The Social Effect of Linguistic Alignment on Speech Production and Comprehension

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Abstract

Analyzing language provides insight into cognitive function and improves our understanding of how information is encoded in the brain and later retrieved for speech production. One aspect of language, called linguistic alignment, measures one's tendency to use the same speech patterns as their conversational partner. This research focused on the effect of cognitive load on linguistic alignment in order to determine whether additional processing demands disrupt one's ability to store or retrieve language information. This was achieved by asking 116 participants to complete a picture naming task in which they would listen to pictures being named and subsequently name the pictures in order to determine if they used the same name that the experimenter had previously used. Some participants also memorized digits during either speech production or comprehension. It was found that alignment occurred the most in the no-load conditions and less while the participants were under load ($p < .05$). These results reject the claim that alignment provides a communicative benefit by allowing the speaker to off-load language processing and opens the door for future research to identify what about alignment is beneficial in communication and how it can be applied to improve collaboration and innovation.

Introduction

Language is a non-invasive signal that provides insight into cognitive function. In recent years, studies of word choice, sentence structure, and pronunciation have improved our understanding of how language is encoded in the brain and later retrieved for speech production. One of the many aspects of language processing, called linguistic alignment, measures one's tendency to use the same speech pattern as one's conversational partner and has been shown in previous studies to improve communication effectiveness. This research focused on the effect of cognitive load on linguistic alignment in order to determine whether additional processing demands disrupt one's ability to store or retrieve language information. The findings provide insight into brain mechanisms and successful linguistic collaboration.

Review of Literature

Lexical Alignment

The term "lexical alignment" was coined by Garrod and Anderson in a 1987 study in which pairs of participants worked together to complete a maze game. "Lexical" refers to the vocabulary or word choice the participants used in their conversation. In this study, partners used similar speech patterns when communicating with each other, and their degree of alignment increased as the game progressed, meaning that they used the same words as their partner more often. The researchers concluded that the partners were coordinating their speech to fit a mutually-accepted description, making it easier to complete the task.

Value of Alignment: Communication Effectiveness and Task Success

There have been several studies that demonstrated the cognitive benefit of linguistic alignment. One study focused on calculating the correlation between alignment and task success by testing pairs of participants who communicated verbally with each other to move objects on separate screens (Nenkova et al., 2008). The researchers found a positive correlation between the participants' level of alignment and their game score ($p<0.008$), meaning that the pairs in which each speaker repeated a higher proportion of their partners words received higher scores in the game. This indicates a strong relationship between alignment and communication effectiveness.

Another experiment quantified the benefits of linguistic alignment between conversational partners who had to identify pictures (Fusaroli et al., 2012). Here participants who aligned their speech showed a collective benefit ($r=0.67$, $p<0.005$) by completing the task faster and with fewer errors (Figure 1). A study of conversational partners who collaborated to build Lego constructions found that those who aligned their speech more had shorter completion times and lower error rates as well (Abel et al., 2016).

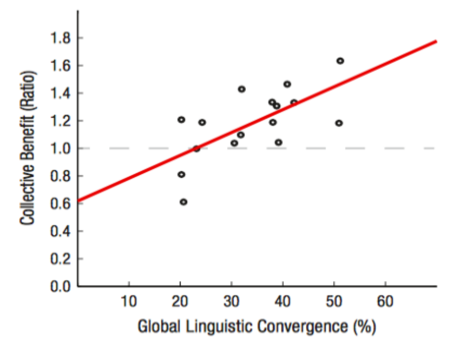


Figure 1: Correlation between task success (Collective Benefit) and alignment (Linguistic Convergence). There is a strong positive correlation between alignment and task success.

Reasons for Alignment: Production vs Comprehension Benefit

While data showed that alignment improves communication effectiveness and task success, it was unknown what caused people to align. One study identified "priming" as the act of introducing language (vocabulary or sentence structure) to the participant that later influenced their speech (Branigan et al., 2000). In this experiment, the subject and experimenter alternated describing images; the experimenter purposely altered their sentence structure throughout the task in order to test the participant's response. The results showed that the subject mimicked the syntax of the experimenter in their speech that immediately followed the experimenter's description, thus demonstrating the influence of priming on speech and suggesting that the primed syntax was easier to produce, indicating a production benefit to alignment.

Another study investigated how alignment was affected by the speaker's beliefs about their partner by having a participant speak to either a human or a computer (Branigan et al., 2011). Results indicated that people aligned most when they believed their partner was less capable, suggesting the purpose of alignment is to benefit the comprehension of the listener.

Because there have been conflicting results in the previous literature, it is still unknown if alignment is more beneficial in conversation to the listener for comprehension or the speaker for production. This is important because it could inform speakers or listeners how to adjust their speech to improve communication effectiveness.

Memory Load and Its Effect on Alignment

"Memory load" is often administered in behavioral science experiments to simulate stress while participants complete other tasks in order to make those other tasks more difficult. Memory load is generally applied by having participants remember a series of words or numbers. Previous studies have demonstrated that memory load negatively impacts one's ability to complete tasks. One study asked participants to memorize a group of three words while simultaneously reading and answering a question about a short passage (Gordon et al., 2001). This study found that memory load interfered with the participant's ability to read and comprehend the passage, showing an overlap of memory and language processing. A study of linguistic alignment in a picture naming task (Krahmer et al., 2014) also found that alignment was lower for participants under memory load (Figure 2).

