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Variations in Inner Language and Conceptual Thought Experience

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Abstract

Inner language is often assumed to include sensorimotor imagery, but is that necessary? How common are conceptual (non-linguistic) thoughts? Does low propensity to think in words indicate lowered ability to imagine language altogether? Here, we sought to characterize the variability in the format of thought by prompting participants (N=228) to (i) think about a given topic or (ii) imagine hearing language or speaking, and then report on their experiences. For thought prompts, a statistically non-trivial percentage of reports included non-sensorimotor inner language (17.5%) and concepts without a verbal or visual form (37.5%). While 74.6% of participants showed high propensity to experience inner language, 4.4% showed no propensity. For language imagery prompts, inner language ability was near-ubiquitous, with only 0.4% (N=1) reporting the absence of linguistic imagery. Overall, we highlight the variability in inner language and conceptual thought experiences, and dissociate the propensity vs. the ability to use language in thought.¹

Keywords: inner speech; concepts; mental imagery; individual differences; language and thought

Introduction

Take a moment to think about what your perfect weekend would include. When doing so, what was your experience like? Did you experience any words? If so, did these words have a sound in your mind? Did you imagine moving your mouth when experiencing them? Or were words experienced without any imagined sounds or movements? How about abstract ideas that did not occur in words or images, were they part of your experience?

You might find these two last experiences odd or impossible. But not all minds are alike. In the domain of mental imagery, for example, while some individuals report extremely vivid visual images (hyperphantasia), others report the inability to conjure up images in their minds (aphantasia) (Zeman et al., 2015). But surprisingly, much less is known about variations in other forms of inner experiences, such as inner speech and conceptual thought.

Inner speech, or inner language, as we propose to call it, is reported to be one of the most common inner experiences (Hurlburt et al., 2013), often claimed to be a universal feature of human cognition (Perrone-Bertolotti et al., 2014). Yet, recent work indicates that some individuals do not tend to experience it, a characteristic named *anendophasia* (Nedergaard & Lupyan, 2023, 2024). It remains unclear, though, whether the lack of *propensity* to think in language indicates a lack of *ability* to do so when prompted.

Another aspect that remains underexplored in inner speech research concerns its phenomenological qualities. A

common assumption is that inner speech is an inner voice that we hear in our minds, having a necessary auditory-phonological component (Langland-Hassan, 2018) or sensorimotor format (Carruthers, 2015, 2018, Prinz, 2002). Words are experienced internally just as they are experienced externally: they are either “heard” or “spoken” or “seen” in our minds. Yet, anecdotal reports suggest that inner language may vary phenomenologically. Individuals with *aphantasia* sometimes report that they experience “unheard” words that carry thoughts” (Watkins, 2018; Krempel, 2025). Experience sampling studies have also indicated that inner language may be experienced without any sensorimotor qualities, a phenomenon named “worded thinking” (Hurlburt & Heavey, 2006). However, these variations in inner language have remained largely ignored. No one has attempted to capture them by means of questionnaires, and we lack good estimates of their frequency.

A more controversial form of experience concerns thoughts or ideas that involve neither words nor images. An intense debate took place in late 19th Century psychology over whether there could exist so-called “imageless thoughts”, with no consensus being reached (Thomas, 2001). Recent experience sampling studies indicate that imageless and wordless thoughts (named “unsymbolized thoughts”) occur quite frequently (Hurlburt & Akhter, 2008). Yet, research on this also remains scarce.

Imageless and wordless thoughts are rarely targeted in questionnaires (though see the NIEQ, Heavey et al., 2019), but multiple questionnaires aim to capture variations in inner speech (e.g. VISQ-R, Alderson-Day et al., 2018; IRQ, Roebuck & Lupyan, 2020; The Self-Talk Scale, Brinthaup et al. 2009). However, they share some characteristics that limit their ability to assess inner language sensory quality, ability, and frequency:

1) *Focus on limited aspects of inner speech.* Current questionnaires focus on variations in the uses and contents of inner speech (e.g. whether it is used for self-reinforcement or self-criticism) (Self-Talk Scale, VISQ-R) or selective aspects of inner speech phenomenology (e.g., whether it is condensed or complete (VISQ-R)). The IRQ assesses some sensory aspects of inner language, but doesn’t consider non-sensorimotor forms.

