows audio recording software). A chin rest was placed at a fixed distance of 60 cm from the monitor.

Stimuli. Eighty-three female face stimuli were used from Dr. David Feinberg's Voice Research Laboratory, Department of Psychology, Neuroscience, and Behaviour at McMaster University.

All the faces were Caucasian following previous studies (see Heisz & Shore, 2008; Heisz et al., 2013) and to avoid the other-race effect. All the faces had neutral expressions and any distinguishing features (such as moles, freckles, blemishes, etc.) were digitally removed; see Figure 1. External features (hair, neck, and ears) were excluded by applying a grey mask with an elliptical window centered on the face. Each face stimulus was presented at a resolution of 420 x 604 and subtended visual angles of 13.3 by 16.5 degrees of arc at a 60 cm viewing distance.

The names associated with the faces were chosen from the top 200 female names of 2000 to 2009 from the United States Social Security Administration database. Each name was presented at the centre of the screen. The names were presented in either a red or blue text to indicate to the participant which voice to use on that trial (bizarre or normal; name colour counterbalanced between subjects) see Figure 2.

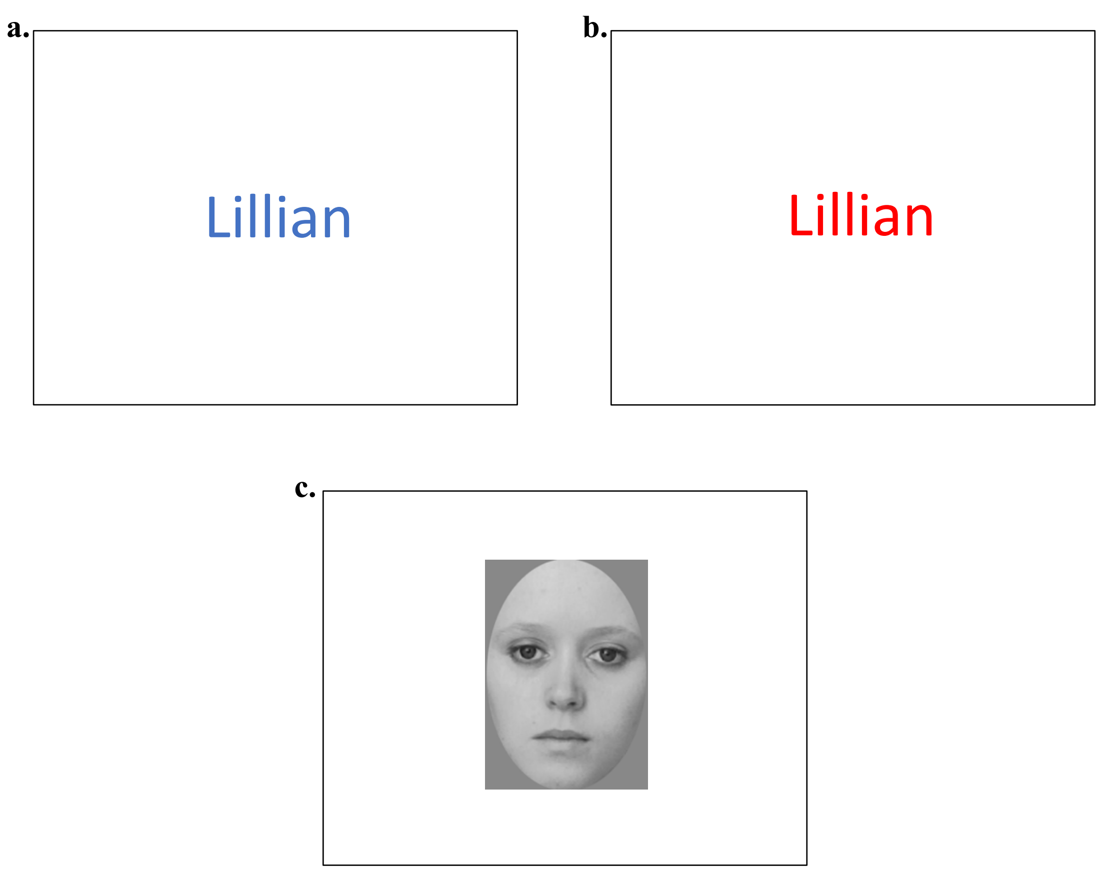

Figure 1. Example of the stimuli presented to participants during the learning phase. Names were counterbalanced by colour to indicate which vocal production to use, bizarre or normal. (a) Half of the participants made a bizarre voice for blue names (b) the other half made a bizarre voice for blue names. (c) Example of a face stimulus.

Tasks. The experiment consisted of four distinct phases. Each of three learning phases consisted of 14 trials. On each trial, a name was presented in the center of the screen for three seconds. The participant was instructed to read the name silently themselves. The colour of the name indicated whether the current trial belonged to the bizarre or normal condition. The number of bizarre-voice trials in each block for every participant varied between 5, 6 or 7 out of the total 14 trials. The face was then presented for five seconds during which the participant then produced aloud the name that they had just previously read, in either a bizarre or normal voice. Participants were not allowed to practice or rehearse the voice or name aloud prior to the onset of the face stimulus.

The cued recall phase presented each face stimulus from the previous learning phase on the screen for five seconds, as a cue for the participants to retrieve the name associated with the face. Each of three cued recall phases tested 12 of the 14 items used in the immediately preceding learning phase trial (the first and last trial were excluded to minimize primacy and recency effects). Once the face was removed from the screen, participants saw a blank screen for ten seconds during which they were required to recall the name that had been paired with that face in the learning phase. They were instructed to give their best guess if they were unable to recall a name. The experimenter manually wrote down participants' answers. No accuracy feedback was given during or after the cued recall phase.

