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Linguistically Determined Cognitive Discrepancies: A Dive into the Tangier Island Vernacular

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ABSTRACT

The following research discusses an esoteric linguistic philosophy called the Theory of Linguistic Determinism, created by American anthropologists, Edward Sapir and Benjamin Lee Whorf. The theory holds that thought is subservient to language, and one's native language is responsible for one's cognitive processes, perception, and worldview. Additionally, the theory suggests that speakers of contrastive languages will think dissimilarly. Through years of refinement, the theory was modified to become an ideology known as weak linguistic determinism. This adaptation claims that while language *impacts* cognition, it is not the paramount determinant of thought. All previous studies on the phenomenon were conducted by juxtaposing heterogeneous languages. This created a gap within the scope of available research. Thus, the Researcher conducted a grounded theory analysis to investigate whether or not *dialects* were also subject to the effects of weak linguistic determinism. The dialect chosen for this study is endemic to a Chesapeake Bay Island known as Tangier. The speakers of the Tangier Island dialect employ a unique semantical idiom called "backward talk." Per the logic of linguistic determinism, the Researcher hypothesized that speakers of this dialect who employ this speech idiom would showcase implicit associations opposite to the implicit associations found on the nearby Virginia mainland in response to visual-emotional stimuli. The Researcher found that a statistically significant percent of Tangier Island residents exhibited divergent perceptions from speakers of the ordinary English dialect spoken on the Virginian coast. These findings suggest that weak linguistic determinism is also evident within dialects of a homogenous language.

Introduction: Philosophical Linguistics

Language and thought have long been considered interrelated. The field of linguistic philosophy is devoted to exploring the relationship between these two archaic virtues, and for centuries philosophers, psychologists, and anthropologists have been attempting to empirically prove one's impact on or *over* the other. The more traditional ideology, held by scientists for the greater half of the 20th century, is that language is subservient to thought; however, this notion has been frequently challenged. Herodotus, an ancient Greek philosopher, theorized that Greeks experienced thought antithetical to Egyptians based upon discrepancies within their written languages (Ancient Greeks wrote from right to left and Ancient Egyptians left to right). This theory made Herodotus the first recorded philosopher to challenge thought's "immutable" control over language (Hunt & Agnoli, 1991). Also suggested in his proposal, was the notion that individuals who speak heterogeneous languages will exhibit differences in cognition, a line of inquiry that was further progressed by Johann Gottfried Herder and Wilhelm Von Humboldt, two German linguists. Herder studied a variety of European languages, finding that certain characteristics of their languages were often exhibited within their cognitive processes and global perceptions. His successor, Humboldt, further progressed this ideology with his "systemic linguistic

philosophy" claiming that: "Language is the external embodiment of a nation's spirit; a national language reflects the national spirit; each language creates a fence around its nation, thus people are restrained by their mother tongue and its world outlook" (Li, 2022).

Although Herder and Humboldt began asserting these claims, the ideology that language determines thought was not solidified as a theory until 1929, when two American anthropologists threatened to challenge everything that was widely accepted within the field of linguistic philosophy. Edward Sapir and his successor, Benjamin Lee Whorf, developed a linguistic hypothesis denominated the Sapir-Whorf Theory of Linguistic Determinism, interchangeability referred to as the Theory of Linguistic Relativity, Whorfianism, or the Sapir-Whorf Hypothesis. Linguistic determinism holds that the language an individual speaks has a *direct* impact on cognitive processes, global perception, and the categorical organization of various tangible and intangible entities. Sapir and Whorf recognized the potentiality of one's "inner voice" to shape interactions with the physical world and attempted to qualify that relationship within their theory. They also noted the intrinsic variability between languages in terms of syntax, grammatical structure, and vernacular. Due to these oblique linguistic differences, the anthropologists made the logical conclusion that speakers of Language A would think in a divergent way to speakers of Language B. Sapir and Whorf attempted to empirically prove their theory through the study of various languages leading to a slew of research conducted on the subject matter. Yet, even presently, many disagree with their unorthodox views (Li, 2022).

Literature Review

The origination of the Sapir-Whorf Theory of Linguistic Determinism sparked an ensuing scientific and philosophical debate. While certain members of the scholastic community found the theory to be completely credulous, others rationalized its complete naivety. Still, others modified the theory, adapting it to fit their viewpoint. Ultimately, there are three ways to interpret linguistic determinism.

Extremists

The "extremist" cohort is meant to describe groups or individuals who find the original unaltered Theory of Linguistic Determinism credible. Although this perspective has been universally refuted within the scientific community**,** it is still important to understand as a foundation for modern views on the theory. The theory itself is entrenched within the personal experiences of Sapir and Whorf as anthropologists, namely Sapir, who spent many years of his life living among indigenous people, such as the Wishram and Takelma tribes of North America (Mandelbaum, 1941). Sapir reasoned that the array of cultural differences he observed within the tribes was due to linguistic discrepancies within their languages (Gastil, 1959). Eventually, it was Benjamin Lee Whorf, Sapir's apprentice, who composed a number of essays regarding the concept, solidifying the theory. Whorf wrote: "We dissect nature along lines laid down by our native languages…the world is presented in a kaleidoscopic flux of impressions that has to be organized by our minds — and this means largely by the linguistic systems in our minds." These assertions make up the core of the linguistic determinism theory (Scholz, n.d.).

After the publication of his essays, Whorifanism spread throughout the linguistic community. Today, those who have fallen in Whorf's footsteps are said to believe in "strong determinism," which "refers to the strict view that language determines thought and that language and thought are identical" (Li, 2022). Since then, many scholars have conducted research attempting to affirm Sapir and Whorf's views. According to Helen De Cruz, a philosopher and chairholder at Saint Lewis University, there are two major ways to conduct research on linguistic determinism: Developmental Psychology and Comparative Linguistics. Developmental Psychology studies note the influence of language acquisition on cognitive development while comparative linguistic studies juxtapose the cognitive processes between speakers of different languages (De Cruz, 2009).

Developmental Psychology Pro-Linguistic Determinism Studies

A study conducted in the field of developmental psychology in hopes of strengthening the linguistic determinism claim was the "Duck and Truck Experiment." This experiment was conducted by scientists, Fei Xu and Susan Carey in 1996. The experiment had two cohorts of young children separated by age. Each group was subject to a perception test. The goal of the experiment was to test children's ability to comprehend sortal concepts (individuality and identity) within nouns. The first group of children, 10 months of age, were shown a yellow duck that proceeded behind a screen followed by a red firetruck that proceeded behind a screen. The screen was then removed, revealing one or both of the objects. If the children were capable of differentiating between the two sortal nouns, then they should be "surprised" to find only one of the objects shown instead of both. The 10-month-olds performed poorly in this task compared to cohort two, the 12th-month-olds. The vast majority of cohort two children expressed surprise when only seeing one object behind the screen — indicated by a longer viewing time. Xu and Carey theorized that this developmental change correlated with language acquisition. As children who are 1 year old are exposed to more language, their ability to comprehend sortal concepts increases. Xu suggested that the success of the 12-month-olds was largely due to their vocabulary database: If the child was aware of the word "duck" or "truck" they were far more likely to be able to differentiate the two. In a replicated study the 10-month-olds were taught the words "duck" and "truck" right before experimentation. The children who had previously failed to show surprise, now performed as well as the 12-month-olds (Carey & Xu, 1996) (De Cruz, 2009).