2) *Focus on differences in propensity rather than ability.* Most questionnaires assess how frequent various forms or uses of inner speech are (cf. VISQ-R, IRQ), showing the *propensity* for inner speech use in certain contexts, but not addressing the *ability* to experience inner language. One

¹ Paper website: <https://github.com/GT-LIT-Lab/Inner-Language-Variation>

could lack the inclination to ever think in language, but still be able to do it if explicitly instructed to.

3) *Retrospective assessment of general experiences rather than assessment of experiences in the moment.* Current questionnaires rely on people's ability to retrospectively estimate the frequency of certain forms of inner speech. This may be hard to do and lead to mistakes and confabulations (Hurlburt et al., 2022).

An alternative method for exploring inner experience is the Descriptive Experience Sampling (DES) (Hurlburt, 1993). DES has identified a number of variations in the phenomenal quality of inner experiences in everyday occurrences. But it is time consuming and not suited for assessing inner language ability, only propensity.

We thus aimed to address the limitations of previous methods in order to investigate often-neglected aspects of inner experiences, addressing the following main questions:

(1) Existence of non-sensorimotor formats of inner experiences: Can inner language occur without associated sensorimotor imagery? Can one experience abstract thoughts or concepts, in the absence of words or images?

(2) Average frequency of thought formats: How often are language and concepts used in thinking? How often does language occur in different forms i.e. auditory, motor, visual and pure lexical format (without sensory-motor features).

(3) Individual differences in propensity: Are there individual differences in the propensity to think in language and in concepts?

(4) Inner language ability: Are there individuals who lack the ability to experience words in their minds?

(5) Thinking vs imagined inner language: Do inner experiences vary depending on whether we are thinking freely about a topic, compared to when we are imagining that we are talking or hearing someone talk?

To overcome the limitations from previous methods and minimize response biases, our study involved instructing participants to think about a topic or imagine speech and then assess their experiences one at a time. This setup was partly inspired by imagery questionnaires like VVIQ (Marks, 1973), which instruct participants to form specific images and rate their vividness. But rather than assessing vividness, following each experience, we asked participants yes-or-no questions about the presence of specific features in their inner experiences: words (in various manifestations: auditory, orthographic, articulatory and non-sensorimotor), visual images and concepts (see Bigelow et al., 2023, for a similar approach).

Methods

Participants

295 participants were recruited via Prolific. We selected the sample size and number of trials based on simulations (see paper website for details). This sample size is also

consistent with previous questionnaire studies that investigated differences in people's inner experiences (e.g., IRQ, NIEQ, and STS). 61 participants failed to pass at least one (out of 6) attention check question and were excluded from analysis. We additionally removed 6 participants who wrote comments that appeared to be AI generated (e.g. theory-laden and overly structured; independently checked by 4 experimenters). The final number of participants included in the analysis was 228 (120 female, 106 male, 2 no gender data or prefer not to say, mean age 41.4). All participants were native or fluent in English and reported no dyslexia. The study protocol was approved by MIT's Committee on the Use of Humans as Experimental Subjects (COUHES).

Procedure

The study asked participants to think about various topics or to imagine either talking or hearing speech (**Figure 1A**). For each instruction prompt, participants indicated whether they experienced words (in English or otherwise), visual images, or concepts. We further probed the nature of their inner language by asking whether the words had associated imagined sound, written form, articulatory movement, or no sensorimotor form (**Figure 1B**). Before the study began, we provided participants with examples of the main experiences to be targeted, to ensure that participants understood the differences between the various forms of thinking (see paper website for full details).