Finally, there was a recognition phase that included 72 face stimuli: all 36 previously tested faces from each of the recall phases (i.e., not the first and last face from the encoding phase) and 36 novel faces. Participants were shown a face for five seconds and were instructed to respond whether the face was 'old' (previously presented in the learning phases) or 'new' (not previously seen). Responses were given by pressing '1' on the number pad for an old face or '3' on the number pad for a new face. If participants responded 'old', they were presented a name on a blank screen and asked whether that name corresponded to the face just previously recognized. Participants used the key pad to respond: '1' to indicate that the name matched the face; '2' to indicate that it was the wrong name; and '3' to indicate they were unsure. Accuracy feedback was not provided during or following the recognition phase.

Prior to the beginning of the experiment, participants were given an opportunity to learn and practice the bizarre voice. This practice phase began with a demonstration from the experimenter on what the bizarre voice should sound like. Participants were then presented with five practice trials. On each of these trials, a name was presented on the screen in which participants were instructed to produce the name aloud in a bizarre voice while the face was on the screen. The practiced bizarre voice was instructed to be used on every bizarre-voice trial in the experiment. The faces presented in the practice phase did not appear in the subsequent experiment.

Design. The experiment used a within-subjects, repeated-measures design with a single factor of name production that had two levels: bizarre or normal vocal production presented in a mixed list. The dependent variables were (1) the proportion of correctly recalled names during each of the cued recall phases; and (2) the corrected hit rate of the recognized faces during the recognition phase. The order of the stimuli (faces and names) and the matching of face to name were randomized uniquely for each participant.

After providing instructions and obtaining informed consent, participants were familiarized with the bizarre vocal production (practice phase). This was followed by three blocks, each of which included a learning phase and a cued recall phase. After 3 blocks of learning–cued recall a final recognition phase was completed (see Fig. 2).

Procedure. Upon arrival participants gave their informed consent to partake in the experiment and separately to have their vocal productions recorded throughout the whole experiment. Next, a handedness questionnaire was completed, an eye dominance test was done, and a subject checklist was filled out. The experiment took place in a dimly lit room. The participant was seated in front of the monitor with their chin on the chin rest. The head-mounted eye tracker was adjusted on the participant's head slowly, ensuring the participants' safety and comfort. Only the right camera was used, which was adjusted so as to not impede the participants view of the monitor, and the camera was focused to obtain maximum clarity for the eyes. Once participants felt comfortable with the eye tracker, the experimenter calibrated the eye tracker. The calibration consisted of the participant fixating their gaze on a black ring target that started from the center of the screen. Once fixated, the dot disappeared and reappeared at one of nine locations across the screen. Following calibration, the same procedure was repeated to validate the calibration. Calibration and validation of the eye tracker took place again before the start of the recognition phase. Before the start of each trial a drift correction was conducted. During the drift correction, participants focused their gaze on a black ring target at the center of the screen and simultaneously pressed the "enter" key repeatedly until the correction was made. The experimenter was present in the room throughout the experiment. At the end of the experiment, the experimenter recorded a subjective rating of the participants' overall engagement in the experiment, which included their ability to produce a bizarre voice and their focus on all of the tasks. The rating scale ranged from one (not focused on the tasks, and/or produced a weak bizarre voice) to five (very focused on the tasks, and/or produced a strong bizarre voice). The experiment duration was approximately 60 minutes, written and verbal debriefings were provided to each participant at the end of the experimental session.

Engagement of participants was recorded for exploratory purposes. A median split separated high engagement participants from low engagement participants. No significant effect involving level of engagement for the two voice conditions was found. Supplementary analyses are provided in Appendix G.

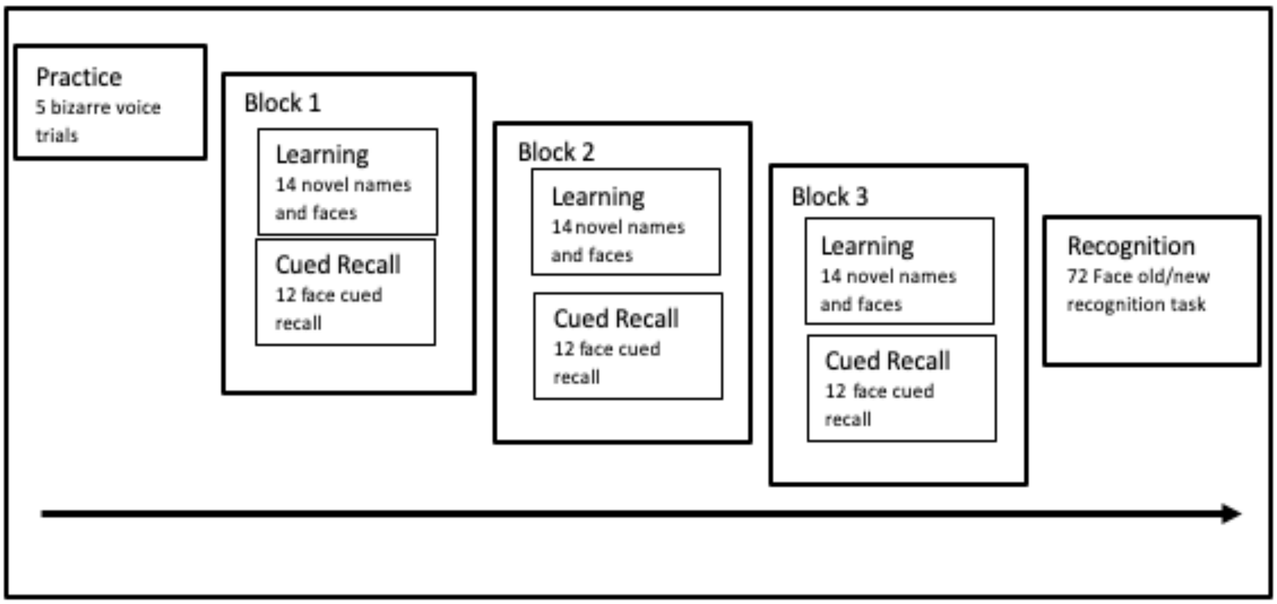

Figure 2. Sequence of tasks displayed during the experiment.