There have been many types of psychological development experiments conducted since the creation of the Sapir-Whorf hypothesis. One such experiment covers the emergence of flexible search strategies. Homo Sapiens have learned to assess their geographic position based on a number of orienting factors, a skill that is often attributed to language. In 1986, Ken Cheng, a distinguished animal behavior specialist, made an important discovery regarding rat spatial orientation. A series of rats were introduced to food items located in a rectangular-shaped room. The food was then buried, and the rats were reintroduced to the environment. Although the rodents were provided non-geometric data points (ie. featural cues) such as unique odors and wall colors, the rats relied solely on the geometric shape of the room to search for the food (Cheng, 1986). Often times the rats would search in the room's geometric equivalent, here referred to as a rotational error (See Figure 1)

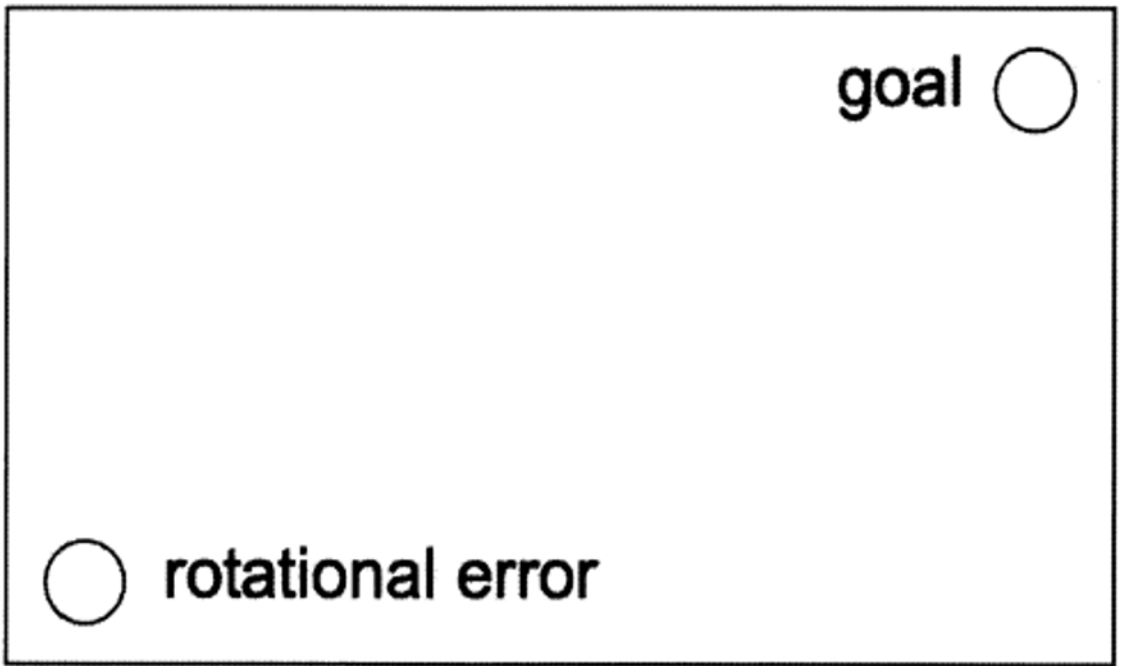

Figure 1.

This same experiment was later replicated by researchers, Linda Hermer-Vazquez and Elizabeth Spelke — this time with toddlers. Interestingly, the toddlers exhibited the same rotational error as the rats when searching for concealed toys; yet children 5 to 7 years old obviated the rotational mistake (Hermer & Spelke, 1996). In 2001, Hermer-Vazquez reevaluated the issue with partners, Anne Moffet and Paul Munkholm in an attempt to determine a cognitive link to her results. They found that language comprehension was the key component allowing for the older children's success in the experiment, particularly mastery of the words "left" and "right." Hermer-Vazquez writes; "These results strongly suggest that the conjunctive powers of language production allow more flexible performance of these tasks in humans," thus, making a strong claim for linguistic determinism (Hermer-Vazquez et al., 2001) (De Cruz, 2009).

Comparative Pro-Linguistic Determinism Studies

According to Sapir and Whorf, natural languages exhibit stark variability, thus a researcher may test for linguistic determinism by juxtaposing the cognitive processes between two speakers of alternative languages. In 2004, anthropologist Peter Gordon, examined two indigenous groups from the Amazon Rainforest with very few words to denote cardinality. One of the people groups, known as the Pirahã, solely employ the words "hói" (about one), "hoí" (a couple), and "baágiso" (lots) when referencing quantities. However, these terms aren't necessarily count words, but rather serve "as approximations of perceived magnitudes." Gordon, therefore, employed a barrage of experiments to test their numeracy. He found that the Pirahã's ability to comprehend exact magnitudes was "severely compromised," particularly when dealing with quantities greater than four. In fact, they performed about as well as a 10-month-old in identifying quantitative differences. Gordon writes, "This study provides a rare and perhaps unique case for Linguistic Determinism," as it showcases limited numerical terms translating to inhibited numerical comprehension (Gordon, 2004) (De Cruz, 2009).

Another comparative linguistic study was done to affirm the direct observations of Whorf himself. As aforementioned, Whorf and Sapir spent time studying various American indigenous groups. One such group, the Navajo, utilize a unique linguistic feature that emphasizes the shape of the object (noun) being spoken. This linguistic cue is not present within the English syntactic structure, and thus, Whorf theorized that the Navajo are more adept at differentiating the physical form of objects than English speakers. This postulation was explored further by researchers Carroll and Casagrande in 1958. Carroll and Casagrande gathered adolescent Navajo Native Americans and situated them into two cohorts. One cohort predominantly spoke Navajo while the other primarily spoke English. All the children were shown two objects (i.e. a yellow rope and a blue stick). Then a comparison object was introduced, containing one feature from each of the previously viewed objects (i.e. a blue rope). The children were then asked which item the comparison object belonged with categorically. Interestingly, 70% of predominantly Navajo speakers chose the yellow *rope*, an indicator of a form-based decision. The predominantly English-speaking children, however, focused more on the color of the items with only 40% of children matching the blue rope with the yellow rope. Carroll and Casagrande's findings are frequently employed in pro-determinism rhetoric (Hunt & Agnoli, 1991) (De Cruz, 2009).

Contrarians

The "strong determinism" views held by the founders of linguistic determinism and subsequent extremists were hastily challenged by the scientific community which accused the theory of being too banal and an oversimplification of cognitive processes. According to Jing Li, published author and researcher for BioWord, "With [the scientific community's] efforts, "strong" determinism and linguistic relativity in the Sapir-Whorf hypothesis have been proven to be indefensible" (Li, 2022). Many linguistic determinism contrarians hold that language principally serves as a mode of communication and not the peremptory factor domineering cognitive processes.

This viewpoint is known as "universalism" and is the notion that all people have access to the same internal concepts. They've reasoned that language is imperative for information acquisition, but after being obtained, thought is primarily a non-linguistic phenomenon (Li, 2022). This assumption has been backed up by a multitude of studies indicating prominent levels of cognition within non-linguistic subjects including prelinguistic infants and non-speaking animals. Each cohort has been able to conduct high-level categorization, interpret implicit meaning based on stimuli, and even complete facile arithmetic (Li, 2022). Micheal Davitt and Kim Sternly, two authors and philosophical linguists, agree with the contrarian viewpoint saying that "[T]he argument for an important linguistic relativity evaporates under scrutiny" (Gastil, 1959). Similarly to extremist believers, contrarians have attempted to prove the validity of their view through developmental psychology and comparative linguistics, namely by scrutinizing experiments made by the extremists (De Cruz, 2009).