While previous research has investigated the cognitive benefit of and reasons for linguistic alignment, few studies have used memory load to directly investigate the production versus comprehension benefit debate around linguistic alignment. In order to address the gap in current knowledge, this study aimed to determine if lexical alignment was more beneficial to the speaker or listener in conversation. This was assessed by administering memory load to the participant during a picture-naming task. Images were selected based on a pilot survey that identified the preferred and dispreferred names for various objects. Participants were given a digit span test to calibrate memory load and a post-experiment questionnaire regarding the subject's perception of the experimenter to assess if there was a social influence on lexical alignment.

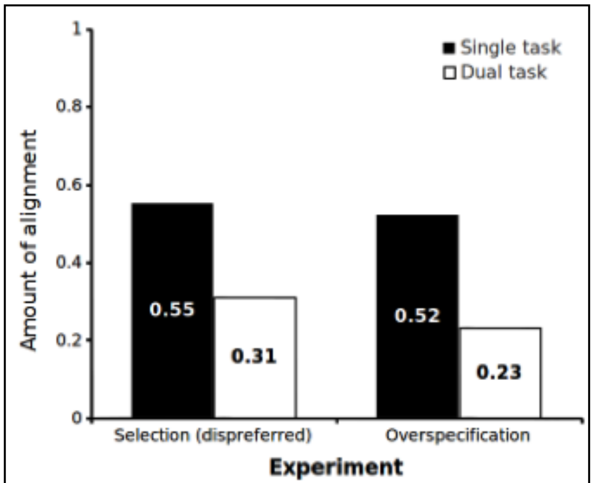


Figure 2: Subjects in the single-task (no memory load) experiment aligned significantly more than dual-task (memory load) subjects.

Problem Statement

1. It is not clear why speakers engage in alignment at all. Previous studies have inconclusive and conflicting evidence for whether alignment has a communicative benefit, and if so whether it aids the speaker's language production or the listener's language comprehension.
2. It is unknown if social perceptions of one's conversational partner impact their propensity to align.

Objectives

1. To assess if alignment is done for a production or comprehension benefit by testing the effect of memory load on alignment during task completion.
2. To determine if one's perception of the speaker influences their degree of alignment.

Hypotheses

1. If alignment aids *production*, then when the *speaker* is under load, the speaker should align more. If alignment aids *comprehension*, then when the *listener* is under load, the speaker should align more.
2. If there is a social component to alignment, participants who rate the experimenter more positively would align more because they are more trusting of the experimenter.

Methodology

Overview

This project consisted of a survey phase followed by a testing phase. The survey was designed and distributed by the student with guidance from the mentor for about 5 weeks during the spring and summer of 2018, and results were analyzed by the student. During the summer of 2018, the student researcher ran 36 dialogue experiments with high school students, each of whom gave consent and had parent/guardian written permission prior to experimentation. Over the course of 16 weeks, during the spring and summer of 2019, the student was responsible for collecting data through dialogue experiments with 40 high school and 40 adult participants, each of whom gave their consent prior to experimentation. These experiments, which each took approximately 30 minutes, consisted of a conversation between the participant and experimenter in which they named pictures of everyday objects. In total, data from 116 participants was collected and speech recordings from each experiment were analyzed. The mentor assisted in the design of the experiment and the analysis of the results.

Survey Phase

Survey Design Since many common objects can be described using multiple names (for example, both *couch* and *sofa* are acceptable for the same object), a pilot survey was designed to determine the most commonly used (preferred) names for these objects. Knowing the preferred and dispreferred name for certain objects enables the design of the subsequent testing phase. Survey respondents were shown a total of 96 pictures and asked to write the word they would use to name the image. The pictures used in this survey were collected from the International Picture Naming Project (IPNP) (Szekely et al., 2004).

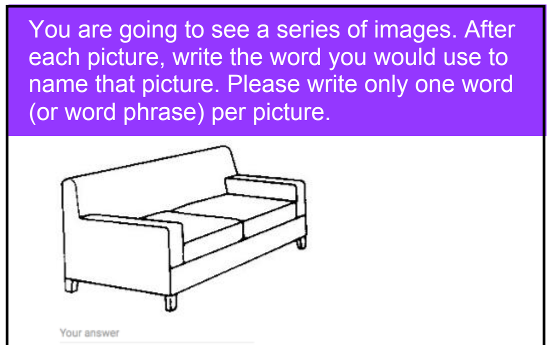


Figure 3: Sample survey question asking respondents to write the word they would use to name the picture

For example, individuals were asked to name the picture in Figure 3 and, based on the responses, we determined what percentage of people used the word *couch* versus the word *sofa* to describe the picture. Other parts of the pilot survey included asking the respondents if a provided name was acceptable for the given image and collecting demographic information about the respondent such as age, gender, and language background, such as which languages they learned in childhood.

