Satiation of Island Constraints is Partially Syntactic Adaptation

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1. Introduction

Linguists have long relied on introspective acceptability judgments of sentences for their theory building. However, these acceptability judgments may not always be as stable as one may desire. For example, linguists often find themselves accepting constructions that originally sound horrible after repeated exposure to sentences of those ungrammatical constructions. This phenomenon is termed the "satiation effect" of acceptability judgment, and it has been widely reported anecdotally by linguists who employ introspective acceptability judgment as a research method.

More recently, there have been several experimental investigations to test if this satiation effect extends to the linguistically naïve population in formal acceptability judgment experiments (i.e. whether participants' acceptability ratings for an ungrammatical construction gradually increase throughout an experiment). Snyder (2000) tested eight island-violated constructions in an experiment where participants were asked to give binary (Y/N) acceptability ratings. It was found that participants gave significantly more positive ratings towards the end of the experiment comparing to the beginning of the experiments for two out of the eight ungrammatical island-violation constructions (complex-NP island and *whether*-island). There was also a marginal satiation effect found in the subject island construction. Since Snyder (2000), island-violated constructions have been the main target of investigation in the satiation literature. The satiation effects of certain island-violated constructions as found in Snyder (2000) were only partially replicated by Braze (2002), Hiramatsu (2000), Francom (2009), Goodall (2011), Crawford (2012), Chaves and Dery (2019) among others. Sprouse (2007, 2009) failed to find satiation effect in any of the eight island-violated constructions that Snyder (2000) originally examined.

2. Previous Approaches to Satiation

Regarding the satiation of the island-violated constructions, we have two major questions to answer: does the satiation effect of island-violated constructions as observed in Snyder (2000) exist, or is it an experimental artifact that cannot be stably replicated? If satiation of island-violated constructions does exist, what is the mechanism behind such boosts in acceptability of ungrammatical sentences?

2.1. Do island-violated constructions satiate?

For the first question, the answers in the literature is mixed. Sprouse (2007, 2009) claim that the increase in acceptability of island-violated constructions found in Snyder (2000) should not be taken as evidence that satiation is taking place. He points out that the stimuli set used by Snyder (2000) was unbalanced: there were more ungrammatical test items than the grammatical filler. This could give rise to an "equalization response strategy" employed by the participants, who keep track of their responses in surveys and try to balance their positive and negative responses. Since there are overwhelmingly more ungrammatical sentences in the stimuli set, participants would find themselves giving more negative responses than positive responses to the test sentences. As a result of the equalization response strategy, their would increase their positive responses towards the later half of the experiment just to balance the negative responses. This would create a false picture where the ungrammatical island items are satiating, when the increase in acceptability is the result of a non-linguistic decision-making heuristic. Sprouse (2009) balanced the original stimuli set in Snyder (2000) by adding more grammatical fillers and did not find any increase in acceptability for the ungrammatical island-violated sentences.

We should note that the crucial piece of evidence in Sprouse (2009) is a null effect and should be taken with a grain of salt. It is possible that the null effect might be due to a lack in power, rather than a lack of satiation. Indeed, there are other studies where satiation effect is still detected even when the stimuli set is balanced. Francom (2009) adopted a design where there are equal numbers of grammatical and ungrammatical items. He found a satiation effect in acceptability in subject island but not complex-NP island. Do and Kaiser (2017) also adopted a balanced set of stimuli, and they detected a satiation effect in complex-NP island constructions but not subject island. Crawford (2012), also using a balanced set of stimuli, found significant satiation in *whether*-island but not adjunct island or subject island. Although these studies provide mixed results on which specific island-violated construction is affected by satiation, they all cast doubt on an equalization-only account. Equalization should not contribute to any change in acceptability ratings if the stimuli set is balanced, and actual satiation effects could be underlying these results.

2.2. What underlies the satiation of islands?

If we think that the satiation effects of island-violated constructions exist (at least for certain types of islands), the second question becomes relevant: what is the mechanism behind the satiation of islands?

One class of approaches attribute satiation (or the lack thereof) to the syntactic properties of the constructions. Snyder (2000) suggested that the number of barriers (Chomsky 1986) in each island construction decides whether it satiates. He proposed that island-violated constructions where the long-distance dependencies cross only one barrier (e.g. *whether*-island) are affected by satiation, while those with long-distance dependencies crossing two barriers (e.g. adjunct island) do not satiate. Similarly, Hiramatsu (2000) proposed that the satiation pattern of island-violated sentences reflects the different sources of ungrammaticality. One main concern for such accounts is the behavior of subject island constructions with respects to satiation. Subject islands are considered to have the same source of ungrammaticality as adjunct islands. In the framework developed in Chomsky (1986), both subject and adjunct islands involve two barriers, contrasting other island types like *whether*-islands or complex-NP islands. In the Condition on Extraction Domain (CED) account of islands developed in Huang (1982), they are both considered as CED island as opposed to islands induced by subjacency violation. It has been shown in several studies that adjunct islands do not satiate (Snyder 2000, Hiramatsu 2000, Braze 2002, Francom 2009, Sprouse 2009, Goodall 2011, Crawford 2012, a.o.). Subject islands, however, display a mixed picture: they have been shown to satiate significantly in Hiramatsu (2000), Francom (2009), Clausen (2011), Chaves and Dery (2014, 2019), marginally in Snyder (2000), and no satiation is found by Goodall (2011), Crawford (2012), and Do and Kaiser (2017). These results pose a challenge to Hiramatsu (2000), since adjunct and subject islands should always pattern the same in her account. As for the account developed in Snyder (2000), it is predicted that subject islands should never satiate since it involves two barriers blocking the long-distance dependency. The studies where subject island does satiate would thus challenge this account.