Psychological Development Anti-Linguistic Determinism Studies

The aforementioned "Duck and Truck Experiment" served as a crux for the extremists' argument; however, author Helen De Cruz, logically refutes it by suggesting that "an alternative, non-linguistic explanation" exists. She reasons that the success of the 12-month-olds was due to an improved ability for "*feature placing.*" Feature placing is the ability to differentiate subjects *without* comprehending them as singular objects. If this were the case, then the older cohort could simply expect to see "redness" or "yellowness" and not the specific noun object "duck" or "truck." Another refutation of Xu and Carey's linguistic deterministic conclusion can be observed in a replication of the Truck and Duck Experiment conducted with chimpanzees. Interestingly, the chimpanzees performed at the same level as the 12-month-olds, though they lack verbal language and therefore have no words for "duck" or "truck." This discovery heavily weakened the validity of "strong determinism" (De Cruz, 2009).

In 2008, researchers Alastair Smith and team, revisited the discovery of Herder-Vazquez, challenging her conclusion that older children obviate rotational error due to increased language acquisition and suggesting that the sterile laboratory setting utilized resulted in an underestimation of the children's real capabilities. To empirically test this, Smith conducted a replicated version of Herder-Vazquez's experiment, only this time forgoing the laboratory setting and opting for an outdoor park. In this setting, it was apparent that the toddlers utilized various geographic features, such as trees and shrubs, to successfully uncover the concealed toys. This posed an issue with the previously concluded linguistic-based hypothesis that relied on directional language acquisition as a prerequisite for success (Smith et al., 2008).

Comparative Anti-Linguistic Determinism Studies

Similarly to psychological development studies, linguistic determinism contrarians also scrutinized many of the extremist's comparative linguistic studies. The study executed by Peter Gordon has been challenged by the findings of Brian Butterworth and Robert Reeve. In their experiment, they explored the numeracy of Australian Aboriginal children from tribes with few count words, similar to the Pirahã. These children, who only spoke Warlpiri or Anindilyakwa, underwent much of the same tests applied by Gordon to the South American tribe. However, these children performed just as well as English-speaking children who frequently utilize count terms. This led Butterworth and Reeve to conclude that the Pirahã failed these same tests simply because they did not understand them and not because of their linguistic discrepancies (Butterworth et al., 2008).

The study conducted on Navajo children has also undergone the scrutiny of the contrarians. Carroll and Casagrande decided to replicate their study, attempting to further validate their results. They added an additional control group to their previously conducted experiment, consisting of white, middle-class children from Boston. Interestingly, the children chose to organize the objects by form over color 80% of the time. This indicated a stronger "Navajo language bias" than the Navajo themselves, completely dismantling Carroll and Casagrande's original argument (Hunt & Agnoli, 1991) (De Cruz, 2009).

Quasi-Supporters

The multi-decade linguistic determinism debate had severely impaired progress within the field of linguistic philosophy. It wasn't until recently, in fact, that the academic community reached a consensus regarding the matter. The quasi-supporter contingent has reviewed the experiments of both the extremists and contrarians via meta-analyses and decided that while the strong determinism belief is incredulous, the universalism belief undermines the intrinsic influence of language on thought. Today, scientific discoveries have further propagated the adaption of the original theory. A biological phenomenon known as neuroplasticity describes the process of the human brain "rewiring" itself. According to the National Library of Medicine, this entails "adaptive structural and functional changes to the brain." Neuroplasticity allows for new neural pathways to develop, ergo, making available new patterns of thought (Puderbaugh & Emmady, 2023). According to a study done by Harvard University, one of the most common endeavors promoting cognitive neuroplasticity is learning a 2nd language. Therefore, it can be concluded that one's native language is responsible for the *initial* wiring of the brain (Wei et al., 2024). Therefore, the scientific community has qualified the original linguistic determinism theory into a new belief, here referred to as "weak linguistic determinism." This modulated theory holds that "thought is merely affected or influenced by languages…It recognizes that the existence of linguistic categories influences the ease with which various cognitive operations are performed." The linguistic community now holds that, although thought and language are "mutually independent," they are still "interactive." The Researcher, henceforth, will be operating off this belief system (Li, 2022) (Gastil, 1959) (Hunt & Agnoli, 1991) (Lucy, 1997).

Gap: Scope of Comparative Linguistic Studies

Although philosophers have been theorizing the influence of language over thought for centuries, attempts at empirically proving linguistic determinism didn't begin until the mid-20th century. Moreover, the majority of 20th-century research studies were so devoted to either supporting or refuting strong determinism that a gap in the research has emerged. While the branch of linguistically determined psychological development is relatively flushed out, including studies involving children, adults, and even animals, comparative linguistic studies are less nuanced. In particular, the studies have remained very broad, only exhibiting the juxtaposition of heterogeneous languages (Lucy, 1997). This made the Researcher wonder what a scaled-down comparative linguistic study would entail, especially considering the level of variability present within homogenous languages. This leads to the general research question: *To what extent is linguistic determinism evident and measurable within dialects of a homogenous language? (*Further narrowed after the first stage of methodology)

This question poses important implications for speakers of larger homogenous languages, such as English, which exhibit a great amount of variability across geographic regions (Lucy, 1997). Unlike the previously conducted comparative linguistic studies, which suggested that speakers of isolated, recondite languages, may think differently than English speakers, the study proposed by the Researcher may suggest that English speakers *juxtaposed* to other English speakers could express divergent ways of thought due to their geographic origins. Therefore, scaling down the comparative linguistic studies increases the scale of influence upon individual speakers of homogenous languages. Additionally, if this postulation is correct, these results could heavily influence current knowledge of the American political landscape by asserting that people who inhabit different geographic regions may pose inherently different perceptions.

Methodology

Methods: Subject Identification and Semantical Examination

An article, written by Raymond D. Gastil, a social scientist, and writer for JSTOR, a journal article committed to preserving anthropological linguistics, explains the process of attempting to conduct a linguistic determinism-centered experiment. Gastil writes, "We must approach the relation between language and thought directly through studying their interaction in the expression of thought" (Gastil, 1959). Thus, the Researcher had to first identify which two languages, or in this case dialects, to juxtapose in order to conduct a comparative linguistic analysis comparable to the aforementioned experiments. As an English speaker, the Researcher logically chose English as the control group, and it serves as a larger homogenous language from which multiple dialects are derived.

