

Don't believe the hype: Sans Forgetica is not desirable for learning

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Do students learn better with material that is perceptually harder-to-process? While evidence is equivocal on the matter, recent claims suggest that placing materials in Sans Forgetica font, which is perceptually hard-to-process, has positive effects on student learning. Given the weak evidence for perceptual disfluency effects, this led us to examine the mnemonic effects of Sans Forgetica more closely. In two preregistered experiments, we tested if Sans Forgetica is really unforgettable. In Experiment 1 ($N = 233$), participants studied weakly related cue-target pairs with targets presented in either Sans Forgetica or with missing letters (e.g., G_RL). Cued recall performance showed a robust generation effect, but no Sans Forgetica memory benefit. In Experiment 2 ($N=528$), participants read a passage about ground water with select sentences presented in either Sans Forgetica, yellow highlighting, or unmodified. Cued recall for select words were better for pre-highlighted information than when unmodified. Critically, presenting sentences in Sans Forgetica did not produce better cued recall than pre-highlighted sentences or sentences presented unchanged. Our findings suggest that Sans Forgetica is really forgeticable.

Keywords: Disfluency, Recall, Desirable Difficulty, Learning and Memory

Word count: 3945

1 Students want to remember more and forget less. Being able 20
2 to recall and apply previously learned information is key for 21
3 successful learning. Decades of research in the laboratory 22
4 and in the classroom have put forth the paradoxical idea that 23
5 making learning harder (not easier) should have the desirable 24
6 effect of improving long-term retention of material—called 25
7 the desirable difficulty principle (Bjork & Bjork, 2011). No-
8 table examples of desirable difficulties include having par- 26
9 ticipants generate information from word fragments instead 27
10 of passively reading intact words (Bertsch, Pesta, Wiscott, & 28
11 McDaniel, 2007), spacing out study sessions instead of mass- 29
12 ing them (Carpenter, 2016), and having participants engage 30
13 in retrieval practice after studying instead of simply restudy- 31
14 ing the information (Kornell & Vaughn, 2016). Another sim- 32
15 ple strategy that has gained some attention is to make mate- 33
16 rial more perceptually disfluent. This can be done by chang- 34
17 ing the material's perceptual characteristics. Visual mate- 35
18 rial that is masked (Mulligan, 1996), inverted (Sungkhaset- 36
19 tee, Friedman, & Castel, 2011), presented in an atypical font 37
38 (Diemand-Yauman, Oppenheimer, & Vaughan, 2011; French
39 et al., 2013), blurred (Rosner, Davis, & Milliken, 2015), or
40 even in handwritten cursive (Geller, Still, Dark, & Carpenter,
41 2018) have all been shown to produce memory benefits. The
42 desirable effect of perceptual disfluency on memory is called
43 the disfluency effect (Bjork & Yue, 2016).
44
45 Although appealing as a pedagogical strategy due to the rel-
46 ative ease of implementation, there have been several ex-
periments that failed to find memorial benefits for percep-
tually disfluent materials (e.g., Magreehan, Serra, Schwartz,
& Narciss, 2016; Rhodes & Castel, 2008, @Rhodes2009;
Rummer, Schweppe, & Schwede, 2016; Yue, Castel, &
Bjork, 2013), casting doubt upon the robustness of the dis-
fluency effect. Corroborating this, A recent meta-analysis by
Xie, Zhou, and Liu (2018) with 25 studies and 3,135 par-
ticipants found a small, non-significant, effect of perceptual
disfluency on recall and ($d = -0.01$) and transfer ($d = 0.03$).
Despite having no mnemonic effect, perceptual disfluency
produced longer reading times ($d = 0.52$) and lower judg-
ments of learning ($d = -0.043$). In the laboratory, Geller et al.
(2018) and Geller & Still (2018) manipulated several bound-
ary conditions (e.g., level of degradation, type of judgement
of learning, retention interval, and testing expectancy) and
found you can get positive memory effects from perceptual
disfluent materials (in recognition), but it is not robust. Taken
together, the evidence is weak for perceptual disfluency be-
ing a desirable difficulty.