Another class of approaches attribute satiation of islands-violated sentences to pure performance factors. Francom (2009) proposes the "memory bottleneck" account of satiation, which assumes that the low acceptability of certain types of island-violated constructions could partially be a result of memory-related processing difficulties (Kluender and Kutas 1993, Hofmeister and Sag 2010, a.o.). After repeated exposure of island-violated constructions, the effect of such processing difficulties can be ameliorated as people gets better at associating the fillers with the gaps in the long-distance dependencies in the island constructions. As a result, the acceptability ratings for certain island constructions would increase, yielding satiation effects. Along the same lines, Do and Kaiser (2017) entertained the possibility that structural priming (i.e. facilitation in processing of certain structures due to prior exposure) could be the mechanism underlying satiation. Nevertheless, their experimental results did not provide conclusive evidence for this

hypothesis. In a self-paced reading study, they found that the reading time of subject island constructions improves after repeated exposure. They took it as evidence that processing facilitation can target ungrammatical sentences, which is the prerequisite for a priming-based account of satiation. However, their off-line acceptability rating results did not show any satiation pattern for the subject island sentences. Interestingly, they found that complex-NP island displays satiation in off-line acceptability ratings, but there are no significant changes in its reading time pattern. Therefore, there is no conclusive evidence that priming is the source of satiation.

2.3. Summary

To sum up, the previous literature is still far from presenting a clear picture on the satiation of island-violated constructions. It is unclear whether the acceptability improvements observed in the past studies should be taken as evidence for actual satiation or merely artifacts caused by participants' decision-making heuristics; assuming the former, we are also unclear about the underlying mechanism for satiation.

3. Speaker-specific Adaptation

Setting aside the debate on the existence and the mechanism of satiation in island constructions, let us first examine a close cousin of satiation effect: speaker-specific linguistic adaptation. Uniform as they may seem, languages demonstrate a great degree of variability in how linguistic representations are encoded by individual speakers (Chomsky 1965, Finegan and Biber 2001, Allen, Miller and DeSteno 2003, Barbiers 2005, Brandner 2012, a.o.). For example, an English sentence that speaker A find perfectly acceptable could sound unacceptable to another speaker B, while both speakers A and B could still be characterized as "English speakers" in the general sense. Quite expectedly, speakers are able to keep track of such individual variations during language use, and adapt to different speakers who they converse with by updating the expectations for the variations in different levels of linguistic representations (Clark and Wilkes-Gibbs 1986, Brennan and Clark 1996, Grodner and Sedivy 2011, Kamide 2012, Kleinschmidt and Jaeger 2015, Ryskin, Qi, Duff and Brown-Schmidt 2017, Schuster and Degen 2020, a.o.). After long enough exposure to another speaker with different linguistic representations of some sort (e.g. different lexical choices, phonetic representations, pragmatic reasoning processes, etc.), language users would create a linkage between the differing linguistic representation with the speaker they are conversing with. As a result, those initially jarring differences in the use of language by the other speaker would eventually become much less unexpected.

Now we shall return to the satiation of island-violated constructions. Similar to adaptation effect, satiation involves language users' repeated exposure to linguistic input that does not conform with their own internal linguistic representations. The outcomes of adaptation and satiation are also similar: speaker-specific adaptation results in an increase expectation for a novel linguistic input, and satiation results in an increase in acceptability for an ungrammatical construction. It is a reasonable step to draw a connection between adaptation and satiation, and hypothesize that adaptation could be the underlying mechanism for the satiation effect of island-violated constructions. When rating acceptability, it is possible that people not only consult their own grammar, but also consult their expectation for a sentence to be uttered by another speaker. Thus, repeated exposure to ungrammatical constructions should increase their expectation for those constructions being produced by another speaker, leading to higher acceptability ratings.

4. Hypotheses

We hypothesize that satiation of island constructions cannot be reduced to a non-linguistic equalization response strategy, and satiation effect is partially a result of speaker-specific adaptation to ungrammatical constructions. One crucial prediction this makes is that the outcome of satiation would be weakened if the

ungrammatical sentence is uttered by a novel speaker rather the speaker adapted to. We conducted two experiments to examine these hypotheses. Experiment 1, with two subparts, aims at establishing the existence of satiation of island-violated constructions independent of an equalization response strategy. Experiment 2 tests if the satiation of island-violated constructions can be attributed to speaker-specific adaptation.