However, the matter of selecting an English dialect as the independent variable in the ensuing comparative linguistic experiment posed a greater challenge. Dialects, by definition, refer to the unique form of a language spoken by a group of people. This differs from accents which are simply pronunciation variations within homogenous languages. Dialects of homogenous languages include differences in pronunciation, vernacular, grammar, semantics, and syntax (Bent et al., 2016). Thus, English American accents such as the northern, southern, midwest, and New York accents could not be considered as features able to be studied in a dialect-based investigation. Thankfully, America is home to a series of unique esoteric dialects. According to Natalie Schilling-Estes, recipient of a PhD in linguistics, these dialects vary from incomprehensible to virtually unnoticeable. Almost every state is home to at least one esoteric dialect (Schilling-Estes, 1997). Schilling-Estes refers to one dialect in particular that stood out to the Researcher, known as the Tangier Island dialect. The island is situated in the Chesapeake Bay, a few miles off the southeast Virginian shore, where the Researcher resides. The proximity of the Tangier Island dialect to this particular region of Virginia made them ideal subjects for comparison. Both cohorts are speakers of the homogenous English language and exhibit geographic proximity, thus the primary remaining variable is the specific dialect they speak. This reduction of variables allows for improved result validity. (See Figure 2)

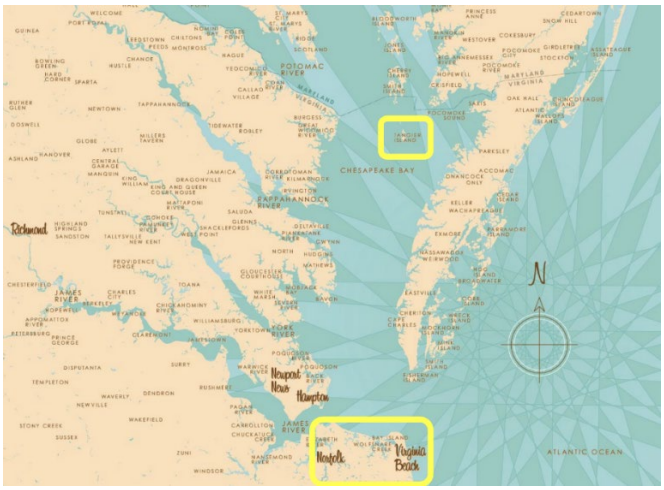

Figure 2. Note: *Map of the Chesapeake Bay region of Virginia. Tangier Island, featured north. Tidewater Region (Mainland), featured south.*

Gastil argues that the best approach for testing the presence of linguistically determined concepts is through semantics (Gastil, 1959). To study semantics is to study the meaning of words in context and their

relation to other words within the same conceptual terrain (Steinhart & Kittay, 1994). Thus, Gastil asserts that it is through the juxtaposition of word meaning, hence semantics, that a comparative linguistic analysis can occur. It's important to note that Gastil mentions in his address the fact that comparative studies can also be conducted by juxtaposing Language A and Language B's grammatical structures or focusing on singular words available in one language but not the other; however, through his research, Gastil found that comparing semantics (i.e word/phrase meaning), and the cognitive results of semantics, yield far stronger results of linguistically determined cognitive discrepancies (Gastil, 1959). In light of Gastil's observations, a semantic comparative analysis was employed by the Researcher.

In order to juxtapose the Tangier Island dialect to the dialect employed on the Virginia coast in a semantical context, the Researcher first had to investigate the nuances of the dialect itself. David L. Shores, an English professor at Old Dominion University and part-time resident of Tangier Island, divulges the subject matter in his book, *Tangier Island: Place, People, and Talk.* He found that the dialect exists due to the isolation of the Island and can be perceived phonetically as a blend of a southern accent, a British accent, and the remnant of old English. The book proceeds to delineate an odd phenomenon, a sarcasm idiom affectionately referred to by the islanders as "backwards talk." According to Shores, to employ backwards talk is to give utterance to that which is semantically opposite. If a resident of the Island sees a beautiful girl, she will commonly be referred to as "ugly." If the weather is sunny and tranquil, it will still be referred to as "poor." To be "early" is to be "late." This occurrence engenders a stark dichotomy between the Tangier Island dialect and Virginian mainland English, particularly in a semantical context. Although the unique dialect spoken on Tangier Island maintains the use of the same words as the mainland, the meaning (ie. the semantics) of the words exhibit variability (Shores, 2000). According to the design delineated by Gastil, backwards talk could be subservient to a semantic comparative linguistic analysis. Additionally, Gastil maintains that when selecting a polysemantic phrase or word to juxtapose between languages, the type of semantic difference should be utilized frequently, further increasing the validity of linguistically determined results. Thankfully, Shores writes, "Tangier folk will employ this speech mannerism at all times." Thus, fabricating a comparative linguistic experiment centered on the backwards talk idiom would pertain to the guidelines laid down by Gastil (Gastil, 1959).

Hypothesis

Linguistic determinism is the ideology that speaking a particular language generates thought patterns divergent from speakers of a contrastive language. The Researcher has already promoted the notion that this could apply on a smaller scale. The aforementioned research question: *"To what extent is linguistic determinism evident and measurable within dialects of a homogenous language?"* can now be further narrowed following the identification of Tangier Island and their backwards speech mannerism. The adapted research question goes as follows: *To what extent is linguistic determinism evident and measurable within the Tangier Island dialect as a result of their sarcasm idiosyncrasy dubbed "backwards talk"?* Due to the frequent use of "backwards talk" by residents of Tangier Island Virginia, the Researcher hypothesizes (H_1) that speakers of this esoteric dialect will exhibit "implicit associations" contradictory to normative associations in response to visual-emotional stimuli (i.e. pictures). Essentially, theorizing that the speakers of the Tangier Island dialect "think about things" in an opposite manner to speakers of ordinary English. The null hypothesis (H_0) in this scenario would be that the implicit associations of the two cohorts are the same.

Methods: Experiment Formation

The Researcher conducted a *Grounded Theory Analysis* to answer the narrowed research question and either prove or disprove their hypothesis. According to the National Library of Medicine (NIH), a grounded theory (GT) analysis is appropriate when investigating a recondite phenomenon. This coincides perfectly with the goal

of the Researcher to explore the effects of linguistic determinism on a smaller scale — a never before attempted task. Additionally, the NIH writes that a GT analysis aims to fabricate a theory *grounded* in collected data, just as the Researcher is attempting to update a preexisting theory (Tie et al., 2019). A GT analysis is subject to both qualitative or quantitative data types, however, no matter the data type employed a GT analysis involves the comparison of two cohorts. In the particular GT study conducted by the Researcher, the two juxtaposed groups were Tangier Island residents and Virginian mainland residents (specifically in the Tidewater region). The first phase of a GT analysis is purposive sampling, or the selection of people employed in the study to answer the desired research question. This was completed in the investigative phase of the Researcher's methodology. The subsequent stage of a GT analysis is data collection. One of the proposed methods of data collection for a GT study by the NIH is through surveys (Tie et al., 2019). Due to Tangier's isolated nature, the Researcher found that an online survey would be the most accessible way to reach the island's residents.

The survey created by the Researcher was broken down into three sections: Demographics, Geographic History, and Comparative Perception Experiment. The experimental portion was then further broken down into three types of questions.

Demographics

Questions 1, 2, and 3 began as very broad demographic questions asking for age, gender, and race. This was done to ensure that the sample sets were diverse enough across all cohorts, increasing the validity of results (Bibbins-Domingo & Helman, 2022). The style of these questions was based on the 2020 American census.

Geographic History: Part I

Questions 4 through 7 asked the respondents where they were born, where they spent the first 10 years of their lives, where they live now, and how long they have lived there in a free response format. According to the National Library of Medicine, language acquisition is strongest in a child's formative years, hence why the Researcher asked where the participants grew up. However, new languages, accents, and dialects can be picked up by frequent exposure, ergo, the Researcher asked the participants where they currently reside and how long they have lived there. This was to ensure that all participants, whether mainland English speakers or Tangier Island residents, were exposed to their assigned dialect frequently enough to possibly show the effects of linguistic determinism (Cristia et al., 2012).

Geographic History: Part II

Question 5 began the second half of the geographic history portion of the survey. It was meant to determine which cohort the participant would fall into (control or experiment group) and simply asked the participate if they have ever lived on Tangier Island, Virginia, asking them to select yes or no.