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Despite the weak evidence, perceptual disfluency is still being touted as a viable learning tool, especially in the popular press. Recently, reputable news sources like the Washington Post (<https://www.washingtonpost.com/business/2018/10/05/introducing-sans-forgetica-font-designed-boost-your-memory/>) and National Public Radio (NPR; <https://www.npr.org/2018/10/06/655121384/sans-forgetica-a-font-to-remember>) claimed that a new font called Sans Forgetica could enhance memory, despite only unpublished evidence being available at the time (Earp, 2018). It is thought that the mnemonic benefit is due to the characteristics of the font. Sans Forgetica is a variation of a sans-serif typeface that consists of intermittent gaps in letters that are back slanted (see fig. 1). Since the release of those news articles, the Sans Forgetica font is available on all operating systems (download the font file), some browsers (e.g., Chrome), and can be downloaded on your phone.

This is an example of Sans Forgetica font

Figure 1. Example of Sans Forgetica font.

Current Studies

Given the weak evidence for the disfluency effect, we thought it pertinent to empirically examine whether Sans Forgetica produces more durable learning. The question of whether Sans Forgetica produces a mnemonic benefits has clear practical implications. In the educational domain, it would be relatively quick and easy to use place materials in Sans Forgetica font. However, in order for the Sans Forgetica to be useful, it is important to note and understand both its successes and failures. To the authors' knowledge, there is only one peer-reviewed paper (Eskenazi & Nix, 2020) examining the effectiveness of Sans Forgetica in generating a desirable difficulty. In one experiment Eskenazi and Nix (2020) found that words and definitions in Sans Forgetica font lead to better orthographic discriminability (i.e., choosing the correct spelling of the word) and semantic acquisition (i.e., retrieving the definition of a word), but only if participants were good spellers. As the Eskenazi and Nix (2020) study focused on lexical acquisition (orthographic and semantic features of a word), it is not clear if the benefits of Sans Forgetica font extends to other memory processes. Given this, we felt it was pertinent to examine the effectiveness of Sans Forgetica in two different memory experiments. To this end, we conducted to two high-powered preregistered experiments examining whether (1) recall is better in Sans Forgetica font and (2) how it compares with other notable learning techniques—generation (Experiment 1) and pre-highlighting (Experiment 2). Comparing Sans Forgetica to other study

techniques allows us to examine the mechanisms underlying the effect, if any.

Experiment 1

In Experiment 1 we were interested in answering two questions. First, is Sans Forgetica more memorable than a normal, fluent, font (e.g., Arial)? Second, is the Sans Forgetica effect on memory similar in magnitude to the generation effect? While very is known about Sans Forgetica, one of the most intuitively appealing theories for why Sans Forgetica font benefits memory is that of mental effort. It is believed that reading materials in Sans Forgetica requires more effort than simply reading a normal font. Essentially, the intermittent gaps of Sans Forgetica requires readers to generate or fill in the missing pieces producing a memory advantage. This mechanism of action is similar to that of the generation effect, wherein information is better remembered when generated or filled-in compared to if it is simply read. In Experiment 1 we examined the mnemonic benefit of Sans Forgetica and generation by looking at cued recall performance with weakly related pairs. If Sans Forgetica does produce a mnemonic benefit, we should observe better cued recall performance for targets in Sans forgetica font compared to Arial font. Further, if it is similar to the generation effect, the magnitude of the memory benefit between the two should be similar.

Method

Participants. Two-hundred and thirty people from Amazon's Mechanical Turk Service participated for money. Sample size was based on a priori power analyses conducted using PANGAEA v0.2 (Westfall, 2015). Sample size was calculated based on the smallest effect of interest (SEOI; Lakens & Evers, 2014). In this case, we were interested in powering our study to detect medium-to-large effect size ($d = .35$). We choose this effect size as our SESOI due in part to the small effect sizes seen in actual classroom studies (Butler, Marsh, Slavinsky, & Baraniuk, 2014). Therefore, assuming an alpha of .05 and a desired power of 90%, a sample size of 230 is required to detect whether an effect size of .35 differs from zero. After excluding participants who 1) did not complete every phase of the experiment, 2) started the experiment multiple times, 3) reported experiencing technical problems did not indicate that they were fluent in English [^2]: This question was not asked during the experiment., or 5) reported seeing our stimuli before, we were left with 115 participants per group.