Results

Cued Recall Performance

An analysis of variance (ANOVA) was conducted on the proportion of names recalled correctly, with the factors of voice manipulation (normal and bizarre) and block (1, 2, and 3). Correct recall of names increased across block, $F(2, 118) = 13.634$, $p < 0.001$. Memory performance was significantly better in block 3 than block 1, $t(59) = 5.005$, $p < .001$ and significantly better during block 2 than block 1, $t(59) = 3.341$, $p = .001$ (see Fig. 3). In contrast to the prediction that using a bizarre voice would improve memory, there was a numerical trend in the opposite direction: correct recall of names was numerically higher following normal voice production trials (M = .129) than following bizarre voice production trials (M = .102), $F(1, 59) = 3.532$, $p = .065$. The interaction between block and voice was not significant, $F(2, 118) = 0.1970$, $p = .821$. Post hoc tests revealed no significant differences between normal and bizarre voice trials in any of the three blocks, *p*'s > .100. Two participants had floor performance (i.e., zero names correctly recalled)[1].

Examination of name-only recall (i.e., did participants recall more names uttered in a bizarre voice regardless of the name–face association) revealed no difference based on voice type used at encoding, $t(59) = -0.365$, $p = 0.716$. Additionally, neither intra-list intrusions (i.e., names that were presented in the learning phase but paired with the wrong face during recall) nor inter-list intrusions (i.e., names that were recalled during the cued recall phase but were from an earlier block) significantly accounted for performance based on voice type used in any of the blocks at encoding, *p*'s > .100.

[1] Although performance was at floor, they were included because their recognition performance was similar to other participants.

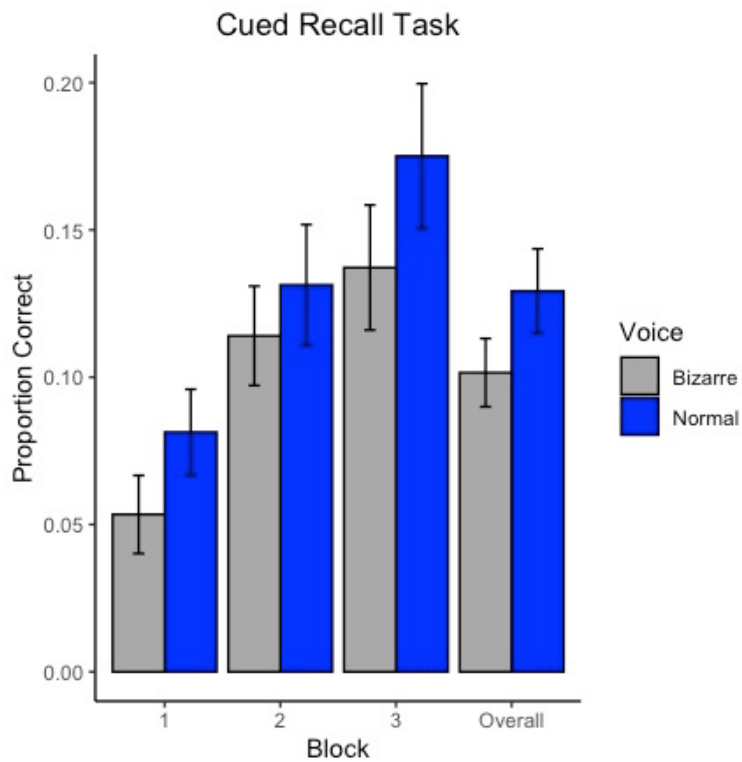

Figure 3. Mean proportion of correctly recalled names during the cued-recall phase separate for each block (1-3) and collapsed across blocks (overall) for normal and bizarre voice production trials.

Recognition Performance

To examine recognition memory performance, d-prime (*d*') scores, were calculated as a measure of recognition sensitivity. The hits, correctly recognizing an old item as "old", and false alarms, incorrectly recognizing a new item as "old", were first calculated. Next, the z-score of the hits and false alarms were computed. To get the *d*' value the z-score of the false alarms was subtracted from the z-score of the hits [*d*'= z(hits) – z(false alarms)]. No participant had a hit rate of 0 but for the participants that had a hit rate of 1 we subtracted 0.5 from the number of hits for that condition to move off ceiling (i.e., 36/36 = 1 became 35.5/36 = 0.986). A *d*' score was calculated for each participant in each voice condition, and an ANOVA was conducted on these *d*' scores.

Recognition memory performance did not significantly differ between the normal vocal production trials and bizarre vocal production trials, $F(1, 59) = 1.591$, $p = .212$. Recognition performance was better for faces from later blocks as observed by a main effect of block, $F(2, 118) = 12.624$, $p < .001$ (see Fig 4). Block 3 faces were better recognized than block 1 faces, $t(59) = 5.027$, $p < .001$ and block 2 faces were better recognized than block 1 faces, $t(59) = 4.276$, $p < .001$.

No significant correlation was found between the recognition memory performance (d') and the number of eye fixations made to the face at learning. An analysis of the eye-tracking results can be found in the supplementary materials.