Survey Consent and Distribution This survey was created on Google Forms. After creating the survey, we obtained IRB approval. In accordance with the IRB rules, all participants, who were minors (age 13-18), gained consent from their parents before completing the survey. The survey included consent questions for the respondent to confirm that they knew the survey was anonymous, voluntary, and that they may stop at any time. The survey was distributed to students at several local high schools in my county via email and social media outlets such as Instagram and Twitter to obtain a more diverse array of respondents.

Survey Analysis Pilot survey results were analyzed to identify a set of 18 images that had two common and acceptable names (e.g., *couch/sofa*) – called critical pictures – and a set of 30 images with only one common and acceptable name (e.g., *apple*) – called filler pictures. These 48 images were printed and made into laminated cards to be used in the subsequent experiment (Figure 4). They were then grouped into six card packs, each with three critical and five filler pictures. These card packs were a deliberate mix of critical and fillers pictures to minimize the chance of the participant guessing the purpose of the alignment experiment and subsequently changing their language patterns. Four extra pictures were also placed in each pack to ensure that card selection did not become significantly easier after many of the cards had been eliminated.

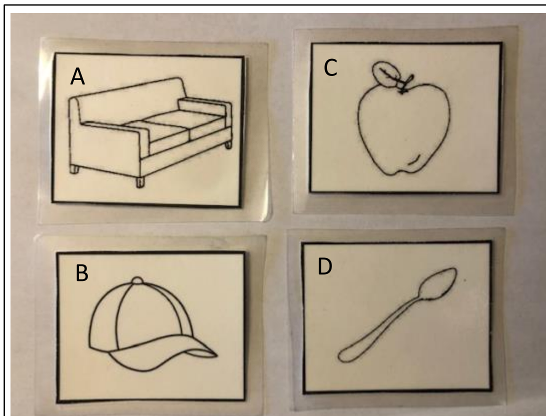


Figure 4: Examples of picture cards used in the testing phase. A and B are examples of critical pictures, each with two acceptable names (*couch/sofa, cap/hat*, respectively). C and D are examples of filler pictures, each with only one acceptable name (*apple, spoon*, respectively)

Testing Phase

Experiment Overview This experiment was designed to test how the tendency of the participant to verbally align to the experimenter (i.e., use the same name as the experimenter to identify the pictures) is affected by being under memory load while completing the picture naming task. Prior to experimentation, each participant was given a consent form to read and have signed by themselves and a parent or guardian (if they were a minor). The consent forms reviewed the purpose of the experiment, scope of activity, testing conditions, and any potential risks and benefits. At the beginning of the experiment, the student researcher collected the signed consent form. Only participants who returned a signed consent form were tested.

Table Setup The participant and experimenter sat facing one another across a table in a quiet room. A divider placed in the center of the table prevented them from seeing one another's cards (Figure 5). Each person had a 2x4 grid in front of them on which they placed their cards they were matching when that picture was named by the other person. Headset microphones

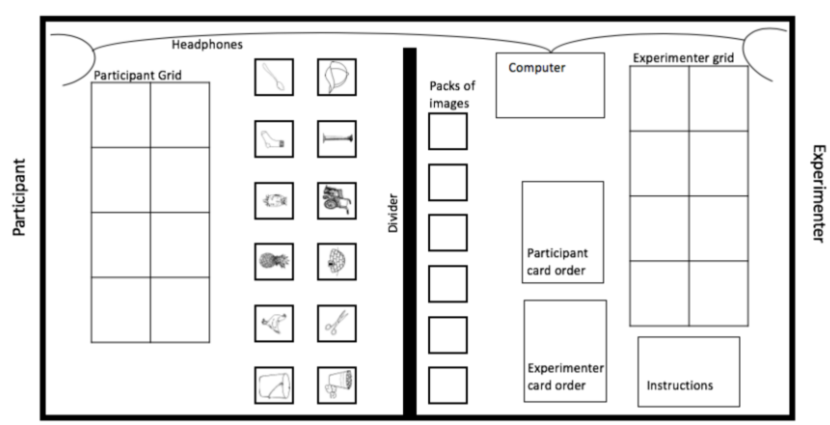


Figure 5: The experimental setup shown here, where the participant is on the left and the experimenter is on the right, sitting across from each other at a table. The materials are laid out before them, including picture cards, grids, and a computer. Each person wears a headset that records their speech.

connected to a laptop computer were used to record the speech of both the participant and experimenter. These recordings were later transcribed by the experimenter in order to determine which name the participant used for each picture during the experiment.

Picture Naming and Memory Load Testing Procedure The participant completed six rounds of the picture naming task in order to test their propensity to align their word choice to that of the experimenter. In the first round, the experimenter placed the 12 cards from the first card pack in front of the participant. The experimenter then named the eight critical and filler cards in a pre-specified order for the participant to find in the set of cards and place on their own grid in order. The experimenter always used the less common name for the critical pictures (based on results from the pilot survey) to allow for the most alignment. For instance, if *sofa* was found to be the less common (dispreferred) name on the pilot survey, then the experimenter would identify that image as "sofa." If the participant later referred to the image as "sofa," this would count as the participant was aligning their speech to the experimenter because the subject produced the same word as the experimenter did for the picture. The experimenter then checked the participant's card placement and collected the cards. Following this, the participant named the same cards in a new order for the experimenter to place on their own grid. This was the portion of the experiment that revealed their degree of alignment. This process was repeated for six rounds in order to collect sufficient data, and the dialog was recorded to capture the participant's word choices.