Materials. The preregistration for Experiment 1 can be found here: <https://aspredicted.org/3ai98.pdf>. All materials, data, and analysis scripts for both Experiment 1 can

be found here (<https://osf.io/d2vy8/>). The results contained herein are computationally reproducible by going to the primary author's github repository for the paper (https://github.com/jgeller112/SF_Expt2) and clicking on the binder button.

Participants were presented with 22 weakly related cue-target pairs taken from Carpenter, Pashler, and Vul (2006)[¹]: Two cue-target pairs (e.g., range-rifle and train-plane) had to be thrown out as they were not presented due to a coding error. The cue-target pairs were all nouns, 5–7 letters and 1–3 syllables in length, and high in concreteness (400–700) and frequency (at least 30 per million). Free association norms (Nelson, McEvoy, & Schreiber, 2004) were used to create 22 weakly associated pairs of similar forward and backward strength. Two counterbalanced lists were created for each difficulty type group (generation and Sans Forgetica) so that each item could be presented in each disfluency conditions without repeating any items for an individual participant.

Design and Procedure. Disfluency (fluent vs. disfluent) was manipulated within-subjects and within-items and difficulty type (Generation vs. Sans Forgetica) was manipulated between participants. For half the participants, targets were presented in Sans Forgetica while the other half were presented in Arial font; for the other half of participants, targets were presented with missing letters (vowels were replaced by underscores) and the other half were intact (Arial font). After a short 2 minute distraction task (anagram generation), they completed a cued recall test. During cued recall, participants were presented 24 cues one at a time and asked to provide the target word. After they were thanked and debriefed.

Participants completed the experiment on-line via the Qualtrics survey platform hosted on Amazon Mechanical Turk. After reading and consenting, participants were randomly assigned to one of two conditions: The generation condition or the Sans Forgetica condition. Participants were told to study word pairs so that later they could recall second word (target) when cued with the first word (cue). The experiment began with the presentation of 22 word pairs, shown one at a time, for 2 seconds each. The cue word always appeared on the left and the target always on the right. Immediately proceeding this, participants did a short 2 minute distraction task (anagram generation). Finally participants completed a cued recall test. During cued recall, participants were presented 22 cues one at a time and asked to provide the target word. Responses were self-paced. Once completed, participants clicked on a button to advance to the next question. At the end, participants were asked several demographic questions.

Scoring. Spell checking was automated with the hunspell package in R (Ooms, 2018) using spellCheck.R. Because participants were recruited in the United States, we used the American English dictionary. A nice walk through on how to

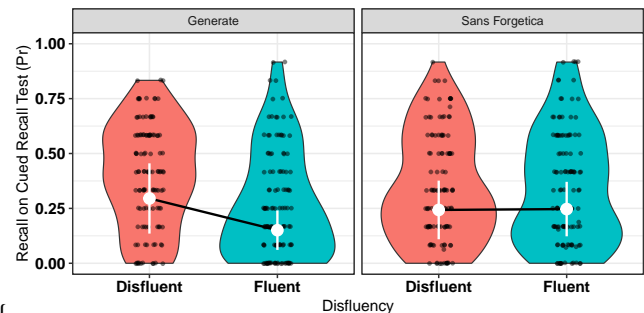
use this package can be found in Buchanan, De Deyne, and Montefinese (2019). Using this package, each response was corrected for misspellings. Corrected spellings are provided in the most probable order, therefore, the first suggestion was always selected as the correct answer. As a second pass, we manually examined the output to catch incorrect suggestions. If the response was close to the correct response, it was marked as correct.