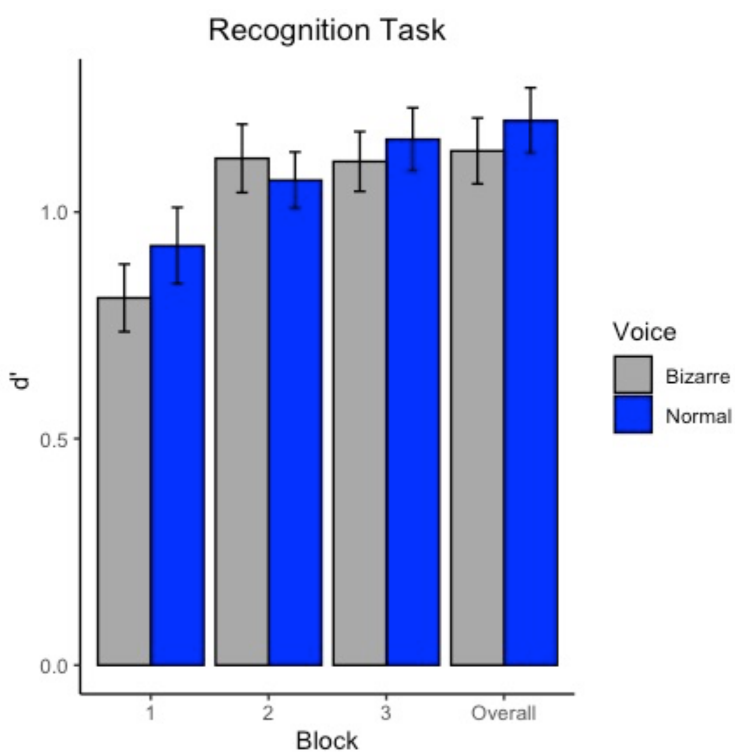

Figure 4. Recognition sensitivity for old and new faces (*d*') presented during the recognition phase for both the normal and bizarre voice production trials.

Discussion

Inspired in part by the Hollywood movie, The House Bunny, the current study examined the pop-culture claim that reciting names in a bizarre voice improves learning of face–name associations. To do this, participants learned face–name pairs by producing the associated name aloud, in either a bizarre or normal voice. Cued recall performance generally improved across blocks, but participants consistently performed better (at least numerically) on normal-voice trials than bizarre-voice trials in each block. This pattern suggests that the use of bizarre vocalizations does not improve memory for face–name associations. We also tested recognition memory for the faces and found no difference in sensitivity between those encoded on bizarre-voice trials and normal-voice trials. These results do not support the pop culture claim that using a bizarre voice to produce names aids memory for face–name associations.

Although this result does not align with pop culture, it is relatively unsurprising given the evidence available in the memory literature on dual-task costs and transfer appropriate processing. It is likely that task demands during learning on bizarre-voice trials were too high to enhance encoding. Producing the bizarre voice was both physically and emotionally taxing, based on anecdotal reports from participants. Thus, producing the name in a bizarre voice likely increased cognitive load, leading to a dual-task cost (Logie et al., 2007), whereby encoding was compromised as resources were allocated to bizarre production instead of being allocated to encoding the face–name association. In contrast, normal production is relatively easy, and thus, this dual-task cost was less, or possibly absent. During the recall test, participants had to retrieve the face–name association to perform well on the task. If bizarre-voice production hindered encoding of this association in the service of name encoding, we might expect cued-recall performance to be the same or worse compared to normal-voice trials. This logic echoes the idea proposed by the transfer appropriate processing principle (Morris et al., 1977); namely, memory performance is good when the processes or representations engaged at encoding and retrieval match.

These ideas of dual-task costs and transfer appropriate processing are supported by the finding that although cued-recall performance steadily increased across blocks (i.e., a practice effect), performance on bizarre voice trials remained lower than performance on normal voice trials. It appears that even with practice, participants could not overcome the large cognitive load encountered on bizarre-voice trials. However, future work with the paradigm in the present study ought to examine memory for individual names directly, to compare it to the results found for face–name associations reported here. If our assumptions about cognitive load are correct, one would expect better memory for bizarrely vocalized names than normally vocalized names, as more resources were allocated to bizarre naming. This would be in direct opposition to the finding here that face–name associations for bizarre vocalized names are not better remembered—presumably because resources were left over for encoding of face–name associations on normal vocalizing trials.

To remedy the potential issue of cognitive load, allowing observers to choose their own bizarre voice or allowing them to change their bizarre voice on each trial could lead to a benefit of using a bizarre vocal production rather than a cost. Subject-generated mediators typically lead to higher recall than experimenter-provided mediators (Bobrow & Bower, 1969). Allowing participants to select their own bizarre voice may allow more focus on forming an association between the name and face rather than attending to making the bizarre voice taught to them, effectively reducing the dual-task cost associated with bizarre production.

However, it is possible that memory for face–name associations would not improve following bizarre production, even if cognitive load was accounted for. This idea is based on the finding that simply producing a name aloud does not aid in associative memory between the name and face, suggesting that the basic production effect does not apply to memory for face–name associations (Hourihan & Smith, 2016). Faces were shown to participants with the associated name displayed underneath in either blue or white, with the colour of name used to cue participants to read the name aloud or silently. Memory was tested for the face–name association through a cued-recall task. No significant effect in associative recall was found for the cued face and associated name (Hourihan & Smith, 2016). Forming the association may be difficult because names can be produced aloud but faces cannot (Hourihan & Smith, 2016), meaning that only half of the information that forms the face–name association (i.e., the name) can be produced. The same is likely true for bizarreness—although the name can be produced in a bizarre way, the face cannot. This is similar to a main tenet of the bizarreness effect: for bizarreness to improve memory, participants must create imagery that bizarrely incorporates both to-be-remembered items. Here, there is no bizarre aspect to the face, only to the name. Thus, it may be that even if any possible issues with the method used in the present paper were addressed, production or bizarreness may not enhance memory for associations, particularly for face–name associations.