5. Experiment 1a

In experiment 1a, we aimed to use an acceptability rating task to test if island-violated constructions demonstrate satiation independent of an equalization response strategy. To control for the equalization strategy, equal number of ungrammatical sentences and grammatical fillers are included in the stimuli set. Similar ways of controlling for the equalization strategy have been used by Sprouse (2009), Francom (2009), among others. If the island-violated constructions satiate independently of an equalization strategy, we should observe an increase in acceptability ratings throughout the experiment.

5.1. Methods

5.1.1. Participants

A total of 146 participants (200 participants recruited, 54 were excluded) were tested on Amazon Mechanical Turk. All participants recruited (including those excluded) were paid $5 for an approximately 25 minutes task. Participants were excluded if their self-reported primary language is not English, if they answered any of the practice trials incorrectly more than once, or if the 95% confidence intervals of their responses for the grammatical fillers and the ungrammatical fillers overlapped.

5.1.2. Materials and Procedures

We tested the three island-violation constructions (complex NP, subject island, and *whether*-island) that were shown to satiate in Snyder (2000). All target sentences were in the form of wh-questions, with the wh-dependency crossing the corresponding island construction boundaries. Target sentences were presented together with a context sentence, which is the declarative form of the target sentence. Example items of the three island conditions are shown below. A total of 45 island items were included.

(1) Complex NP:
Context: The teacher believes the claim that the girl lost her wallet.
Target: *What does the teacher believe the claim that the girl lost?*

(2) Subject island:
Context: The detective thinks that a bottle of poison killed the man.
Target: *What does detective think that a bottle of killed the man?*

(3) *Whether*-island:
Context*:* The teacher wonders whether the student spilled a cup of coffee.
Target: *What does the teacher wonder whether the student spilled?*

Also included in the stimuli were 49 grammatical filler items and 4 ungrammatical word-salad filler items. All grammatical filler items were in the form of regular wh-questions without island construction. An example is shown below.

(4) Grammatical filler:
Context: The journalist thought that the politician wrote a book.
Target: *What did the journalist think that the politician wrote?*

The ungrammatical fillers were also wh-questions, but with word-order permuted starting the second word. An example is shown below.

(5) Ungrammatical word-salad filler:
Context: The priest of the local church saw a man sleeping under the bridge.
Target: What bridge the under saw church local the of did priest the?

The entire experiment is divided into 15 blocks. For 11 out of the 15 blocks, each block contains three island items (one from each condition) and three grammatical filler items. For the other 4 blocks, each block contains three island items (one from each condition), four grammatical fillers, and one ungrammatical word-salad fillers. These four blocks are randomly interspersed among the others. The ordering of items within block and the ordering of blocks were randomly determined. Three lists were created in a Latin Square fashion.

For each test item, the participants see a target sentence along with the corresponding context sentence. They were asked to rate the acceptability of the target using a slider-bar with two ends labelled "completely unacceptable" and "completely acceptable". The responses were recorded as numeric values between 0 and 1, with the "completely unacceptable" end represented by 0 and the "completely acceptable" end represented by 1. An example interface is shown in the Figure below.

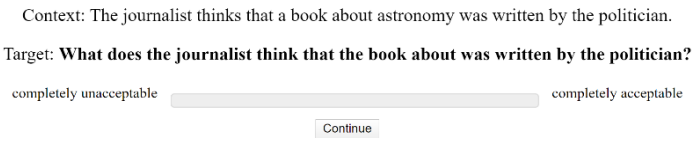

Figure 1. Example Interface of Experiment 1a

5.2. Results and Discussion

We used a linear mixed effects model predicting acceptability responses from fixed effects of *Presentation Order*, *Condition*, and their interaction. Random by-participant and by-item intercepts were included, as well as by-participant and by-item slopes for the fixed effects. Satiation of islands constructions was detected as a significant interaction of *Presentation Order* and *Condition*, with the grammatical fillers being the control and the response increasing as presentation order increases. The plot of acceptability rating as a function of *Presentation Order* is shown below.

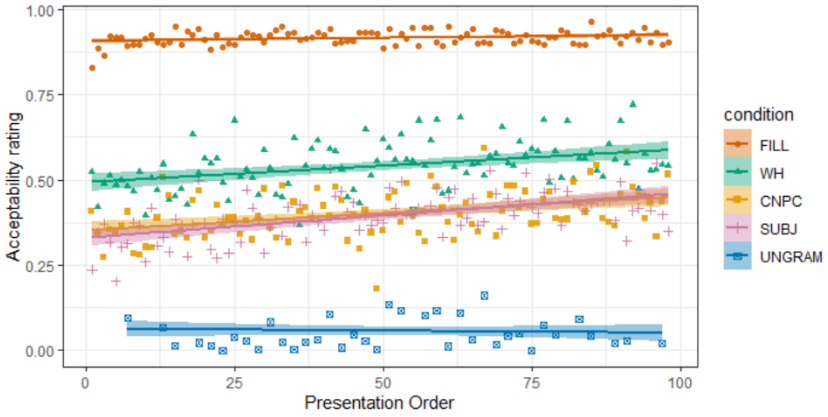

Figure 2. Satiation Plot of Experiment 1a

There is a signicant main effect of *Presentation Order* (β=0.0002, β SE=0.00008, *t*=2.16, *p*<0.05) With the grammatical filler being the control, there is a significant interaction of *Presentation Order* × *Condition* for the *whether*-island condition (β=0.0008, β SE=0.0003, *t*=3.13, *p*<0.01), the complex-NP island condition (β=0.0009, β SE=0.0003, *t*=3.48, *p*<0.01), and the subject island condition (β=0.0010, β SE=0.0003, *t*=3.61, *p*<0.01).