Memory Load Conditions – Experiment 1 Memory load was administered to each participant in order to inflict additional processing demands upon their working memory while they simultaneously completed the picture naming task. In Experiment 1 there were three experimental groups. The participants in the *Experimenter Load – Comprehension* group gave digits to the experimenter to remember prior to the step in which the participant named the pictures and the experimenter recalled the digits after the participant finished naming the pictures (Table 1). In the *No Load* group, no digits were given to either the participant or experimenter to remember. The participants in the *Subject Load – Production* group were given digits to remember prior to them naming the pictures and they later recalled the digits when they had finished naming the pictures. In Experiment 1, the memory load was always 4 digits.

Table 1: Visual aid to assist in the understanding of the order in which memory load was administered in Experiment 1.

Alignment Experiment Procedure	Experimenter Load - Comprehension	No Load	Subject Load - Production
COMPREHENSION: Participant listened to experimenter name pictures & matched cards	✓	✓	✓
Experimenter received memory load	✓		
Participant received memory load			✓
PRODUCTION: Participant named cards while experimenter listened & matched cards	✓	✓	✓
Experimenter recalled memory load	✓		
Participant recalled memory load			✓

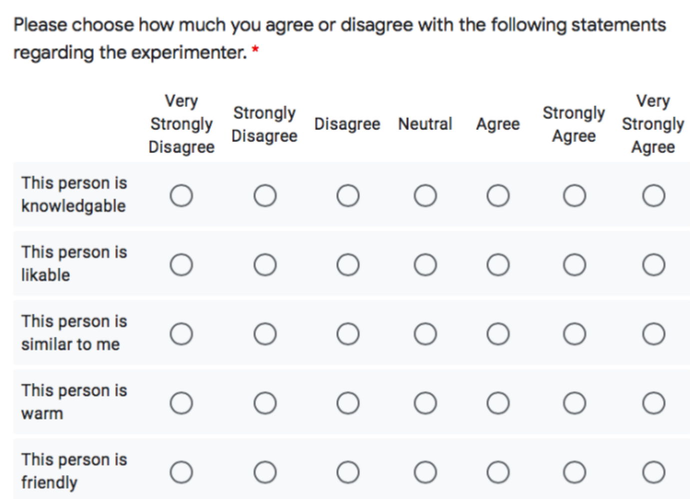
Memory Load Conditions – Experiment 2 There were four experimental groups in Experiment 2, which differed based on when they received and recalled their memory load (Table 2). The participants in the *No Load – Comprehension* group were told their digits prior to the step in which the experimenter named the pictures aloud to the participant; these individuals were asked to repeat back the set of digits right away. The participants in the *Subject Load – Comprehension* group were asked to remember their digits and recall them after listening to the experimenter name the pictures. The participants in the *No Load – Production* group were told their digits prior to the step in which the participant named the pictures aloud to the experimenter; these individuals were asked to repeat the set of digits right away. The *Subject Load – Production* group participants were asked to remember the digits and recall them when they finished naming the pictures. The experimenter always recorded the digits that the participants recalled and noted if they were the correct digits. The number of digits the subjects were asked to remember during Experiment 2 was determined based on a Digit Span Test.

Table 2: Visual aid to assist in the understanding of the order in which memory load was administered in Experiment 2.

Alignment Experiment Procedure	No Load - Comprehension	Subject Load - Comprehension	No Load - Production	Subject Load - Production
Participant received memory load	✓	✓		
Participant recalled memory load	✓			
COMPREHENSION: Participant listened to experimenter name pictures & matched cards	✓	✓	✓	✓
Participant recalled memory load		✓		
Participant received memory load			✓	✓
Participant recalled memory load			✓	
PRODUCTION: Participant named cards while experimenter listened & matched cards	✓	✓	✓	✓
Participant recalled memory load				✓

Digit Span Test Experiment 2 began by the student researcher conducting a digit span test on the participant to determine their memory span. This was done in order to calibrate the overall memory capacity of each participant, which would allow the student researcher to adjust the amount of memory load given to the participant later in the experiment and ensure a consistent level of cognitive load for each participant. The digit span test consisted of the student researcher reading a series of digits followed by the participant repeating the digits back from memory. This was done starting with two digits and increasing to a longer series of digits until the participant could no longer repeat them all accurately. The longest series of digits the participant could accurately recall was considered their "digit span" (Blackburn, 1957). The results of this test were used to select how many digits to give the participant for memory load during the subsequent picture naming task. The memory load administered during the experiment was chosen as half of their digit span (rounded up if digit span was odd). For example, if a participant had a digit span of seven, they would be asked to remember four digits during the picture naming task. Adjusting the number of digits for the picture naming task based on digit span normalized the level of stress for each participant during the experiment; without this step, a participant with a larger digit span would have found the memory load much less taxing than someone with a smaller digit span.