It is also worth noting that in the bizarreness literature, a benefit for bizarre sentences is reliably observed in free recall but not in cued-recall (Wollen & Cox, 1981). Bizarreness seems to enhance memory performance specifically when there are no cues present at retrieval (Wollen & Cox, 1981). In the current study, providing the face as a cue at recall, thereby promoting retrieval of an association rather than the name itself, may have triggered a different set of retrieval processes than those that may have resulted in a benefit for bizarre-voice trials. More broadly, this sensitivity of the bizarreness effect to retrieval task differences points to an issue of feasibility regarding the purported benefit forwarded in the Hollywood movie. Seeing the face again, having produced their name in a bizarre voice before, may not benefit recall of the name (as the movie claimed). However, recall of the name (or face) again without any retrieval prompt may be helped by the bizarre voice production—however, it is unclear if there is any ecological validity to such a scenario.

In sum, future work may benefit from the following methodological adjustments. Participants can make a bizarre voice of their choosing to reduce cognitive load during learning. Along with the cued-recall memory task, the addition of a free recall task of the names alone would help determine if names produced with a bizarre voice are remembered better over time than names produced in a normal voice. If names produced with a bizarre voice are remembered better than names produced in a normal voice it could mean the bizarre voice manipulation affects memory for the name but not the association between the face and name. This could be the reason why we see a cost towards using the bizarre voice in cued-recall performance for bizarre-voice trials. Lastly, to make the study more ecologically valid (i.e., generalize to the real-world) external features could be added back to the faces.

In conclusion, our preliminary exploration has found that using a bizarre voice to produce new names, while studying the associated new face, does not help memory performance in a later cued-recall or recognition task. We suggest that the cost of using a bizarre voice may be due to cognitive load being divided between producing the novel bizarre voice and forming an association between the name and face simultaneously. Also, the bizarreness in the voice applies only to the name and not the face, perhaps limiting the extent to which bizarreness affects the process of associating the face and name together. Perhaps allowing participants to create their own voice or listen to pre-recorded voices can improve the association between the face and name.

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Supplementary Material

Eye movements

Analysis. The eye tracking software generated EyeLink Data Files (EDFs) for each participant during the course of the study. The EDFs were loaded into Data Viewer, an SR Research Ltd software program used to analyze the files. A fixation report was generated for the 5000ms timeframe that showed the face stimuli to the participant. MATLAB R2016b was used to analyze the fixation reports for each participant to determine the total number of fixations made to the face during the learning phase for each block and voice manipulation. The number of fixations made during encoding were correlated with the d' scores for the normal vocal production trials and bizarre vocal production trials. A Multivariate Analysis of Variance (MANOVA) was conducted with the number of fixations and d' score as dependent variables, and block and voice manipulations as the independent variables.

Results. No significant correlation was observed between the number of fixations made during the learning phase and the d' scores of the normal vocal production trials, $r(55) = 0.213$, $p = .111$, (see Fig 1), or between the number of fixations during encoding and the d' scores for the bizarre vocal production trials, $r(55) = 0.195$, $p = .146$, (see Fig 2). No significant correlation was observed between any of the blocks and the number of fixations when we collapsed across the voice manipulations.

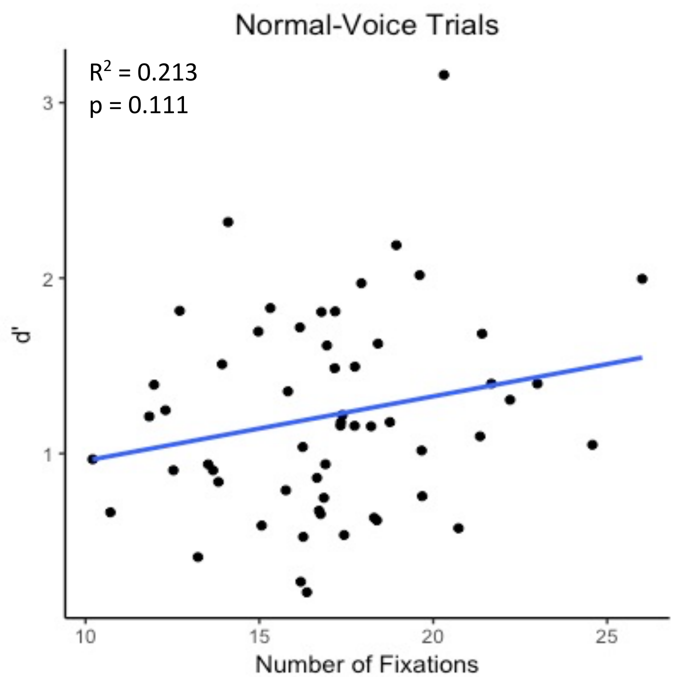


Figure 1. Correlation between the d' scores and the mean number of fixations at encoding for the normal voice production trials.