The following 3 questions serve the same purpose as the ones listed above — to ensure that the participants claiming to be in the Tangier Island cohort had been exposed to the dialect frequently enough to showcase the possible effects of linguistic determinism. This was particularly important because the Researcher had to outsource to speakers of the dialect not currently living on the Island due to their small population size. The Researcher had to ensure that those who had moved away from the Island still returned frequently enough to uphold the dialect (Cristia et al., 2012).

Comparative Perception Experiment

The remaining 9 questions make up the experiment portion of the survey. The Researcher wanted to test if the frequent use of backwards talk would cause speakers of the Tangier Island dialect to exhibit counter-normative visual-emotional perceptions when compared with Virginian mainlanders who do not speak the dialect nor pervasively employ the sarcasm idiom. If this hypothesis were correct, it would strongly suggest that the effects of linguistic determinism are present within dialects. The Researcher concluded that this could be achieved by

testing the participants' implicit associations of various images. According to a study conducted by Princeton University, implicit associations are the conscious or unconscious factors that impact one's decision-making and are linked to one's general perception of stimuli. Since one of the main cognitive categories that linguistic determinism impacts is perception, the Researcher wanted to see if speakers of different dialects would exhibit opposing implicit associations (Cristia et al., 2012).

Dichotomous Questions

Questions 1 through 3 of the experimental portion of the survey contained a question stem asking the participant to identify which image they most associated with the emotions joy, happiness, and depression. For each of these questions, the participants were shown two images created by an AI image generator known as Imagine AI. The Researcher used a prompt such as: "Create a joyful nature scene." Followed by, "Create a depressing nature scene." AI was utilized for these questions to keep the images as comparable as possible, with the only variable being the terminology "joy" or "depression" in order to solely focus on the participants' visual-emotional perceptions. If the question stem told the participant to select the image they most associate with joy and they proceeded to select the one created to showcase depression, this would be an example of a *counter-normative response* or a counter-normative implicit association (See Figure 3).

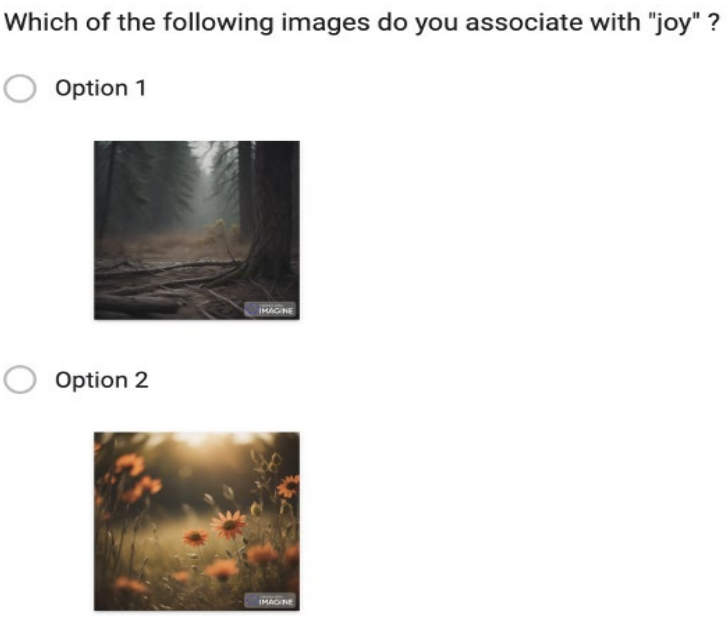

Figure 3. Note: *This Figure represents an example of a Dichotomous Question, in this particular question the correct answer is Option 2, making the counter-normative response Option 1.*

Scale Questions

The following 3 questions were based on scale factors. The Researcher selected 4 images pertaining to a central subject, in these cases, homes, boats, and time, to showcase different degrees of associations with key terms provided in the question stems. For each of these three questions, the participants were told to select the image they most associate with the terms, "broke," beautiful," and "late." These 3 particular words were chosen by the Researcher because they are frequently employed by the islanders when speaking in the backwards talk fashion (Shores, 2000). For these questions, the normative response would be the image that coincides with the question stem and the counter-normative response would be the image representing the opposite extreme. The

intermediate two images served as distractions and upon selection would not be considered as the Researcher was only testing normative versus counter-normative responses (See Figure 4)

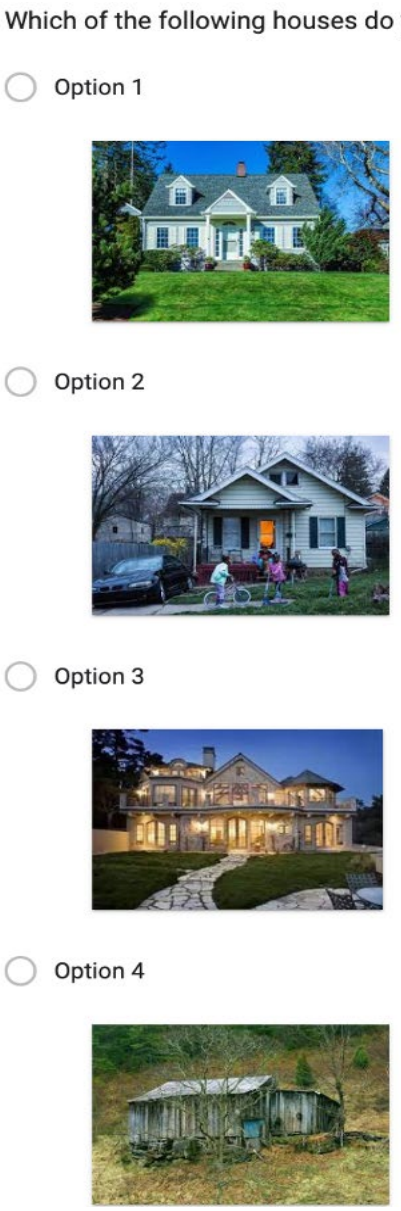

Figure 4. Note: *This Figure represents an example of a Scale Question. Option 4 represents the normative response and Option 3 represents the counter-normative response. Option 1 and 2 served as distractors and did not factor into the results (Shores, 2000).*

Multiple Choice Questions

The final 3 questions of the survey were based on common stereotypical associations, some of which were supported by research and others by logic and experience.

Question 7 inquires which season the participants most associate with joy. According to Charles Boutell, a graduate of Cambridge and Oxford University, spring and summer are commonly associated with vigorous life and prosperity. This contrasts starkly with fall and winter which are commonly associated with death

and decay (Boutell, 1877). Ergo, summer and spring are more typically associated with joy, allowing for the creation of question 7 and making winter and fall the counter-normative responses.

Question 8 included images of different facial expressions to see how speakers of the Tangier Island dialect interpreted them compared to speakers of the mainland dialect. The question stem asked the participants which of the faces they most associate with sadness. According to Claire Williams and team, "Sadness is typically characterized by raised inner eyebrows, [and] lowered corners of the mouth" (i.e. frowning) (Arias et al., 2020). Ergo, Option 3, was the normative response.