Post Experiment Questionnaire When all six rounds were completed, the participant completed a post experiment questionnaire on Google Forms. This survey was anonymous and only recorded each respondent's subject number. The questionnaire asked participants to record their demographics (age, gender, language history, where they grew up), rate the task difficulty (of both the picture naming and the digit recall), and explain what they thought the experiment was testing. Questions about the likability of the experimenter were also included to determine if there was a correlation between likability and alignment in order to explore the potential social effect on linguistic alignment. For example, the participants were asked to rate how much they agree with statements such as "this person is friendly" on a scale ranging from "Very Strongly Disagree" to "Very Strongly Agree" (Figure 6).


Please choose how much you agree or disagree with the following statements regarding the experimenter. *

	Very Strongly Disagree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Very Strongly Agree
This person is knowledgable	○	○	○	○	○	○	○
This person is likable	○	○	○	○	○	○	○
This person is similar to me	○	○	○	○	○	○	○
This person is warm	○	○	○	○	○	○	○
This person is friendly	○	○	○	○	○	○	○

Figure 6: Questions from the post experiment questionnaire regarding experimenter likability.

Statistical Analysis All audio recordings of the picture naming experiments were saved in a secure folder and transcribed into Microsoft Excel for analysis of the words the subjects used to describe the pictures. An alignment score was calculated for each participant by determining the percentage of critical images for which the participant used the same dispreferred name as the experimenter used. The resulting alignment score could range from 0% (meaning the participant never used the same picture name as the experimenter for the critical images) to 100% (meaning the participant always used the same picture name as the experimenter for the critical images). These alignment scores were compared between the four experimental groups with differing memory load conditions. Using JMP Pro, a statistical analysis program, an analysis of variance (ANOVA) was run on the different experimental conditions, and p-values were calculated to determine the statistical significance of the differences between the four groups. A p-value less than .05 would indicate that there is a low likelihood that the measured difference is by chance and is considered statistically significant. With statistically significant data, we can interpret the causes and effects of alignment.

Alignment values were also looked at as a function of certain demographics such as age, gender, and languages spoken in order to determine if any of these factors have a significant effect on alignment. The participant's assessment of experimenter likability was calculated based on answers to the five likability questions in the post experiment questionnaire. A p-value was also calculated to find out if there was a statistically significant relationship between likability and alignment, which would suggest that participants may align their speech in order to foster a social relationship in the communication.

Results

Survey Phase

A total of 119 responses were collected on the pilot survey regarding common and acceptable names for different pictures. In order to be included in analysis, each participant must have learned English by age 7, answered "yes" to every consent question, and answered the survey questions in English. Images were selected as critical items (images with two commonly used names; e.g. couch/sofa) if both the common and uncommon names were considered 'acceptable' by >90% of respondents and either of the names were produced by >90% of respondents. Images were selected as filler items (images with only one commonly used name; e.g. apple) if the name was produced by 99-100% of the respondents. Based on these criteria, 18 critical items and 30 filler items were selected. The full list of critical and filler items is shown in Table 3.

Table 3: Critical and filler items chosen to use in the alignment experiment based on results from pilot survey

Critical Items	
Uncommon word	Common Word
hen	chicken
column	pillar
cap	hat
cup	glass
shoe	sneaker
looseleaf	paper
painting	picture
jacket	coat
gift	present
wardrobe	closet
barbecue	grill
aquarium	fish tank
boat	ship
crocodile	alligator
bunny	rabbit
mule	donkey
box	crate
sofa	couch

Filler Items
acorn
apple
arrow
bed
bridge
butterfly
camera
cat
ear
giraffe
hand
igloo
key
ladder
owl
pineapple
popcorn
pumpkin
scarf
snowman
sock
spoon
strawberry
sun
table
toothbrush
tree
umbrella
wheelchair
zebra

Testing Phase

Experiment 1 A total of 36 high school students age 13-18, all native English speakers, were tested in one of three load conditions. As seen in Figure 8, there was a reduction in alignment when either the subject or experimenter was under load, however no significant effect of memory load was found (p = .21) (Figure 7).

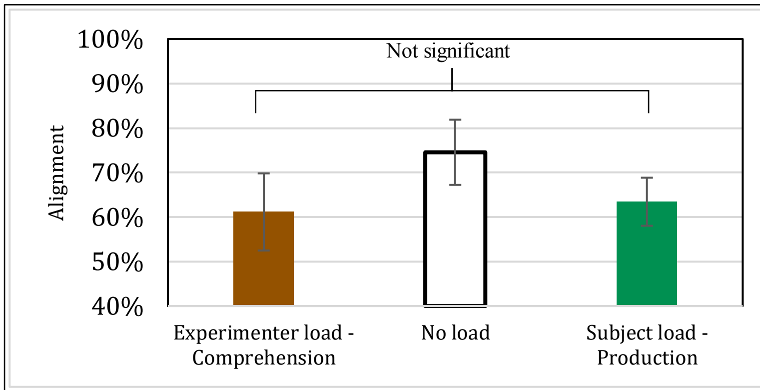


Figure 7: Alignment scores for three load conditions in experiment 1 (all subjects, n = 36, p = .21).