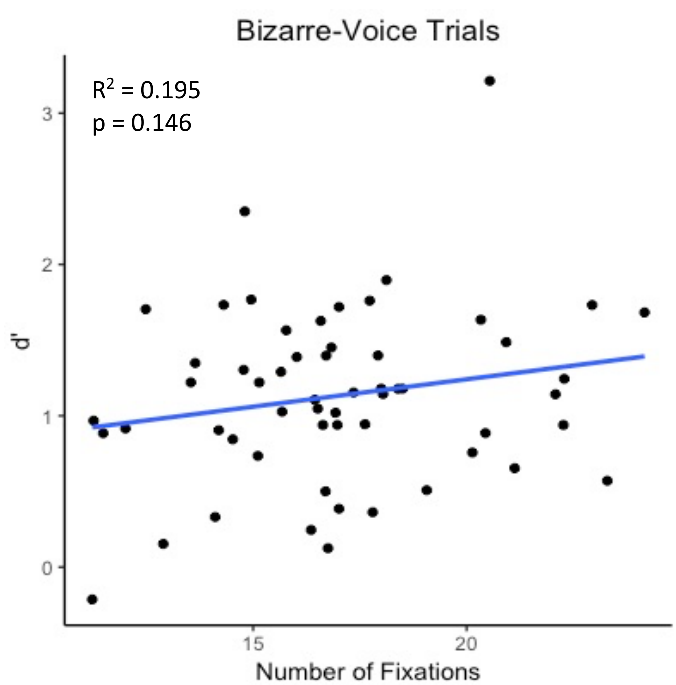


Figure 2. Correlation between the d' scores and the mean number of fixations at encoding for the bizarre voice production trials.

Appendix A: Consent Form

McMaster University, Psychology Department
LETTER OF INFORMATION
Memory for Face–Name Associations

MULTISENSORY
PERCEPTION LABORATORY
DEPARTMENT OF PSYCHOLOGY, NEUROSCIENCE & BEHAVIOUR
FACULTY OF SCIENCE • MCMASTER UNIVERSITY
MULTISENSORY.MCMASTER.CA

Sponsor: NSERC Canada
Principle Investigator (P.I.): Dr. David Shore, dshore@mcmaster.ca
P.I. Contact Number: 905-525-9140, ext. 23013
Researchers: Payal Patel; Katherine Silang; Sehar Arfeen

Research Contact Number/Email: patep20@mcmaster.ca; silank1@mcmaster.ca; arfees@mcmaster.ca , ext. 24824

Purpose: To explore memory for face–name associations.

Description: In this experiment, you will see a series of names followed by faces, while your eye-movements are recorded using a head-mounted eye-tracker. You will be asked to study the name silently to yourself, and then say aloud the name when you see the face appear on the screen, using different voice styles. Your naming during the experiment will be recorded and stored for possible future experimental use (your consent for future use of your vocal recording is asked later in this form); however, you have the option to complete the experiment, but to decline having your voice recorded. Your memory for the face–name pairs will be tested at various points throughout the experiment.

Risks: There is very little risk for your participation in this research. However, you may become tired and/or frustrated with the task. If you wish to halt the experiment at any time please inform the researcher immediately and the task will be terminated. Due to the use of an eye tracker you may experience discomfort; please take a break between each block and calibration. You may experience some discomfort in your vocal cords after making various different vocal productions, we will provide bottled water during the course of the experiment.

Benefits: This research increases scientific understanding of memory for face–name associations.

Confidentiality: Any information that is obtained in connection with this study and that can be identified with you will remain confidential. A number will code your data, and only the researcher will have access to which numbers correspond to which people.

Conflict of Interest: Given that the researchers may be your instructor or peer, there is the possibility for a conflict of interest. However, the researchers will not be able to link your individual data back to you in any way. If a conflict does arise, we can request another researcher to run the experiment.

Compensation: Open to all psychology classes – experimental credit (1 hour) or $10 per 1 hour session.

Participation: You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may exercise the option of removing your data from the study. You may also refuse to answer any questions you do not want to answer and still remain in the study.

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. Additionally, you can request to have your data removed from the experiment after your experimental session, and up to one year after the study is completed.

This study has been reviewed and received ethics clearance through the McMaster University Research Ethics Board (MREB). If you have any questions regarding your rights as a research participant, please contact the researcher or:

MREB Secretariat
c/o the Office of Research Ethics
McMaster University
1280 Main St W., GH-305
Hamilton, ON L8S 4L9

Telephone: 905-525-9140, ext. 23142
Email: ethicsoffice@mcmaster.ca

I understand the information provided for the "Memory for Face–Name Associations" study as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study.

____
Name of Participant

______________________________ ____________________
Signature of Participant Date

In the current study, as mentioned above, we will be recording your vocal responses. The purpose of recording your vocal responses is to use these sound clips as stimuli in future experiments. If you consent to your vocal recordings being used in future experiments, please sign and date the section below. If do not consent, simply leave this space blank.

____
Name of Participant

______________________________ ____________________
Signature of Participant Date

Once completed, a summary of the study results will be available on Dr. Shore's webpage. If you are interested in learning more about this topic, you are encouraged to look up Dr. Shore's web page. Dr. Shore's web page: http://www.mcmaster.ca/dshore.

Appendix B: Dominant Eye Test Instructions

1. Extend your arms in front of you with your palms facing away from your body.
2. Bring your hands together, forming a small hole by crossing the thumbs of your fore-fingers (i.e., a triangle shaped hole).
3. Choose a small object about 15-20 feet away from you. With both eyes open, focus on the chosen object as you look through the small hole.
4. Close one eye and then the other. When you close one eye, the object you are focusing on will be stationary. When you close the other eye, the object should disappear from the hole or jump to one side of your view.

The eye that sees the object of focus and does not move is the dominant eye.

Appendix C: Dominant hand questionnaire

Date: ________________ Subject Number: ________________

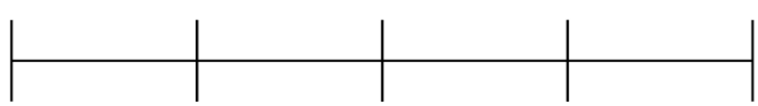
Handedness Questionnaire

Instructions:
Answer each of the following questions as best you can. If you always use one hand to perform the described activity, circle **RA** (for right always) or **LA** (for left always). If you usually use one hand circle **RU** (for usually right) or **LU** (for usually left), as appropriate. If you use both hands equally, circle **EQ**.