The study consisted of **3 blocks (Figure 1A):**

Block 1 - Thinking: participants were instructed to think about a particular topic. Topics concerned either personal preferences or commonly known things.

Block 2 - General: (2a) Inner speaking & (2b) Inner hearing: Participants were instructed to imagine *talking* and *hearing* someone talk about certain topics. Topics here concerned commonly known things.

Block 3 - Specific: (3a) Inner speaking & (3b) Inner hearing: Participants were instructed to imagine *saying* and *hearing* specific sentences. The sentences were uncontroversial statements, involving abstract nouns (e.g. "time") to minimize the occurrence of visual imagery, allowing participants to focus on inner language.

The Thinking block was designed to assess the formats that participants would spontaneously recruit in thinking. Other blocks were designed for participants to imagine speech, taking into account that it can occur in the form of inner speaking or inner hearing (Hurlburt et al. 2013). Block 3 in particular meant to investigate inner language ability.

Participants were also asked about the presence of other forms of experience (e.g., emotions and imagined tastes), whether their eyes were open or closed, whether they said words aloud or actually moved their mouths, and for estimations of frequency of their experiences in everyday life, but these were not included in the analysis conducted here. They also had the option to provide comments about

their experiences. (See paper website for a complete list of questions)

Afterwards, participants completed the Plymouth Sensory Imagery Questionnaire (Psi-Q) to measure the vividness of their sensory imagery. The study was implemented using jsPsych (de Leeuw et al., 2023).

A. Instructions

Practice	Think about what your ideal work environment would be like
Block 1: Thinking (20s each)	Think about what you would do on an unexpected day off Think about what your perfect weekend would include Think about your ideal daily routine Think about what you would do if you won the lottery Think about what you plan to do tomorrow Think about the weather in the city you live in Think about things that a five-year-old can do for fun Think about good oral hygiene habits Think about the traffic in the city you live in Think about what people usually do on a beach vacation
Block 2a: General Inner Speaking (20s each)	Imagine talking about the cost of living in your area Imagine talking about popular foods in your area Imagine talking about activities people typically do on weekends Imagine talking about useful skills in life Imagine talking about how technology has changed our lives
Block 2b: General Inner Hearing (20s each)	Imagine hearing someone talk about the nutrients the human body needs Imagine hearing someone talk about the neighborhood you live in Imagine hearing someone talk about essential preparation for traveling Imagine hearing someone talk about how people usually spend their mornings Imagine hearing someone talk about good habits to stay healthy
Block 3a: Specific Inner Speaking (10s each)	Imagine saying the sentence: English is a language Imagine saying the sentence: Mathematics is a major Imagine saying the sentence: Democracy is a system Imagine saying the sentence: Growth is a process Imagine saying the sentence: Time is a dimension
Block 3b: Specific Inner Hearing (10s each)	Imagine hearing the sentence: Logic is a tool Imagine hearing the sentence: Gravity is a force Imagine hearing the sentence: Ideas are valuable Imagine hearing the sentence: Honesty is a quality Imagine hearing the sentence: Learning is a journey

B. Questions

e.g., "Think about your ideal daily routine."

General

Language:	Were words in English part of your inner experience?
	Were words in a language other than English part of your inner experience?
Visual:	Were visual images part of your inner experience?
Concept:	Were abstract thoughts and ideas (without words or images) part of your inner experience?

Answer options: · Yes · No

Forms of Language

Auditory:	Did you experience the words as having sound in your mind?
Orthographic:	Did you experience the words as having a written form in your mind?
Articulatory:	While experiencing words, did you imagine moving your mouth, lips, tongue, or throat?
Pure Lexical:	Did you experience the words without any imagined sound, visual form, or movement ?

Answer options: · Yes · No · I did not experience words

Figure 1: (A) All instruction prompts by block. (B) Questions probing forms of inner experiences.