Experiment 2 A total of 80 participants were tested, including 40 high schoolers (age 13-18) and 40 adults (age 23-29).

Digit Span The memory load for each participant was adjusted based on their memory capacity, as determined by a digit span test. The possible scores ranged from 2 to 9 and the average measured digit span was 7.075 digits (Figure 8), consistent with previously published results (Miller, 1994). Participants were given a memory load during their picture naming experiment of half their digit span (rounded up to the nearest whole number). Therefore, the average memory load given during the experiment was 4.

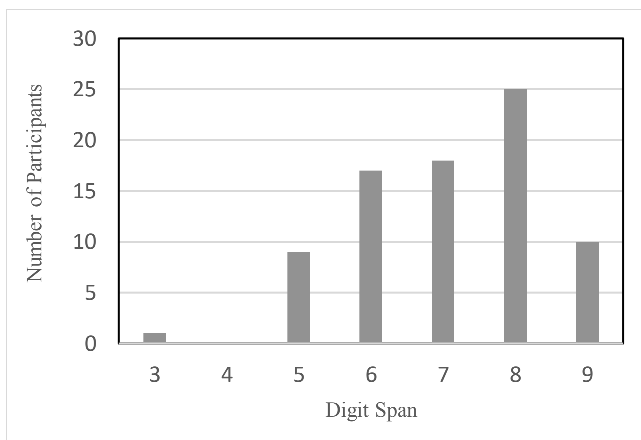


Figure 8: Digit span of each participant

Alignment Figure 9 shows calculated alignment scores for all four experimental groups. No significant difference between the groups was found (all $x^2(1) < 1$, $p > .05$). However, when the results were split by the two populations, high schoolers (age 13-18) and adults (age 23-29), a significant difference was seen ($p < .04^*$) (Figure 10).

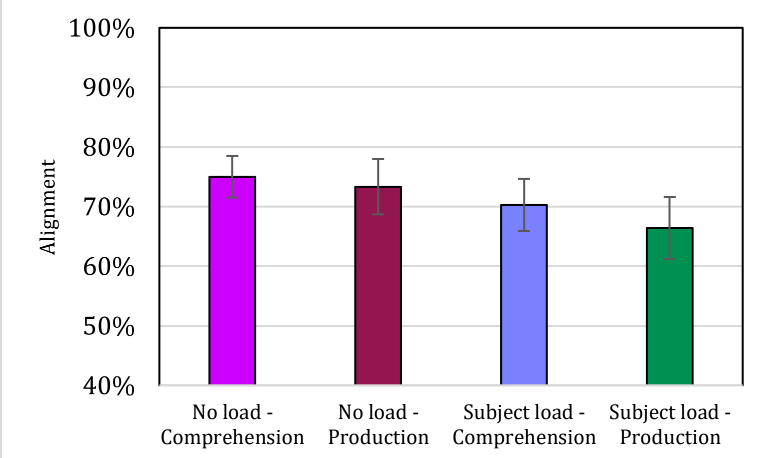


Figure 9: Alignment levels for each of the four experimental groups (n = 80).

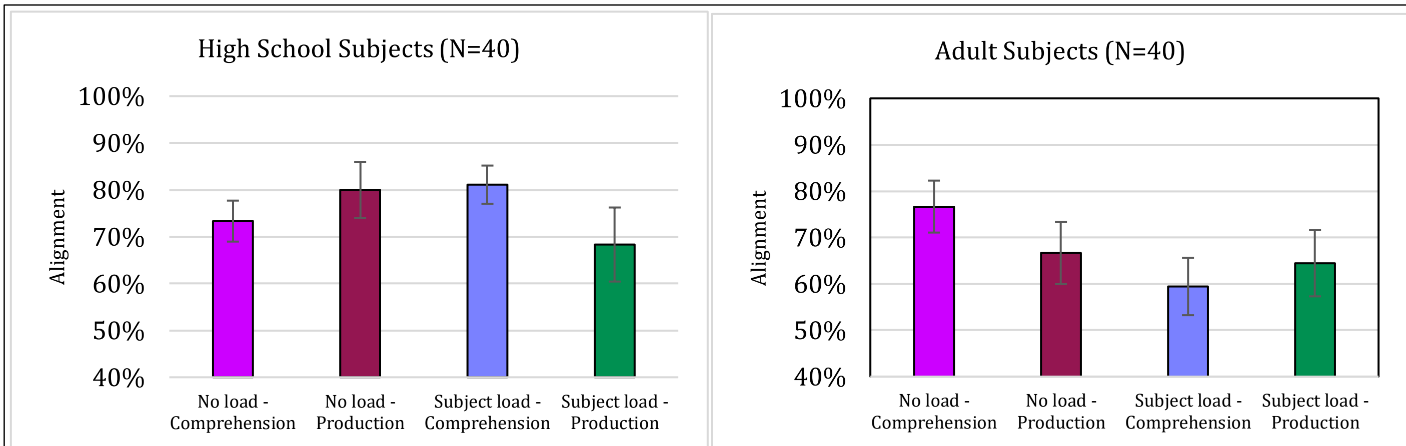


Figure 10: Alignment scores split by condition and population ($p < .04^*$).