Do not simple circle one answer for all questions, but imagine yourself performing each activity in turn, then mark the appropriate answer. If necessary, stop and pantomime the activity.

Which hand do you use for writing?	**LA**	**LU**	**EQ**	**RU**	**RA**
With which hand would you turn on a water trap?	**LA**	**LU**	**EQ**	**RU**	**RA**
In which hand do you hold your toothbrush?	**LA**	**LU**	**EQ**	**RU**	**RA**
With which hand would you pick up a penny off a desk?	**LA**	**LU**	**EQ**	**RU**	**RA**
With which hand would you draw a picture?	**LA**	**LU**	**EQ**	**RU**	**RA**
Which hand would you use to dial a number on a phone? (push button)	**LA**	**LU**	**EQ**	**RU**	**RA**
With which hand would you point to a distant object?	**LA**	**LU**	**EQ**	**RU**	**RA**
In which hand do you hold scissors to cut paper?	**LA**	**LU**	**EQ**	**RU**	**RA**
With which hand do you use the eraser on the end of a pencil?	**LA**	**LU**	**EQ**	**RU**	**RA**
With which hand do you hold a comb when combing your hair?	**LA**	**LU**	**EQ**	**RU**	**RA**

On the scale below please circle the vertical line that you feel best corresponds to the strength of your handedness:



Strong Left Ambidextrous Strong Right

Appendix D: Subject checklist

Subject Checklist: Sex of Faces

Master Number: _____________ Subject Code: ________

Colour File Used: Red = Bizarre OR Blue = Bizarre

Stim-File Used:

Date (MO/DD/YR): _____/_______/______ Time (HH:MM): _____:_____ AM/PM

Sex: FEMALE / MALE

Cultural Ethnicity: _______________ Canadian-born: YES / NO

Date of birth (MO/DD/YR): _____/_______/______ Age: _______

Corrected Vision: GLASSES / CONTACTS / NONE

Dominant Eye (See Dominant Eye Test): L / R

History Of Visual Abnormality: NO / YES: ______________

Handedness: ___________

Experiment Conditions:

Experiment 4 (Experimental Group, Female Faces First)

Block	Trials	Sex of Face	Comments
1- Practice	5 practice	5 F	
2- Learn	14	Female	
3- Recall	12	Female	
4- Learn	14	Female	
5- Recall	12	Female	
6- Learn	14	Female	
7- Recall	12	Female	
8- Recognition	72	Female	

Engagement in the experiment:

1 2 3 4 5

Comments**:**

Appendix E: Cued Recall Answer Sheet Example

Ss# _________________

File:StimFile1v6.txt

Recall Phase 1 Answers
[ ] Natalie __________________
[ ] Katie __________________
[ ] Gabriella __________________
[ ] Zoey __________________
[ ] Ella __________________
[ ] Isabella __________________
[ ] Ruby __________________
[ ] Savannah __________________
[ ] Jennifer __________________
[ ] Kelly __________________
[ ] Sophia __________________
[ ] Rachel __________________

Recall Phase 2 Answers
[ ] Emma __________________
[ ] Vanessa __________________
[ ] Kendall __________________
[ ] Angela __________________
[ ] Jade __________________
[ ] Anna __________________
[ ] Grace __________________
[ ] Samantha __________________
[ ] Jessica __________________
[ ] Miranda __________________
[ ] Kimberly __________________
[ ] Jillian __________________

Recall Phase 3 Answers
[ ] Alexis __________________
[ ] Karina __________________
[ ] Veronica __________________
[ ] Sabrina __________________
[ ] Elizabeth __________________
[ ] Allison __________________
[ ] Lucy __________________
[ ] Amy __________________
[ ] Amanda __________________
[ ] Kelsey __________________
[ ] Erica __________________
[ ] Makenzie __________________

Observer name: ________________

Appendix F: Debrief Form

McMaster University, Psychology Department
DEBRIEFING INFORMATION SHEET
Memory for Face–Name Associations

Sponsor: NSERC Canada
Principal Investigator(s) (P.I.): Dr. David Shore dshore@mcmaster.ca
P.I. Contact Number: 905-525-9140 ext 23013
Supervisor: Payal Patel; Katherine Silang; Sehar Afreen, ext. 24824
Researcher(s): patep20@mcmaster.ca; silank1@mcmaster.ca; arfees@mcmaster.ca, ext. 24824

SECTION A - OVERVIEW

Question: Will there be an improvement in memory performance for face–name associations when names are produced aloud in unnatural voices versus normal voices?

Theory: Remembering faces, names, and which name goes with which face is important for everyday social experiences. In the experiment you just completed, we are testing whether bizarre name production enhances memory for face–name associations. Previous research has found better memory for bizarre images (Einstein et al., 1989), and the present study aims to identify whether this bizarreness benefit extends to memory for face–name associations. In the study, you were presented with faces and names, and asked to read some names aloud normally, and some names aloud in a bizarre voice. We subsequently tested your memory for the face–name associations in a cued recall test (given face, asked for name) and a recognition test (given face, asked if it is old or new, and if given name is correct or incorrect).

In addition, your eye movements were recorded throughout the experiment. Previous research has shown that females perform better on recognition memory tests of faces when comparison to males, and that this effect is possibly due to the increased amount of fixations that females make during encoding of the faces (Heisz et al., 2013).

Hypothesis: Memory for face–name associations will be better for names said in a bizarre voice, and more eye fixations will be made at study for faces that are remembered at test, compared to those that are not remembered.

SECTION B - DETAILS

Independent Variables (I.V.): name production (normal vs. bizarre)

Dependent Variable (D.V.): proportion recalled in cued recall; corrected hit rate (hits minus false alarms in recognition); number, location, and duration of eye fixations

Experimental Design: Between subjects design, repeated measures design

Statistics & Analyses: one-way t-test (cued recall and recognition); correlational analysis between number of fixations and memory performance (d-prime scores).