Lastly, question 9 asked the participants which direction they associated with "getting better." The process of getting better is typically referred to as "*progress*." Pro is a Latin root meaning "forward" and since English speakers read from right to left, "forward" is typically associated with a right-facing arrow. Additionally, "getting better," is also commonly thought of as "overcoming." Thus, an additional significant proportion of people associate "getting better" with "going up" (Stotsky, 1977). Question 9 showcased all 4 directional arrows, with the right and upward arrows serving as the normative responses and the left and downward facing arrows serving as the counter-normative responses (See Figure 5)

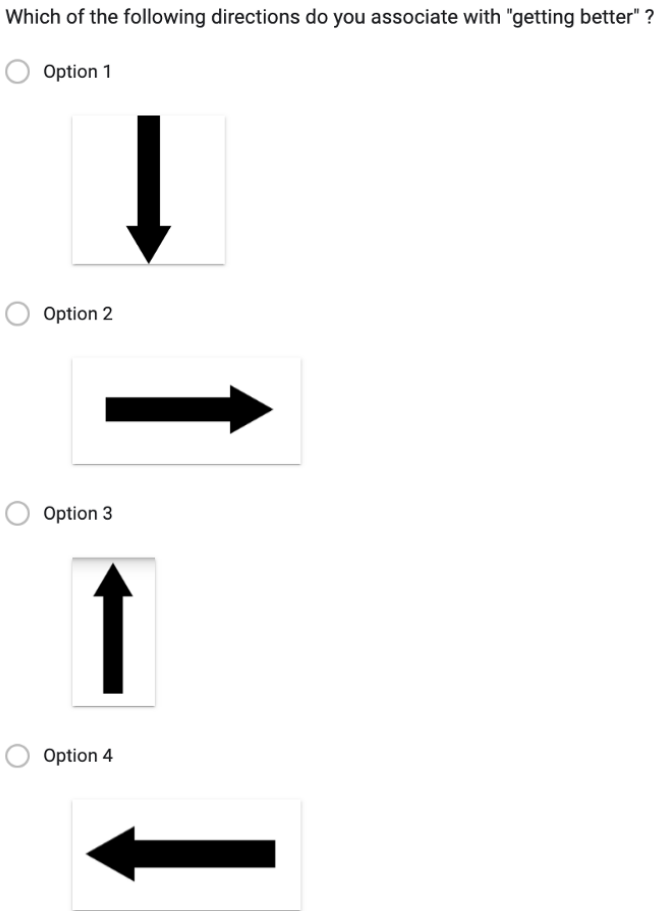

Figure 5. Note: *This Figure represents a Multiple Choice Question. This particular question had two normative responses (Option 2 & 3) and two counter-normative responses (Option 1 & 4)* (Stotsky, 1977).

Gastil claims that "any important proof of linguistic determinism must show that many of the recorded semantic differences add up cumulatively and play an important role in the causation of a more or less steady tendency to divergence in the thought of the speakers of the two groups" (Gastil, 1959). Therefore, the Research

employed such varied question types in order to create a diverse database to record "semantic differences" and observe how they "add up cumulatively" (Gastil, 1959). The survey was sent out via social media to people in the Tidewater region (mainland, Virginia) and to residents of Tangier Island, Virginia.

Ethical Considerations

According to the 2018 Common Rule, created by the Office for Human Research Protection, as a part of the Department of Health and Human Services (HHS), the Researcher's survey was exempt from requiring a consent form or IRB approval. Section §46.104, article d (3i), clauses (A) and (B), highlights this exception (Protections (OHRP), 2017).

Although the Researcher acquired some personal information for the participants, this information would not lead to the identification of individuals (A) and would not put the participants at risk (B) therefore a consent form was not required (Protections (OHRP), 2017).

Analysis of Results

There are three stages of analyzing results when conducting a grounded theory analysis: Initial Coding, Intermediate Coding, and Advanced Coding. According to the National Library of Medicine, "Coding is an analytical process used to identify concepts, similarities, and conceptual reoccurrences in data." Coding is the pivotal link between data collection and theory fabrication. The Initial Coding process entails organizing incoming data, labeling categories, and identifying conspicuous trends present within the survey responses (Tie et al., 2019).

Initial Coding

The Researcher conducted their Initial Coding by organizing all the data into a spreadsheet, separating participants into the control and experimental groups, highlighting with color obvious counter-normative responses, and noting initial trends.

This phase also served as a convenient time to "weed out" invalid participants using information from the demographic half of the survey. In total, 4 out of 174 participants had to be excluded due to lack of exposure to their dialect. During the Initial Coding phase of the analysis, the Researcher began to note more color- present within the Tangier Island sector of the spreadsheet, an indicator of more counter-normative responses. This trend had to be further evaluated during the Intermediate Coding phase of analysis (Tie et al., 2019).

Intermediate Coding

According to the NIH, the Intermediate Coding phase propagates the Researcher to break down the responses into narrowed cohorts and denote "what is really going on in the data" (Tie et al., 2019). During this phase, the Researcher further broke down the data present in the spreadsheet by question type, creating a table to contain the data. As mentioned in the methodology, there were three major cohorts of questionnaires; yet, these categories were not actually denominated nor solidified until the Intermediate Coding phase. The first series of questions, the dichotomous questions, were placed together, followed by the scale questions, and ending with the multiple choice questions. Now that three cohorts had been established, the Researcher was able to tally how many counter-normative responses were present per question, per category, and per group of people (See Table 1).

Table 1. Note: The bolded ratios are the total number of counter-normative responses out of the total responses per question found by adding the aforementioned ratios. Some of the questions exhibited varying numbers of responses, this is because the participants skipped over certain questionnaires.
Advanced Coding

Number of Counter-Normative (C-N) Responses out of Total Responses Per Question			
Question Style	Question Number	Cohort	
		Mainland Virginia	Tangier Island
Dichotomous	1	5/69	6/34
	2	11/68	8/34
	3	6/67	5/31
Total Dichotomous C-N Responses		**22/204**	**19/99**
Scale	4	1/69	1/34
	5	6/67	7/34
	6	4/82	5/35
Total Scale C-N Responses		**11/218**	**13/103**
Multiple Choice	7	0/69	1/34
	8	1/69	0/34
	9	21/69	8/34
Total Multiple Choice C-N Responses		**22/207**	**9/102**
Final Total Counter Normative Responses		**55/629**	**41/304**

To reiterate, the Researcher wanted to know to what *extent* linguistic determinism was evident within the Tangier Island dialect. In order to empirically form an answer to this question the collected data had to be

quantified and statistical significance solved for. This brought the Researcher to the Advanced Coding phase of a GT Analysis. According to the NIH, Advanced Coding encompasses "techniques used to facilitate the integration of the final grounded theory" (Tie et al., 2019). In the case of this scaled-down comparative linguistic analysis, the technique employed was a Two Proportion Z-Test. A Two Proportion Z-Test, as described by PennState, is a method employed in statistics, utilized when juxtaposing two population percentages. A Two Proportion Z-Test operates with a null hypothesis (H_0) that both collected ratios should be equivalent, however, discrepancies in these ratios show that some sort of variable (in this case the use of backwards talk) has altered the percentages more than the naturally anticipated dividend. For a data set to be statistically significant, the Two Proportion Z-Test formula (See Figure 4) must output a p-value ≥ 0.05 (*9.4 - Comparing Two Proportions | STAT 415*, 2023).

$$z = \frac{(p1 - p2)}{\sqrt{\frac{p1(1-p1)}{n1} + \frac{p2(1-p2)}{n2}}}$$

Figure 4. Note: *p1 represents the 1st population proportion, p2 represents the 2nd population proportion, n1 represents the total number of responses in the 1st population, and n2 represents the total number of responses of the 2nd population* (*9.4 - Comparing Two Proportions | STAT 415*, 2023).

Utilizing the data chart created in the Intermediate Coding phase of analysis, the Researcher was able to input the counter-normative response ratios into the Two Proportion Z-Test formula for each questionnaire cohort (See Table 2).