Memory Load Accuracy

Subjects with no load were always accurate in recalling their digits but subjects under load showed some errors. Specifically, it was found that the recall performance in the *Subject Load –*

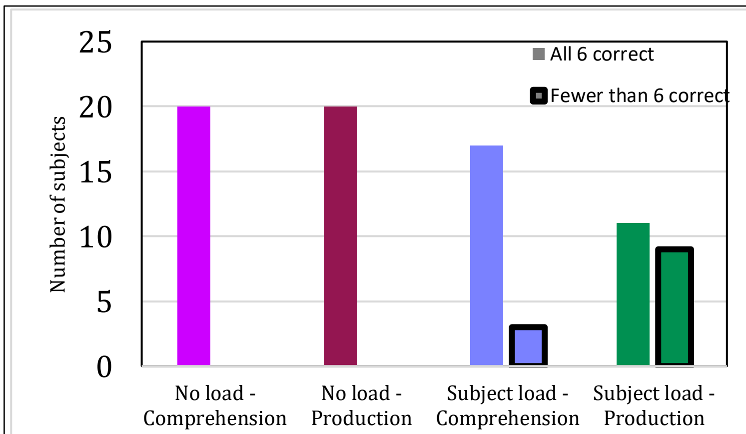


Figure 11: Number of subjects who were able to correctly recall all six rounds of memory load for each condition (n=20 in each condition) and number of subjects who did not get each round correct

Production group was significantly lower than all other groups ($x^2(3) = 23.3$, $p < .0001$) (Figure 11).

Post-Experiment Questionnaire Based on the post-experiment questionnaire that all 80 participants completed, 57.5% identified as male while only 42.5% identified as female. Almost all (92.5%) of participants were native English speakers, however many (n=29, 36.25%) also learned a second language before the age of 7. Additionally, almost everyone (89%) indicated that the picture naming task was "extremely easy," while the difficulty of the digit recall task had a wider range of difficulty responses (Figure 12). When the likability ratings were assessed, no significant correlation was found between experimenter likability and alignment scores ($p > .05$). However, it was found that participants were able to estimate accurately what percentage of the time they had aligned ($p < .0001$) (Figure 13). In fact, participants often underestimated the amount they aligned, suggesting that alignment is an unconscious process of which the speaker is unaware.

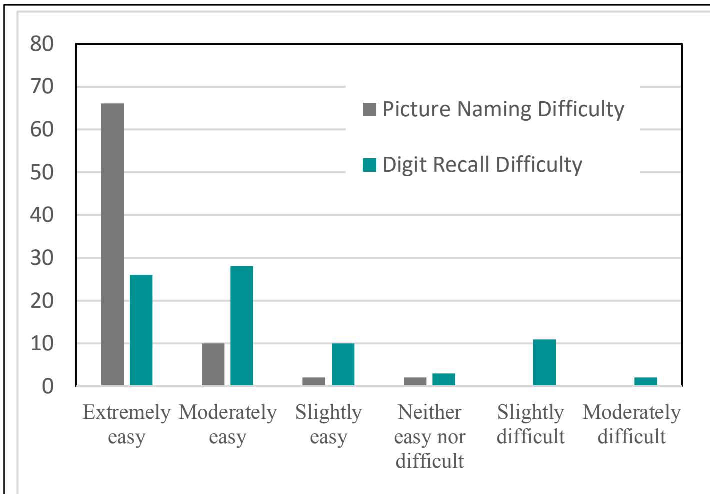


Figure 12: Picture naming difficulty and digit recall difficulty as self-reported on the post-experiment questionnaire (n=80).

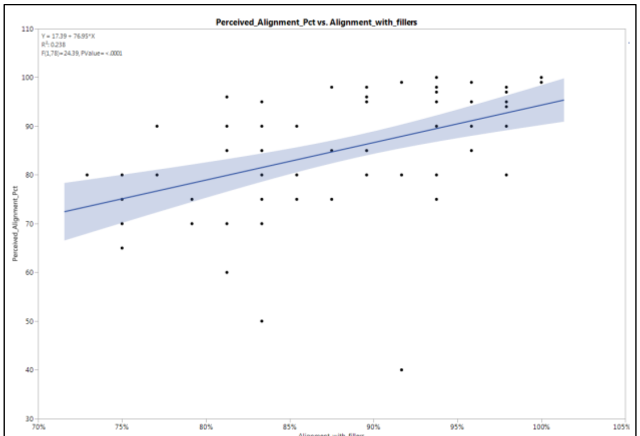


Figure 13: Participants self-rated alignment level and their actual alignment.

Discussion

Experiment 1 Because there was no effect of memory load condition on alignment, this experiment concluded that alignment does not increase as a result of cognitive difficulty and speakers do not align as a compensatory strategy for processing difficulty. Instead, the process of alignment requires attention, memory, or additional cognitive processing. Therefore, simultaneous cognitive load reduces available cognitive resources and thus alignment.