SECTION C: NOTES & REFERENCES

We would like to thank you for your participation in our study. Please do **not** share this information with any other students who may be potential participants in this study. Knowing the details before participating may influence their performance and/or the results.

If you are interested in learning more about this topic, you are encouraged to look up the following reference:

Einstein, G. O., McDaniel, M. A., & Lackey, S. (1989). Bizarre Imagery, Interference, and Distinctiveness. Journal of Experimental Psychology: Learning, Memory, and Cognition, 15(1), 137–146.

Heisz, J. J., Pottruff, M. M., & Shore, D. I. (2013). Females Scan More Than Males: A Potential Mechanism for Sex Differences in Recognition Memory. Psychological Science, 24(7), 1157–1163.

Appendix G: Engagement by Median Split Analysis

Univariate Type III Repeated-Measures ANOVA Assuming Sphericity

	Sum Sq num	Df	Error SS den	Df	F value	Pr(>F)	
(Intercept)	4.7950	1	2.1700	58	128.1596	2.564e-16	***
Eng_MS	0.2834	1	2.1700	58	7.5736	0.007892	**
block	0.4824	2	2.0564	116	13.6052	4.921e-06	***
Eng_MS:block	0.0311	2	2.0564	116	0.8768	0.418868	
voice	0.0690	1	1.1471	58	3.4911	0.066753	.
Eng_MS:voice	0.0064	1	1.1471	58	0.3241	0.571365	
block:voice	0.0063	2	1.8798	116	0.1956	0.822586	
Eng_MS:block:voice	0.0190	2	1.8798	116	0.5860	0.558174	

	Mean	Standard Error
Low Engagement group	0.143466	0.01192
High Engagement group	0.087355	0.00812

Low Engagement Group:

	t value	df	p-value
B1 and B2	-2.6571	29	0.01268
B1 and B3	-2.8712	29	0.007564
B2 and B3	-0.5528	29	0.5846
Normal and Bizarre	1.051	29	0.3019

High Engagement Group:

	t value	df	p-value
B1 and B2	-2.0922	29	0.04529
B1 and B3	-4.1817	29	0.00024
B2 and B3	-2.1485	29	0.04016
Normal and Bizarre	1.5504	29	0.1319

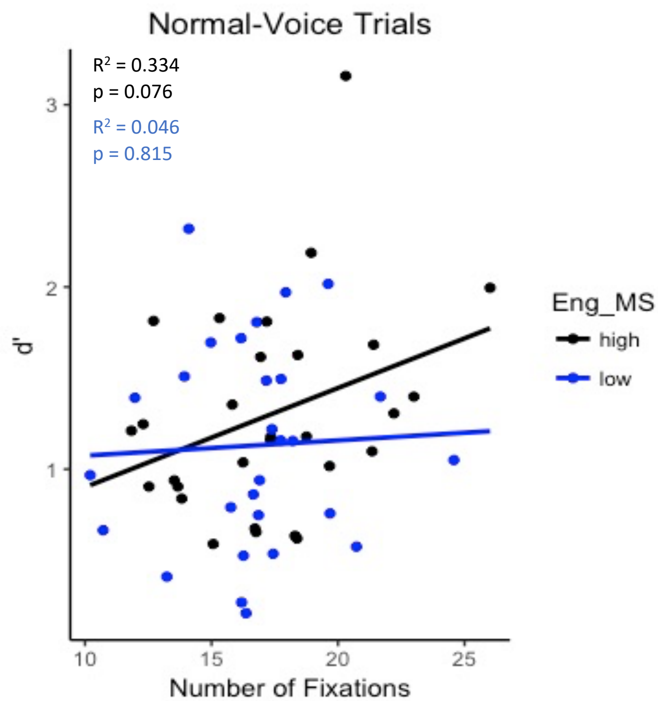


Figure 1. Normal-voice trials: Correlation between the number of eye fixations and d' by engagement level

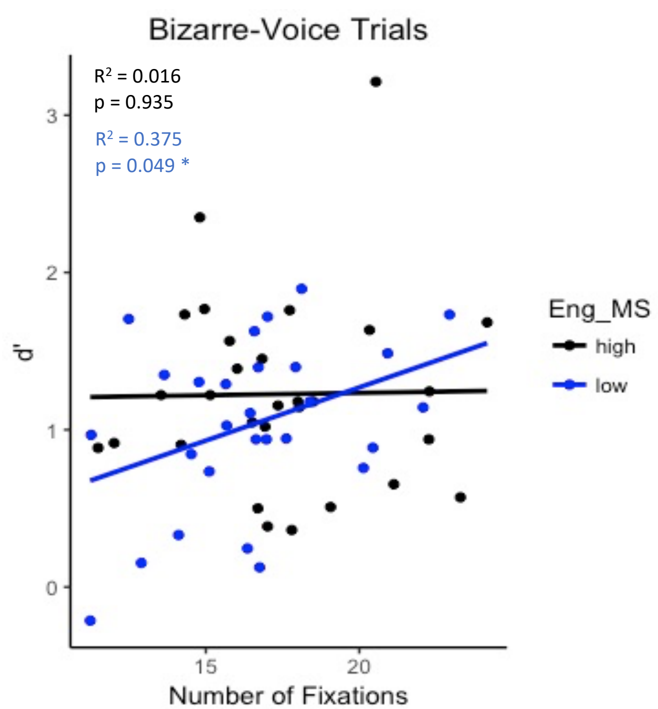


Figure 2. Bizarre-voice trials: Correlation between the number of eye fixations and d' by engagement level