The results suggest that there is significant satiation effect for all three island conditions, roughly replicating the findings in Snyder (2000). The only difference is in the subject island condition, where Snyder (2000) only reported a marginal satiation effect. This results would not be expected if we assume the equalization response strategy is the only underlying source of acceptability improvement: the stimuli set is balanced between ungrammatical island/word-salad items and grammatical fillers, and equalization strategy should be controlled for. A look at the by-trial/cumulative average of the responses provides further corroboration: if the equalization response strategy is the only reason acceptability improvement takes place, the average responses across all conditions should only drift towards the midpoint of the scale. However, as shown in the plots below, both the by-trial average and the cumulative average of the responses drift away from the midpoint (0.5), suggesting that the equalization strategy cannot be the sole underlying cause of acceptability improvement.

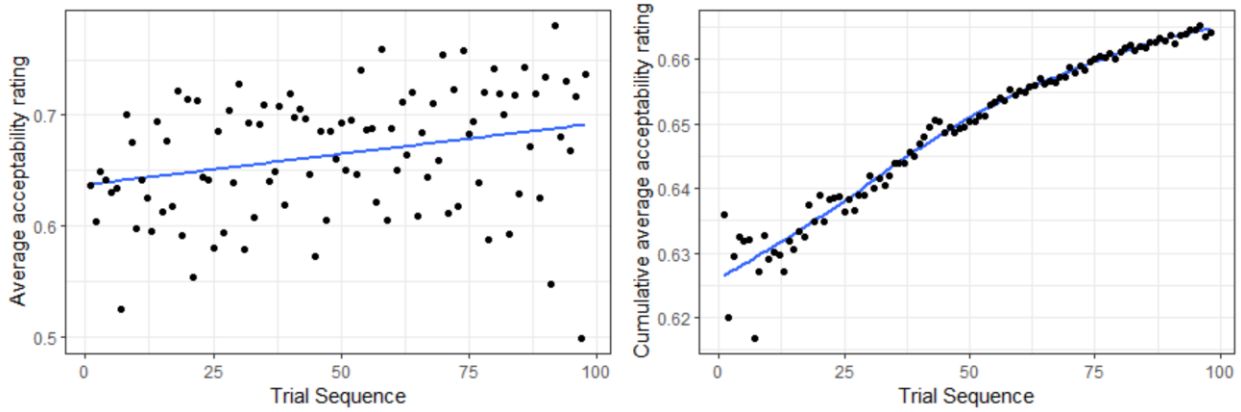

Figure 3. By-trial and Cumulative Average of Experiment 1a Responses

One potential problem for the method of balancing the stimuli set in Experiment 1a concerns the status of the island conditions. As we can see from the satiation plot, the ratings for the island conditions were not exactly at floor, but rather at around midpoint level. If equalization response strategy is a domain-general decision-making heuristic that is blind to the linguist-representations, the reasonable way to control for equalization would be balancing the acceptable and unacceptble items, rather than balancing the grammatical and ungrammatical items. Island items in Experiment 1a, though ungrammatical, should rather be considered as neither acceptable nor unacceptable given their mipoint-level acceptability. This gives rise to a different way of balancing the stimuli set to control for the equalization response strategy, which we adopted in Experiment 1b.

6. Experiment 1b

Experiment 1b aims to verify the results from Experiment 1a with a different method of balancing the stimuli set: one where all island items are considered as neutral, and the the numbers of grammatical/word-salad filler items are balanced.

6.1. Methods

6.1.1. Participants

A total of 106 participants (120 participants recruited, 14 were excluded) were tested on Amazon Mechanical Turk. All participants recruited (including those excluded) were paid $4 for an approximately 20 minutes task. The same exclusion criteria as in Experiment 1a apply: participants were excluded if their self-reported primary language is not English, if they answered any of the practice trials incorrectly more than once, or if the 95% confidence intervals of their responses for the grammatical fillers and the ungrammatical fillers overlapped.

6.1.2. Materials and Procedures

Experiment 1b used the same materials as in Experiment 1a, but with different total number of grammatical and ungrammatical word-salad filler items. The experiment is divided into 15 blocks, with each block containing three island items (one of each condition), one grammatical filler, and one ungrammatical word-salad filler. In this way, the total number of grammatical and ungrammatical fillers were balanced, while the island items were considered as neutral. The ordering of items within block and the ordering of blocks were randomly determined. Three lists were created in a Latin Square fashion. The same interface as in Experiment 1a was used.