Experiment 2 Similar conclusions can be drawn from the results of Experiment 2 where no significant difference in alignment was found based on memory load. This refuted the first hypothesis that those in the production load group would align most. The two no-load groups aligned to the same degree, indicating that hearing and immediately recalling numbers has no effect on one's alignment value. Additionally, there was no correlation between experimenter likability and alignment ($p > .05$), refuting the hypothesis that there is a social component to alignment.

Combined Analysis Combining the data from Experiment 1 and Experiment 2 showed that there was a significant reduction in alignment in the *Experimenter Load – Comprehension* and *Subject Load – Production* conditions as compared to the *No Load* condition (Figure 14). This indicated that alignment actually *decreased* as a result of cognitive difficulty,

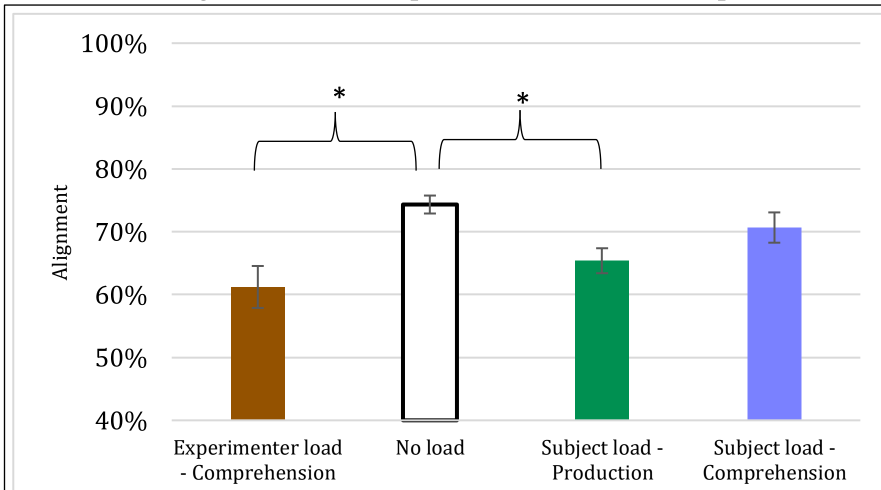


Figure 14: Combined analysis from experiment 1 and 2 (total n = 116) in which the subject load – production groups were combined and all three no load groups were combined. Significant differences were found in the experimenter load – comprehension ($p = .05$) and subject load – production ($p = .04$).

results consistent with those found by Abel in 2016. This suggests that alignment does not occur as a compensatory mechanism to aid language processing while one is under load.

Given that it has already be shown that linguistic alignment is correlated with communication effectiveness and task success (Nenkova, 2008; Fusaroli, 2012; Abel, 2016), the functional benefit of linguistic alignment must exist. Once the true 'purpose' of alignment is isolated, one's level of alignment may be used to provide guidance on communication effectiveness and task success and potentially to identify cognitive deficiencies that impair communication. This research shows that alignment does *not* provide the communicative benefit of allowing the speaker to off-load processing while under stress.

Future Research

In order to determine why we naturally align speech in conversation, future research must be done to identify alternate benefits to alignment not found in this study. Future studies should assess if language proficiency has an effect on one's alignment. It is possible that if a participant is not a native English speaker, they may align more. This may be due to them having a limited vocabulary, where it would be helpful for them to produce a word already used in conversation. The majority of language studies were done in English-speaking countries and may show results that are the product of the English language. (Note, all but one of the studies cited in this paper were conducted in English, which is representative of the preponderance of published research.) Additionally, cultural differences may play a role in lexical alignment. For example, it may be considered "polite" to mimic other's speech patterns in some countries, but in other countries, this may be considered rude. It is important to take this into account when testing alignment and extending the results globally.

Finally, testing subjects with a larger age gap in which there is a greater difference in brain development may be interesting to determine if alignment can be indicative of one's cognitive maturity. For instance, if a study comparing alignment levels of young children and adults found that the young children align more, it is possible that alignment could be used as a way to determine how developed one's brain is. This could be particularly useful in people with atypical brain development where it may be helpful to determine how mature one's brain is by using alignment tests where higher levels of alignment indicate less brain development.

Conclusion

The objective of this study was to determine how lexical alignment is affected by memory load with the intent of identifying the specific way in which alignment is beneficial towards communication effectiveness and task success. This was achieved by asking 116 participants to complete a picture naming task, some of whom also memorized digits during either speech production or comprehension. It was found that alignment occurred the most in the no-load conditions and less while the participants were under load ($p < .05$), indicating that alignment does not occur as a compensatory mechanism to aid communication while one is under memory load. This suggests that alignment requires memory and/or attention, which was less available while the participant was under additional load. The results refuted both hypotheses that alignment would increase when the participant was under load during their speech production and that a positive correlation would be found between alignment and experimenter likability. These results reject the claim that alignment provides a communicative benefit by allowing the speaker to off-load language processing and opens the door for future research to identify what about alignment is beneficial in communication and how it can be applied to improve collaboration and innovation.

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