Table 2. Note: The p1 and p2 values represent the proportion of counter-normative responses out of total responses. The decimals employed represent the approximation of the fractions created during the Intermediate Coding Phase (i.e. 22/204 = 0.108). The n1 and n2 values represent the total number of responses or the denominator of the fractions created during the Intermediate Coding Phase (See Table 1).

Dichotomous Questions	Scale Questions	Multiple Choice Questions
$z = \frac{(0.108 - 0.192)}{\sqrt{\frac{0.108(1-0.108)}{204} + \frac{0.192(1-0.192)}{99}}}$	$z = \frac{(0.050 - 0.126)}{\sqrt{\frac{0.050(1-0.050)}{218} + \frac{0.126(1-0.126)}{103}}}$	$z = \frac{(0.106 - 0.088)}{\sqrt{\frac{0.106(1-0.106)}{207} + \frac{0.088(1-0.088)}{102}}}$
p-value = 0.045 < 0.05	p-value = 0.016 < 0.05	p-value = 0.620 > 0.05

Both the Dichotomous and Scale questions yielded a statistically significant p-value < 0.05, meaning that far more Tangier Island residents selected counter-normative responses when juxtaposed to the mainland. However, the multiple-choice question did not yield the same results and the p-value was not significant. The final measure taken when conducting a GT analysis is known as theoretical sensitivity. As defined by Glaser and Strauss, theoretical sensitivity is "the ability to recognize and extract from the data elements that have relevance for the emerging theory" (Glaser & Strauss, 1967). In the case of the particular data set generated by the Researcher, the most relevant data to formulate an adapted theory would be a holistic approach. Again, Gastil writes that any important proof of Linguistic Determinism must add up cumulatively. Thus, the Researcher applied the Two Proportion Z-Test formula to the total counter-normative responses from both the Tidewater region of Virginia and Tangier Island, Virginia (See Table 3).

Table 3. Note: The numbers employed in this table were found by adding the total number of counter-normative responses per question (See Table 1). The p-value < 0.05 proves the hypothesis (H_1) and disproves the null hypothesis (H_0).

Total Counter-Normative Responses Selected
$$z = \frac{(0.088 - 0.135)}{\sqrt{\frac{0.088(1-0.088)}{629} + \frac{0.135(1-0.135)}{304}}}$$
p-value = 0.025 < 0.05

The results of this final assessment facilitate the emergence of a final grounded theory capable of answering the research question:

Research Question:

To what extent is linguistic determinism evident and measurable within the Tangier Island dialect due to the presence of their sarcasm idiom dubbed "Backwards Talk?

Grounded Theoretical Answer

A statistically significant proportion of Tangier Island residents selected counter-normative answer choices. This can be likely attributed to their frequent use of backwards talk. Additionally, the presence of a linguistic feature affecting cognitive perception is considered an example of weak linguistic determinism, therefore, weak linguistic determinism is evident to a statistically significant extent within the Tangier Island dialect.

Discussion

The Researcher has found that the people of Tangier Island selected counter-normative responses to a statistically significant extent. This is likely due to their frequent use of backwards talk, hence a result of linguistically determined visual-emotional perception.

Limitations

While this study suggests that linguistic determinism can be found within dialects of a homogenous language, its limitations cannot be overlooked. There is an unfortunate phenomenon known as "response bias" found in nearly all surveys. One particular response basis, known as confirmation basis, is at a higher risk in the Researcher's particular survey. Confirmation basis is the notion that the participants of the survey are aware of the intent of the survey. Tangier Island residents are aware of their backwards talk idiom and of people's fascination with it, therefore, they may have been aware of the intent of the survey and purposely selected counter-normative responses. The Researcher tried to limit confirmation bias by ambiguously titling the survey and never referring specifically to backwards talk (Althubaiti, 2016).

Another less nuanced limitation simply comes from participant quantity. Unfortunately, the people of Tangier Island are secluded which made it hard to acquire responses. Only 34 people exposed to the Tangier Island dialect responded to the survey, and of those 34, only 25 inhabit the island presently. Such low numbers can decrease the overall validity of the results (Cobern & Adams, 2020). However, although these numbers are fairly meniscal, they do, in fact, makeup 6.25% of the total island population. This percentage mitigates the low quantity of responses.

Implications

Despite its limitations, this study poses many important implications for both the linguistic community and future research on the topic. As discussed in the literature review, there has been a lull of recent research done on the subject of linguistic determinism following the succession to the weak-determinism belief. These findings could spark additional research in the field and explore other unique geographic-based American dialects or perhaps test for the presence of weak linguistic determinism within American accents (Schilling-Estes, 1997). This research suggests that dialects impact cognitive processes. Interestingly, these findings hold political implications. According to the NIH, "using data collected from across the U.S. we find that even when people share the same political identity, those in "bluer" locations are more likely to support left-leaning policies and vote for Democratic candidates than those in "redder" locations" (Feinberg et al., 2017). These findings suggest that political identities are formed and shaped by geographic regions, similar to the formation of dialects. This ideology can be logically enhanced by the findings of the Researcher, that geographic-based dialects can result in cognitive discrepancies between inhabitants of different areas. Perhaps, the polarization of the American political spectrum, in a geographic context, is due to cognitive variations among Americans who speak different dialects. Further research on the phenomenon could explore the relationship between geographic-based political identities and dialect-determined cognitive processes, something politicians and campaigners would be highly intrigued by. Campaigning is already a multi-million-dollar process (Feinberg et al., 2017). By gaining further insight into how inhabitants of certain regions intrinsically perceive things, the number of political dollars spent could be better focused on messaging that coincides with the way of thought inherent to particular geographic regions (Feinberg et al., 2017). This implication could be enhanced by further research in the field, specifically exploring the impact of linguistic determinism in accents.

Conclusion

The Theory of Linguistic Determinism developed by Sapir and Whorf in the early 1900s, faced stringent opposition within the scientific community. Even still, pieces of the original theory remain today and continue to influence the field of philosophical linguistics. The comparative dialect-based cognitive analysis conducted by the Researcher suggests that the ideologies theorized by Sapir and Whorf also apply on a parochial scope. This was showcased when speakers of the Tangier Island dialect, who often say the opposite of what they really intend (backwards talk), exhibited counter-normative implicit associations when compared to speakers of ordinary English. This knowledge has many implications in both the linguistic and political fields as it could spark additional research on other American regional dialects and the inherent cognitive process they mold.

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References

9.4 - Comparing Two Proportions | STAT 415. (2023). PennState: Statistics Online Courses. https://online.stat.psu.edu/stat415/lesson/9/9.4

Althubaiti, A. (2016). Information Bias in Health research: definition, pitfalls, and Adjustment Methods. *Journal of Multidisciplinary Healthcare*, *9*(9), 211–217. https://doi.org/10.2147/JMDH.S104807

Arias, J. A., Williams, C., Raghvani, R., Aghajani, M., Baez, S., Belzung, C., Booij, L., Busatto, G., Chiarella, J., Fu, C. H., Ibanez, A., Liddell, B. J., Lowe, L., Penninx, B. W. J. H., Rosa, P., & Kemp, A. H. (2020). The neuroscience of sadness: A multidisciplinary synthesis and collaborative review. *Neuroscience & Biobehavioral Reviews*, *111*(111), 199–228. https://doi.org/10.1016/j.neubiorev.2020.01.006

Bent, T., Atagi, E., Akbik, A., & Bonifield, E. (2016). Classification of regional dialects, international dialects, and nonnative accents. *Journal of Phonetics*, *58*, 104–117. https://doi.org/10.1016/j.wocn.2016.08.004