6.2. Results and Discussions

Same as in Experiment 1a, a linear mixed effects model is used to predict acceptability ratings from fixed effects of *Presentation Order*, *Condition*, and their interaction. Random by-participant and by-item intercepts were included, as well as by-participant and by-item slopes for the fixed effects. Satiation of islands constructions was detected as a significant interaction of *Presentation Order* and *Condition*, with the grammatical fillers being the control and the response increasing as presentation order increases. The plot of acceptability rating as a function of *Presentation Order* is shown below.

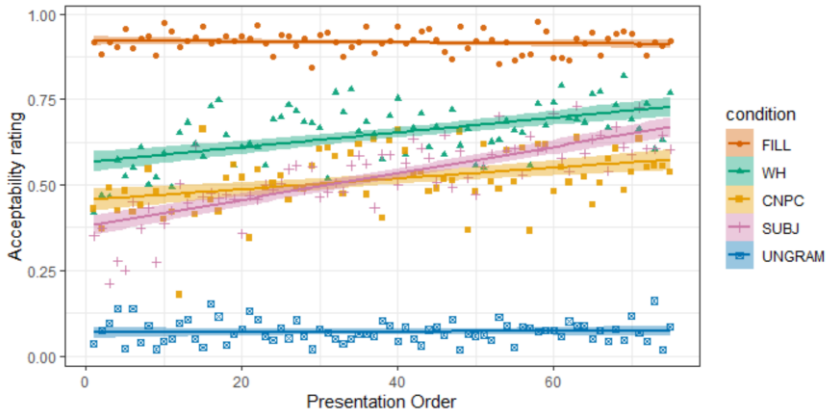

Figure 4. Satiation Plot of Experiment 1b

There is no signicant main effect of *Presentation Order* (β=0.0001, β SE=0.0002, *t*=0.44, *p*=0.66), but with the grammatical filler being the control, there is a significant interaction of *Presentation Order* × *Condition* for the *whether*-island condition (β=0.0024, β SE=0.0004, *t*=5.77, *p*<0.001), the complex-NP island condition (β=0.0018, β SE=0.0005, *t*=3.42, *p*<0.01), and the subject island condition (β=0.0039, β SE=0.0005, *t*=7.27, *p*<0.001).

The results suggest that there is significant satiation effect for all three island conditions, replicating our findings in Experiment 1a. The by-trial average and cumulative average of the responses, as shown in the plots below, also crossand drift away from the midpoint of the scale, same as in Experiment 1a. This

again suggests that the equalization response strategy cannot be the only contributing factor to the accepatbility improvements.

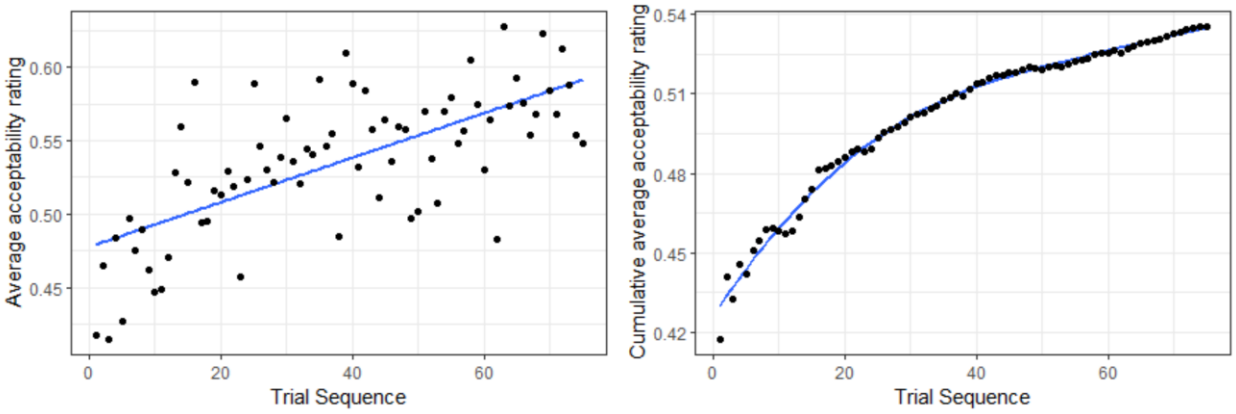

Figure 5. By-trial and Cumulative Average of Experiment 1a Responses

7. Experiment 2

Thus far, we have shown that whether-islands, subject islands, and complex-NP islands demonstrate satiation, and the acceptability improvements cannot be explained by the equalization response strategy alone. In Experiment 2, we directly test the hypothesis that satiation of island constructions is a syntactic adaptation effect.