Results and Discussion

Although we had pre-registered a simple 2 X 2 mixed ANOVA approach, we opted for a more powerful mixed modeling approach that better represents the structure of the data (Hoffman & Rovine, 2007; Locker, Huffman, & Bovaird, 2007). Models were fit in R (vers. 3.5.0; R Core Team, 2019) with the lme4 package (vers. 2.3.1; Bates, Mächler, Bolker, & Walker, 2015). All models were analyzed using maximal random effects structures with random slopes where allowed (???). All figures were created with ggplot (Wickham, 2016). We fit a generalized linear mixed model (logit link) to predict cued recall accuracy with difficulty type (generation vs. sans forgetica) and disfluency (fluent vs. disfluency). We fit the maximal model (formula: “glmer(acc~difftypedisflu + (1+disflResponseID) + (1+difftypedtarget), family=binomial, data=data”). Effect sizes (Cohen's *d*) were labelled following Chinn (2000)'s recommendations. The effect of difficulty type was non-significant, $b = -0.09$, $SE = 0.11$, 95% CI [-0.30, 0.13], std. beta = -0.09, $p = 0.431$, $d = 0.05$). Individuals did recall more disfluent target words than fluent target words, $b = 0.21$, $SE = 0.06$, 95% CI [0.09, 0.33], std. beta = 0.22, $p < .001$, $d = 0.12$). This was qualified by an interaction between difficulty type and disfluency was significant, $b = 0.22$, $SE = 0.04$, 95% CI [0.14, 0.30], std. beta = 0.21, $p < .001$, $d = .11$). As seen in Fig. 2, the magnitude of the generation effect is larger than the Sans Forgetica effect.

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Method

\caption{Accuracy on cued recall test. Raw data points (black) with mean (white dot) and 95% CIs were derived using the modelbased R package.} \end{figure}

The results for Experiment 1 are clear-cut. Cued recall for items presented intact and in Sans Forgetica font were equivocal. That is, we did not observe a memory benefit for Sans Forgetica font. We did, however, observe greater recall for generated items, which replicates decades of literature (Bertsch et al., 2007). This suggests that (1) presenting materials in Sans Forgetica does not lead to better memory and (2) the Sans Forgetica effect is most likely not a desirable difficulty.

Experiment 2

Experiment 1 failed to find a memory benefit for Sans Forgetica effect. A limitation of Experiment 1 is that simple stimulus-response learning lacks educational realism. To remedy this, Experiment 2 tested the mnemonic effects of Sans Forgetica using more realistic materials. Whereas Experiment 1 tested whether Sans Forgetica is driven by the generative process of retrieval, Experiment 2 examined whether the Sans Forgetica effect might exert its mnemonic benefit by making material more distinctive. Specifically, Sans Forgetica may make the marked portion of text more memorable because it stands out from the surrounding text. This is similar to the effects of pre-highlighting on learning.

Indeed, some evidence supports this type of role for highlighting: When students read pre-highlighted passages, they recall more of the highlighted information and less of the non-highlighted information compared to students who receive an unmarked copy of the same passage (Fowler & Barker, 1974; Silvers & Kreiner, 1997). To this end,

Experiment 2 compared cued recall performance on a passage where some of the sentences were either presented in: Sans Forgetica, pre-highlighted in yellow, or unmodified. We hypothesized that if the Sans Forgetica effect is mainly driven by distinctiveness, words presented in Sans Forgetica should benefit more from the disfluency than the passage presented unmodified. Further, the benefit for Sans Forgetica should be similar in magnitude to the pre-highlighting condition as both manipulations serve to increase the distinctiveness of the text.

The pre-registration form for Experiment 2, which includes hypotheses, planned analyses, exclusion criteria, and sample size justification, can be found at: <https://aspredicted.org/3jz3z.pdf>.

Participants. Five hundred and twenty-eight undergraduates participated for partial completion of course credit. Sample size was based on a priori power analyses conducted using PANGAEA v0.2. Sample size was calculated based on the smallest effect of interest (Lakens & Evers, 2014). Similar to Experiment 1, we were interested in powering our study to detect a medium-sized effect size ($d = .35$). Therefore, assuming an alpha of .05 and a desired power of 90%, a sample size of 170 per group is required to detect whether an effect size of .35 differs from zero. After excluding participants based on our preregistered exclusion criteria, we were left with unequal group sizes. Because of this, we ran six more participants per group, giving us 176 participants in each of the three conditions.

Materials. Participants read a passage on ground water (856 words) taken from the U.S. Geological Survey (see ???). Eleven critical phrases¹ each containing a different keyword, were selected from the passage (e.g., the term *recharge* was the keyword in the phrase: Water seeping down from the land surface adds to the ground water and is called recharge water.) and were either presented in SF, highlighted, or unmodified. Then, 11 fill-in-the blank questions were created from these phrases by deleting the keyword and asking participants to provide it on the final test (e.g., Water seeping down from the land surface adds to the ground water and is called _____ water). There was 1 manipulation check question: “What was the passage you read on?”