Bibbins-Domingo, K., & Helman, A. (2022). Why Diverse Representation in Clinical Research Matters and the Current State of Representation within the Clinical Research Ecosystem. In *www.ncbi.nlm.nih.gov*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK584396/

Boutell, C. (1877). Symbols of the Seasons and Months Represented in Early Art. *The Art Journal (1875-1887)*, *3*, 233. https://doi.org/10.2307/20569095

Butterworth, B., Reeve, R., Reynolds, F., & Lloyd, D. (2008). Numerical thought with and without words: Evidence from indigenous Australian children. *Proceedings of the National Academy of Sciences*, *105*(35), 13179–13184. https://doi.org/10.1073/pnas.0806045105

Carey, S., & Xu, F. (1996). *APA PsycNet*. Psycnet.apa.org. https://psycnet.apa.org/record/1996-01747-001

Cheng, K. (1986). A purely geometric module in the rat's spatial representation. *Cognition*, *23*(2), 149–178. https://doi.org/10.1016/0010-0277(86)90041-7

Cobern, W., & Adams, B. (2020). Establishing survey validity: A practical guide. *International Journal of Assessment Tools in Education*, *7*(3), 404–419. https://doi.org/10.21449/ijate.781366

Cristia, A., Seidl, A., Vaughn, C., Schmale, R., Bradlow, A., & Floccia, C. (2012). Linguistic Processing of Accented Speech Across the Lifespan. *Frontiers in Psychology*, *3*. https://doi.org/10.3389/fpsyg.2012.00479

De Cruz, H. (2009). IS LINGUISTIC DETERMINISM AN EMPIRICALLY TESTABLE HYPOTHESIS? *Peeters*, *52*(208), 327–341. Logique et Analyse.

DEPARTMENT OF HUMAN RESOURCE MANAGEMENT POLICIES AND PROCEDURES MANUAL HOURS OF WORK. (2004). https://www.dhrm.virginia.gov/docs/default-source/hrpolicy/pol1_25hoursofwork.pdf?sfvrsn=2

Feinberg, M., Tullett, A. M., Mensch, Z., Hart, W., & Gottlieb, S. (2017). The political reference point: How geography shapes political identity. *PLOS ONE*, *12*(2), e0171497. https://doi.org/10.1371/journal.pone.0171497

Gastil, R. D. (1959). Relative Linguistic Determinism. *Anthropological Linguistics*, *1*(9), 24–38. https://www.jstor.org/stable/30022228

Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge.

Gordon, P. (2004). Numerical Cognition Without Words: Evidence from Amazonia. *Science*, *306*(5695), 496–499. https://doi.org/10.1126/science.1094492

Hermer, L., & Spelke, E. (1996). Modularity and development: the case of spatial reorientation. *Cognition*, *61*(3), 195–232. https://doi.org/10.1016/s0010-0277(96)00714-7

Hermer-Vazquez, L., Moffet, A., & Munkholm, P. (2001). Language, space, and the development of cognitive flexibility in humans: the case of two spatial memory tasks. *Cognition*, *79*(3), 263–299. https://doi.org/10.1016/s0010-0277(00)00120-7

Hunt, E., & Agnoli, F. (1991). The Whorfian hypothesis: A cognitive psychology perspective. *Psychological Review*, *98*(3), 377–389. https://doi.org/10.1037/0033-295x.98.3.377

Implicit Associations: The Academic Search Process and Letters of Recommendation. (n.d.). Academic Inclusion. Retrieved April 21, 2024, from https://academicinclusion.princeton.edu/implicit-associations-academic-search-process-and-letters-recommendation#:~:text=What%20is%20Implicit%20Association%3F

Katz, M. (n.d.). *Language of Thought Hypothesis | Internet Encyclopedia of Philosophy*. Internet Encyclopedia of Technology. https://iep.utm.edu/lot-hypo/#:~:text=The%20language%20of%20thought%20hypothesis%20(LOTH)%20is%20the%20hypothesis%20that

Li, J. (2022). Relationship Between Language and Thought: Linguistic Determinism, Independence, or Interaction? *BIO-BYWORD*, *6*(5), 32–37. Journal of Contemporary Educational Research.

Lucy, J. A. (1997). LINGUISTIC RELATIVITY. *Annu. Rev. Anthropol*, *26*, 291–312. https://cslc.nd.edu/assets/142525/lucy_linguistic_relativity.pdf

Lucy, J. A. (2015). *Sapir-Whorf Hypothesis - an overview | ScienceDirect Topics*. Sciencedirect.com. https://www.sciencedirect.com/topics/psychology/sapir-whorf-hypothesis

Mandelbaum, D. (1941). Edward Sapir. *Jewish Social Studies*, *3*(2), 131–140. https://www.jstor.org/stable/4464395

Margules, J., & Gallistel, C. R. (1988). Heading in the rat: Determination by environmental shape. *University of Pennsylvania, Philadelphia, Pennsylvania*, *16*(4), 404–410. Animal Learning and Behavior.

Multiple Intelligence Theory. (2022, May 26). UTHSC. https://www.uthsc.edu/tlc/intelligence-theory.php#:~:text=Interpersonal%20intelligence%20is%20the%20ability

Protections (OHRP), O. for H. R. (2017, March 7). *2018 Requirements (2018 Common Rule)*. HHS.gov. https://www.hhs.gov/ohrp/regulations-and-policy/regulations/45-cfr-46/revised-common-rule-regulatory-text/index.html#46.104

Puderbaugh, M., & Emmady, P. D. (2023, May 1). *Neuroplasticity*. PubMed; StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK557811/

Schilling-Estes, N. (1997). Accommodation versus Concentration: Dialect Death in Two Post-Insular Island Communities. *American Speech*, *72*(1), 12. https://doi.org/10.2307/455606

Scholz, B. C. (2024). *Philosophy of Linguistics > Whorfianism (Stanford Encyclopedia of Philosophy)*. Plato.stanford.edu. https://plato.stanford.edu/ENTRIES/linguistics/whorfianism.html

Shores, D. L. (2000). *Tangier Island: place, people, and talk*. University Of Delaware Press; London, England.

Smith, A. D., Gilchrist, I. D., Cater, K., Ikram, N., Nott, K., & Hood, B. M. (2008). Reorientation in the real world: The development of landmark use and integration in a natural environment. *Cognition*, *107*(3), 1102–1111. https://doi.org/10.1016/j.cognition.2007.10.008

Steinhart, E., & Kittay, E. (1994). Generating Metaphors from Networks: A Formal Interpretation of the Semantic Field Theory of Metaphor. *Springer EBooks*, *238*, 41–94. https://doi.org/10.1007/978-94-015-8315-2_3

Stotsky, S. L. (1977). Teaching Prefixes: Facts and Fallacies. *Language Arts*, *54*(8), 887–890. https://www.jstor.org/stable/41404561

Tie, Y. C., Birks, M., & Francis, K. (2019). Grounded Theory research: a Design Framework for Novice Researchers. *SAGE Open Medicine*, *7*(1), 1–8. NCBI. https://doi.org/10.1177/2050312118822927

Wei, X., Gunter, T. C., Adamson, H., Schwendemann, M., Friederici, A. D., Tomás Goucha, & Anwander, A. (2024). White matter plasticity during second language learning within and across hemispheres. *Proceedings of the National Academy of Sciences of the United States of America*, *121*(2). https://doi.org/10.1073/pnas.2306286121