In earlier sections we discussed the possibly that participants may consult their expectations for the island constructions to be produced by another speaker in addition to their own grammar while giving acceptability judgments, where more expected structures receive higher ratings. Assuming repeated exposure to a certain structure increases the expectation for that structure, the acceptability ratings for that structure would also increase. Given that no speaker identity for the target sentences are provided in past experiments, it is hard to know whether or not the participants are constructing abstract speaker identities and tracking the likelihood of different structure being produced by these speakers during the experiment (i.e. whether speaker-specific adaptation is taking place). To control for this uncertainty, we overtly provide speaker information for each target item in this experiment, and each speaker is consistently matched with one specific construction. If satiation is the result of a speaker-specific adaptation, the acceptability increase after repeated exposure should be diminished if the satiation construction is suddenly produced by a novel speaker.

7.1. Methods

7.1.1. Participants

A total of 271 participants (360 participants recruited, 89 were excluded) were tested on Amazon Mechanical Turk. All participants recruited (including those excluded) were paid $4 for an approximately 20 minutes task. The same exclusion criteria as in Experiment 1a and 1b apply: participants were excluded if their self-reported primary language is not English, if they answered any of the practice trials incorrectly more than once, or if the 95% confidence intervals of their responses for the grammatical fillers and the ungrammatical fillers overlapped.

7.1.2. Materials and Procedures

The same island conditions as in Experiment 1a and 1b are tested in Experiment 2, but each participant only saw one of the three island conditions (randomly selected for each participant). The experiment consists of 21 blocks in total: 15 exposure and 6 testing blocks. Each block contains one island item, one grammatical filler, and one word-salad. The grammatical and word salad filler items are desgined in the same way as in Experiment 1a and 1b. Each item was accompanied by a cartoon avatar (representing the speaker), and the target sentence was phrased as a direct quotation. An example interface is shown below. Three avatar-represented speakers were matched with each condition (island, grammatical, word-salad) during the exposure phase. In the testing phase, the speakers for the island items and the grammatical fillers were either swapped or maintained (randomly selected for each participant).

Figure 6. Example Interface of Experiment 2

To control for any stereotypical or idiosyncratic perception of the avartars by the participants, the speaker identies for the island and gramatical filler items were randomly drawn from a pool of four identities (shown below) for each participants. The speaker identities were also randomly matched to the conditions, except for the word-salad fillers. The word-salad fillers were always produced by a robot named “Iron-Head”. The pool of four human speaker identites and the robot “Iron-Head” as shown below.

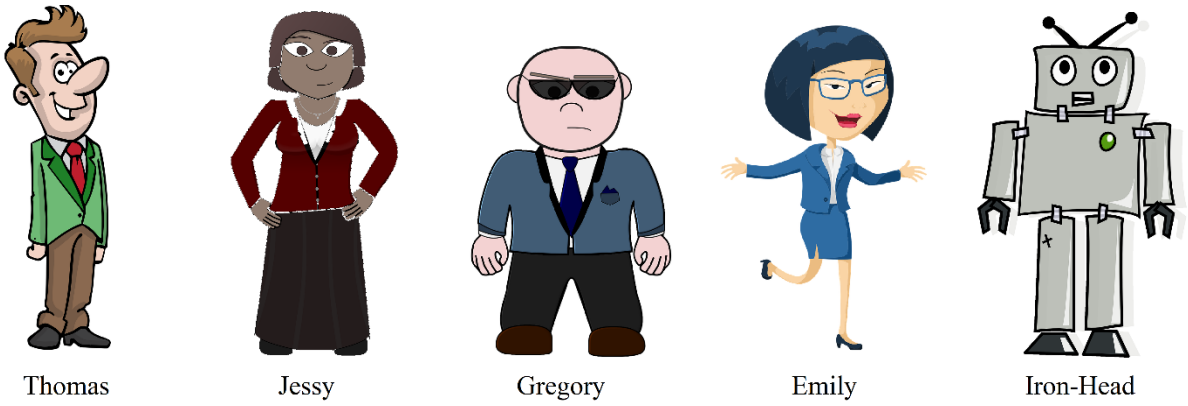

Figure 7. Speaker Identities Used in Experiment 2

7.2. Results and Discussions

We shall first see if the exposure phase demonstrates the same satiation pattern as seen in Experiment 1a and 1b. We used a linear mixed effects model predicting acceptability responses in the exposure phase from fixed effects of *Presentation Order*, *Condition*, and their interaction. Random by-participant and by-item

intercepts, and by-item slopes for the fixed effects were also included. Satiation of islands constructions was detected as a significant interaction of *Presentation Order* and *Condition*, with the grammatical fillers being the control and the response increasing as presentation order increases. The plot of acceptability as a function of *Presentation Order* within the exposure phase is shown in the figure below.