Design and Procedure. Participants were randomly assigned to either the pre-highlighted condition, sans forgetica condition, or unmodified condition. Our design manipulated three difference types of passages between-subjects: pre-highlighting, Sans Forgetica, and unmodified.

Participants completed the experiment on-line via the Qualtrics survey platform. After reading and signing a consent form, participants were randomly assigned to one of three conditions: pre-highlighting, Sans Forgetica, or unmodified. Participants read a passage on ground water. All participants were instructed to read the passage as though they were studying material for a class. After 10 minutes, all participants were given a brief questionnaire (2 questions) asking them to indicate their metacognitive beliefs after reading the passage. The two questions were: “Do you feel that the presentation of the material helped you remember” and “How likely is it that you will be able to

¹originally we had 12 critical phrases but a pilot test showed that one of the questions was repeated twice so we removed one of them and also added a manipulation check question to sure participants were paying attention

recall material from the passage you just read on a scale of 0 (not likely to recall) to 100 (likely to recall) in 5 minutes?"

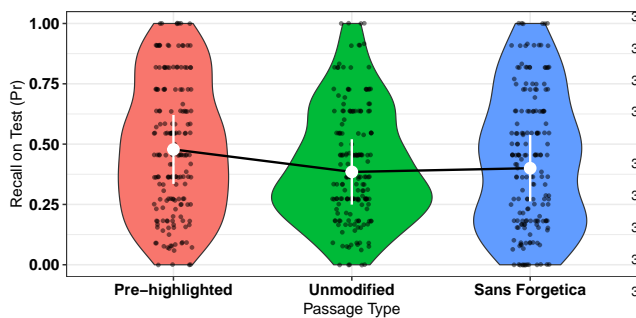
Participants were then given a short distraction task (anagrams) for 3 minutes. Finally, all participants were given 12 fill-in-the-blank test questions, presented one at a time.

Scoring. Spell checking was automated with the same procedure as Experiment 1.

Results and Discussion

For congruence with Experiment 1, we fit a logistic mixed model in a similar fashion (this goes against our pre-registration). We fit a model with passage type as a fixed effect and random intercepts for participants ($N=528$) and questions ($N=11$): (formula: $\text{acc}=\text{glmer}(\text{auto_acc} \sim \text{passage_type} + (1|\text{Participant}) + (1|\text{Question}), \text{data}=\text{data}, \text{family}=\text{"binomial"})$). Passage type was coded using treatment coding. We hypothesized that recall for pre-highlighted and Sans Forgetica sentences would be better remembered than normal sentences and that there would be no recall differences between the highlighted and sans forgetica sentences. Our hypotheses were partially supported (see Fig. 2). Results indicated that pre-highlighted sentences were better remembered than sentences presented normally, $b = 0.38$, $SE = 0.17$, 95% CI [0.05, 0.71], std. beta = 0.38, $p < .05$, $d = 0.21$, and were marginally better remembered than sentences presented in Sans Forgetica, $b = -.317$, $\exp(B) = 1.37$, $SE = .168$, $z = -1.89$, $p = .059$, $d = -0.18$. Critically, there was no difference between sentences presented normally and in Sans Forgetica, $b = 0.06$, $SE = 0.17$, 95% CI [-0.26, 0.39], std. beta = 0.06, $p = 0.700$, $d = .03$. A Bayes factor computed with the hypothesis function from the brms package [Bürkner (2018)] indicated strong evidence for no effect between the two conditions ($BF_{01} = 7.47$).

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were dervied using the modelbased R package..}
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Exploratory Analysis

In Experiment 2 we also asked students about their metacognitive awareness of the manipulats. Specifically we asked participants: "How likely is it that you will be able to recall material from the passage you just read on a scale of 0 (not likely to recall) to 100 (likely to recall) in 5 minutes?" Initial analyses suggest that the normal passages were given higher JOLs ($M = 57.4$, $SE = 1.97$) than the pre-highlighted passage ($M = 50.3$, $SE = 1.97$), $t(525) = -7.08$, $p = .023$. There were no reliable differences between the pre-highlighted passage and Sans Forgetica ($M = 53.8$, $SE = 1.97$), $t(525) = -3.52$, $p = .415$ or between the passage in Sans Forgetica and the passage presented normally, $t(525) = 3.56$, $p = .406$.