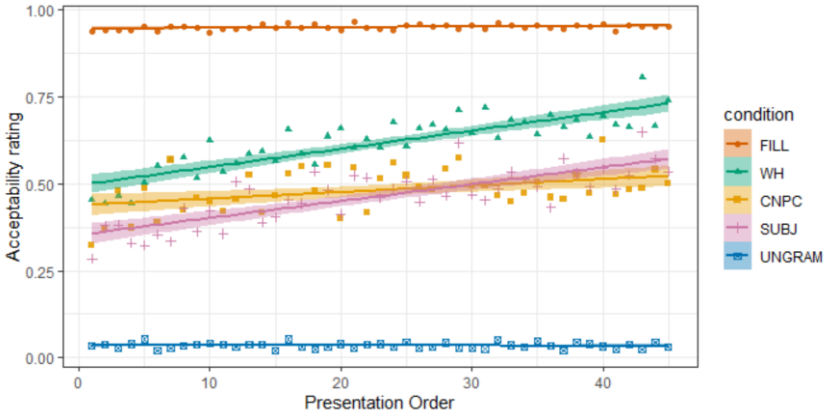

Figure 8. Satiation Plot of Experiment 2

There is no signicant main effect of *Presentation Order* (β=0.0002, β SE=0.0002, *t*=1.05, *p*=0.29), but with the grammatical filler being the control, there is a significant interaction of *Presentation Order* × *Condition* for the *whether*-island condition (β=0.0051, β SE=0.0005, *t*=9.31, *p*<0.001), the complex-NP island condition (β=0.0016, β SE=0.0006, *t*=2.43, *p*<0.05), and the subject island condition (β=0.0046, β SE=0.0005, *t*=10.21, *p*<0.001). These results suggest that all three island conditions demonstrate satiation effect within the exposure phase, replicating the results from Experiment 1a and 1b.

For the testing phase results, we used a linear mixed-effects model with *Condition* and *Speaker-match/mismatch* (i.e. whether the speakers are swapped or not compared to the exposure phase) being factors. Random by-subject and by-item intercepts, and by-item slopes for the fixed effects are included. If the accepatbility improvements throughout the exposure phase were induced by speaker-specific adaptation, we should see an acceptability drop in the speaker-mismatch condition, but not in the speaker-match condition. Such speaker-specificity effect was detected as a significant interaction of *Condition* and *Speaker-match/mismatch*. The average accepatability ratings for each condition are shown in the figure below, with by-participant average responses plotted as the semi-transparent dots.

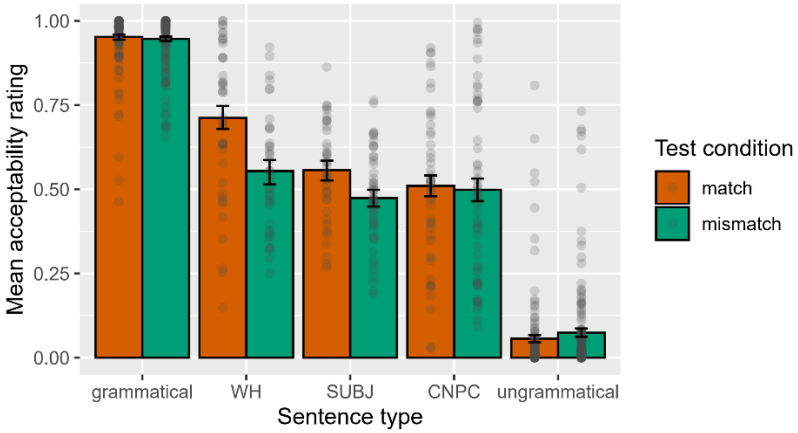

Figure 9. Experiment 2 Testing Phase Results

Significant Condition× Speaker-match/mismatch interactions (with grammatical filler being the control) were found for *whether*-island (β=0.15, β SE=0.031 t=4.86, p<0.01), subject island (β=0.073, β SE=0.020 t=3.59, p<0.01), but not for complex-NP island (β=0.0090, β SE=0.018 t=0.50, p=0.62).This suggests that the satiation outcomes for subject island and whether-island are speaker-specific, and could be reduced if the speaker identity is switched. For complex-NP island, however, we do not have conclusive evidence that the satiation effect is speaker-specific.

To test if the acceptability ratings in the speaker-mismatch condition drops back to the level before satiation happened, we compared the first six trials of the exposure phase with the testing phase speaker-mismatch condition items (shown in the figure below). The data were analyzed using a linear mixed-effects model with *Condition* and *Phase* (First six trials of the exposure phase vs. the speaker-mismatch trials of the testing phase) being factors. Random by-subject and by-item intercepts, and by-item slopes for the fixed effects are included. Difference between the first six trials of the exposure phase and the speaker-mismatch trials of the testing phase was detected as significant interactions of *Condition* and *Phase* with the grammatical fillers being the control.

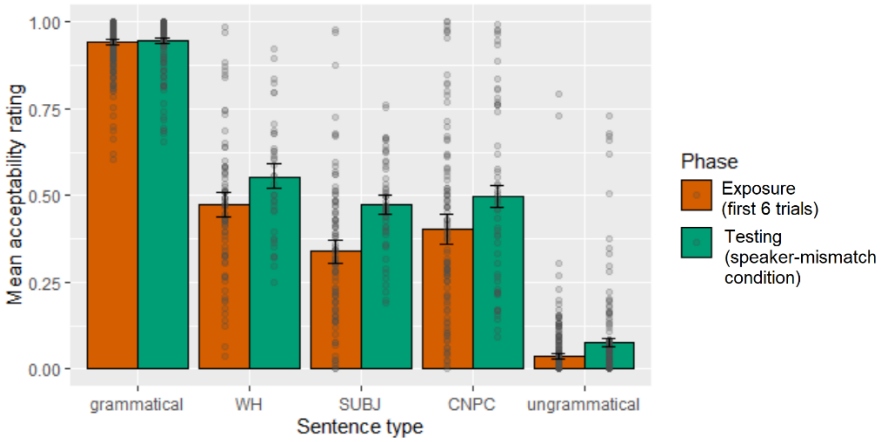

Figure 10. First Six Trials of Exposure Phase Compared with Speaker-Mismatch Testing Trials

Significant interactions of *Condition* and *Phase* were found for *whether*-island (β=0.080, β SE=0.036 t=2.21, p<0.05), subject island (β=0.13, β SE=0.025 t=5.04, p<0.001), and complex-NP island (β=0.0080, β SE=0.029, t=2.71, p<0.05). This suggests that the accepatbility increase gained through satiation is not entirely diminished by the switch in speaker-identity.

Putting the pieces together, all three island types demonstrate ssatiation in the exposure phase. By switching the speaker identity between the island constructions and the grammatical fillers in the testing phase, we observed an accepatbility drop in *whether*-island and subject island conditions, but not in complex-NP island conditions. Such drop in acceptability does not entirely diminish the accepability increase caused by satiation. These findings generally supports our satiation-as-adaptation hypothesis: satiation of *whether*-islands and subject islands can be partially understood as speaker-specific syntactic adaptation, while there may also be other contributing factors for the accepatbility increase.

8. General Discussion

In Experiment 1a and 1b, we established the existence of satiation effect for three different island-violated constructions: *whether*-island, subject island, and complex-NP island. To examine the proposal that exposure-induced accepatbility increase is caused by a non-linguistic equalization response strategy (Sprouse 2009), the stimuli sets were balanced. In experiment 1a, the total numbers of grammatical and

ungrammatical items were balanced; in experiment 1b, the total number of accepatble and unacceptable fillers were balanced, while the island items were considered as neutral. The by-trial and cumulative average of the responses also drift away from the midpoint of the scale in both experiments, which is also not predicted by an equalization-only account of accepability improvement. Therefore, we have strong evidence for the existence of domain-specific syntactic satiation effects for the island constructions tested. The responses may still be affected by some equalization strategies employed by the participants, but they should not be the only things contributing to the accepability improvements.

Having established the existence of actual satiation effects, we examined the underlying mechanism of satiation in Experiment 2. By providing overt speaker identities for the target sentences, we observed a drop in accepatbility the satiated constructions when they were produced by speakers, which suggests that the satiation effect observed is sensitive to speaker identity. This result supports the our satiation-as-adaptation hypothesiswhere satiation is partially understood as speaker-specific adapation to the ungrammatical constructions.

Taking a step back, we shall examine the previous approaches to satiation in the context of these findings. Experiment 1a and 1b provides sufficient evidence against the account where satiation is understood as an equalization response strategy that is not sensitive to linguistic representations (Sprouse 2009). Experiment 2 suggests that satiation is sensitive to speaker-identities, and thus any theory of satiation should take into account performance-performance factors like the speaker-specific expectations for different structures. This finding clearly poses a challenge for theories of satiation based on syntactic properties of the island constructions (Snyder 2000, Hiramatsu 2000), which do not take into account the performance-related factors. The performance-based memory-bottleneck account of satiation (Francom 2009, Do and Kaiser 2017) also cannot directly account for the findings in Experiment 2. According to the memory-bottleneck account, satiation occurs as the processing of ungrammatical island constructions is facilitated through repeated exposure (i.e. structural priming). This account does not make any direct prediction regarding the speaker-specificity of satiation, and thus cannot directly explain the results from Experiment 2. However, it is still possible that syntactic adaptation and structural priming may share the same underlying mechanism, but further studies will be needed to construct this linkage.

There are a few potential directions of future studies. First, it is interesting how different island constructions demostrate different speed of satiation. For example, the subject island condition demonstrates a numerically larger acceptability increase than the complex-NP island, which roughly has the same average accepatbility rating as the subject island. Further study is needed to reveal how exactly the structural difference between the island constructions could interact with the factors that contribute to satiation. Second, there have been attempts to used the satiation profile of different constructions to inform syntactic theories of islands (Hiramatsu 2000, Goodall 2011, Crawford 2012, a.o.). This study reveals that performance factors contribute significantly to the satiation effect. A potential future direction is to re-examine the theories of islands proposed in these studies by taking into account the various processing factors affecting satiation.

9. Conclusion

Satiation effect exists for *whether*-island, subject island, and complex-NP island constructions, which cannot be reduced to the equalization response strategy. The acceptability improvements also demonstrate sensitivity to speaker-information, which supports the account where satiation is partially understood as speaker-specific syntactic adaptation.

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