contrast	estimate	SE	df	t.rat
Pre-highlighted - Unmodified	-7.079546	2.7792	525	-2.5473
Pre-highlighted - Sans Forgetica	-3.517046	2.7792	525	-1.2654
Unmodified - Sans Forgetica	3.562500	2.7792	525	1.2818

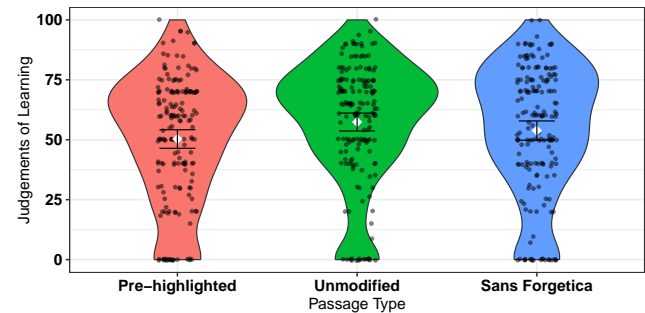


Figure 2. Judgements of learning as a function of passage type.

Words presented in Sans Forgetica did not lead to better recall than words left unmodified or pre-highlighted. We did, however, observe better memory for pre-highlighted information compared to words presented unmodified or in a Sans Forgetica font.

Examining metamemory judgments, we showed that a passage in Sans Forgetica font does not produce lower judgement of learning compared to unmodified or pre-highlighted passages. Interestingly, individuals gave lower JOLs to pre-highlighted information compared to materials presented in a normal font. One potential reason for pre-highlighted information receiving lower JOLs than the normal passage is that pre-highlighted information served to focus participants attention specific parts of the passage. Given the question, participants might have

\caption{Passage Accuracy as a function of passage type.
Raw data points (black) with mean (white dot) and 95% CIs

thought this would hinder them if tested over the passage as a whole.

Experiment 3

The pre-registration form for Experiment 3, which includes hypotheses, planned analyses, exclusion criteria, and sample size justification, can be found at: <https://osf.io/ekqh5>.

Participants. Sixty participants participated for partial completion of course credit. Sample size was determined by a similar procedure to the above experiments.

Design and Procedure

Type of script (Arial vs. Sans Forgetica) was manipulated within-subjects. A total of 188 words were presented, 94 at study (47 in each script condition) and 188 at test (94 old and 94 new). This resulted in four counterbalanced lists.

Lists were assigned to participants so that across participants each word occurred equally often in the four possible conditions: Arial-old, Arial-new, Sans Forgetica-old, Sans Forgetica-new.

Word order was completely randomized, such that Arial and Sans Forgetica words were randomly intermixed in the study phase, and Arial and Sans Forgetica old and new words were randomly intermixed in the test phase. All old words were presented at test in the same manner in which they were presented at study; that is, Arial words during study were presented in Arial font at test, and Sans Forgetica words during study were presented in Sans Forgetica font at test.

Each trial began with a fixation cross appearing at the center of the screen for 500 ms. The fixation cross was then replaced by a word in the same location. Study was self-paced. The participants pressed the continue button to go to the next trial.

After the study phase, a short 3-minute distractor task was administered in which participants wrote down as many United States capitals as they could. Afterward, participants took an old-new recognition test. At test, a word appeared in the center of the screen that either had been presented during study ("old") or had not been presented during study ("new"). Old words occurred in their original script, and following the counterbalancing procedure, each new word was presented in Arial font or Sans Forgetica font. For each word presented, participants chose from one of two buttons displayed on the screen: a button labeled "old" to indicate that they had named the word during study, and a button labeled "new" to indicate they did not remember naming the word. Words stayed on the screen until participants gave an "old" or "new" response. All words were individually

randomized for each participant during both the study and test phases. After the experiment, participants were debriefed. The entire experiment took about 30 minutes to complete.

Results

In recognition memory, signal detection theory has proven to be a very informative and efficient approach to analyzing binary accuracy data. However, considering the deficiency in precision and power in traditional analyses compared to mixed effects analyses, it is worth considering a generalized linear mixed effect approach to signal detection theory (??). In its simplest form, SDT models are probit regressions. To estimate the SDT parameter of interest (d'), we fit a GLMM to participant responses (their actual response (old vs. new)) as a function of the actual status of the item (whether the item was old vs. new) and condition (model: old-

```
new=glmer(sayold~isold*condition+(condition|Participant.Private.ID)+
(condition|Stims), data=data contrasts =
list(condition="contr.sum"),
family=binomial(link="probit"), control=glmerControl(optimizer="bobyqa", optCtrl=list(maxfun=100000)))).
```

The variables isold and condition were treatment coded to allow for the estimation of the d' parameter.

The results are pretty straightforward.

Discussion

Taken together, these results suggest that Sans Forgetica might not be a desirable difficulty. While it has been reported that Sans Forgetica font can enhance performance (see Eskenazi & Nix, 2020), we report results from two high-powered experiments arguing against this claim. Specifically, we demonstrated that Sans Forgetica does not enhance recall for cue-target pairs (Experiment 1) or words embedded in sentences from a passage (Experiment 2). This adds to the increasing literature showing that perceptual disfluency has very little impact on actual memory performance (e.g., Magreehan et al. (2016); Rhodes and Castel (2008); Rhodes and Castel (2009); Rummer et al. (2016); Xie et al. (2018); Yue et al. (2013)). While Sans Forgetica did not produce a memory benefit, we did observe a memory advantage for items that had to be generated (Experiment 1) and that were pre-highlighted, thereby replicating previous results ().

Limitations

Transfer-appropriate processing. In both experiments we looked at cued recall. A recent transfer-appropriate

processing (TAP) framework has contextualized when difficulties are desirable and when they are not (McDaniel & Butler, 2011). Its essence emphasizes the qualitative mismatch of the evoked encoding processes of the applied difficulty (and by the material) with respect to the required retrieval processes of the memory test. Thus, one important aspect postulated by this framework denotes the specific encoding processes stimulated by the type of difficulty applied. For example, generating incomplete word-fragments within a text intensifies the processing of the word cue and the word surroundings that help to identify the word, thus enhancing proposition-specific encoding. In contrast, creating sentence coherency in a text with randomized sentences intensifies the processing of the relationships of information in the text, thus enhancing relational encoding (McDaniel, Hines, Waddill, & Einstein, 1994). Consequently, the generation-task, which required word-generation, led to improved verbatim recall, but it was not desirable for relational test questions (and vice versa).

These differently evoked encoding processes (proposition-specific versus relational) by the generation task predicted different memory effects. It is thus possible that the Sans Forgetica effect arises only under certain memory paradigms (e.g., free recall or recognition). It is hard to test this however, as the mechanisms that give rise to the effect are unclear and currently there is not strong evidence that the Sans Forgetica effect is reliable. Future research should explore different testing conditions.

Processing Difficulty. One criticism put forth when examining perceptual disfluency is that studies do not objectively test (e.g., by using RTs) that stimuli are in fact perceptually disfluent [see Geller et al. (2018)]. Given that the two experiments contained herein were presented on-line using the Qualtrics platform, it was difficult to test this assumption. However, recently, a eye-tracking study by (Eskenazi & Nix, 2020) provided evidence that Sans Forgetica is perceptually disfluent. In their study, as better spellers had longer gaze duration and spent more total time on words presented in Sans Forgetica than poor spellers. This suggests that Sans Forgetica is perceptually disfluent as long as you are a good speller.

disfluency effect that should be considered. Once more research is published, a meta-analysis can be conducted to determine the effect size and any moderating factors of the Sans Forgetica effect. Regardless, it is our conclusion that Sans Forgetica lives up its name. Students looking to remember more and forget less should use other “power tools” shown to enhance learning.

Conclusion

The two experiments herein present evidence against claims put forth by its creators and the media [also see Eskenazi and Nix (2020)]. We concede that our conclusions of no effect might be a bit premature. It is possible that there is an effect of Sans Forgetica, but the effect size might be smaller than we could detect across our two studies. We powered our studies to detect a medium-sized effect. Further, as noted by (Eskenazi & Nix, 2020) and others [Geller2018; Geller2019] there are important moderating factors of the

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