Statistics

We used the Wilcoxon signed-rank test to test the existence of different inner experience forms by comparing the average frequency against 5% (we consider 5% as a baseline for a non-trivial existence). The same test was also used to establish the prevalence of different forms (significantly more than 50%), differences between forms and comparing the prompt effect between blocks. The Spearman rank-order correlation was used to examine the relationship between different thought forms. Benjamin/Hochberg method was used to correct for the number of comparisons.

Results

Average Frequency of Thought Formats and Existence of Non-Sensorimotor Formats

We investigated the average frequency of spontaneous thought formats in the Thinking block (Block 1). We found

that people reported language as part of their inner experiences in the majority of trials (80.0%; >50%; $p < 0.001$) (**Figure 2**). Among language-related experiences, auditory inner language was the most common (54.7%; >50%, $p = 0.045$, uncorrected). Compared to auditory, orthographic (19.3%) and articulatory (21.8%) inner language were less prevalent (vs. auditory, $ps < 0.001$), but still experienced at a non-trivial rate (>5%, $ps < 0.001$). Notably, in 17.5% of trials, people reported experiencing language in pure lexical forms—verbal thoughts without sensorimotor features at a non-trivial frequency (>5%; $p < 0.001$). These data show that inner language can be detached from sensorimotor experiences.

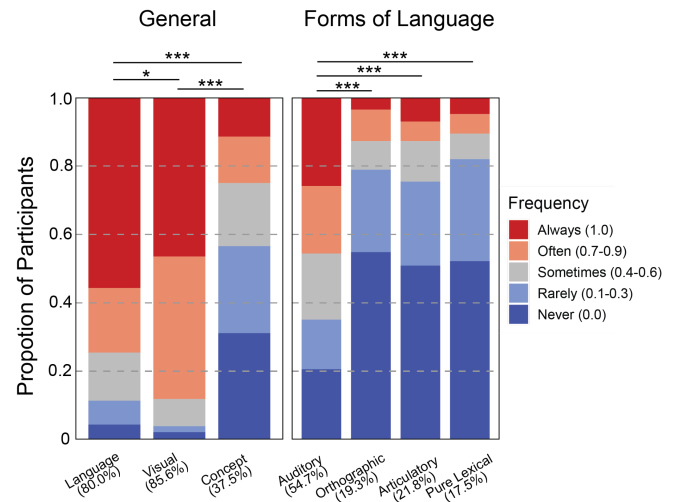


Figure 2: Frequency of thought forms during Block 1. Percentages shown below each label indicate the average frequency across individuals. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

In addition, we found that concepts were reported in 37.5% of trials (>5%, $p < 0.001$), indicating that abstract thoughts or concepts can be experienced in the absence of words or images.

Finally, people also reported experiencing visual images in the majority of trials (85.6%; >50%, $p < 0.001$), a slightly higher overall rate than inner language ($p = 0.032$).

Together, these results indicate substantial variability in inner experience forms. In particular, although less frequent than sensorimotor experiences, non-sensory forms of thinking (pure lexical and conceptual experiences) occurred in a meaningful proportion of trials.

Individual Differences in Propensity

We investigated individual differences in the propensity to think in language and in abstract concepts in Thinking scenarios. As shown in **Figure 2**, 74.6% of people often (70-90% of trials) or always (100% of trials) experienced language, which indicates that high propensity of language use in thinking is the norm. In contrast, 4.4% of participants

never experienced inner language in any trials, indicating no propensity to spontaneously think in language, and 7.0% showed low propensity, rarely (10-30% of trials) thinking in language.

Regarding forms of inner language, 45.6% of participants showed a high propensity to experience auditory inner language, whereas 35.1% showed low to no propensity to experience it. In contrast, the majority of participants had low to no propensity for articulatory inner language (75.4%) or orthographic inner language (78.9%); only 12.7% and 12.7% of participants showed a high propensity for each of these two forms (**Figure 2**). Furthermore, individuals with a high propensity for articulatory imagery also tended to have a high propensity for orthographic imagery ($r=0.30$, $p<0.001$) and auditory inner language ($r=0.33$, $p<0.001$) (**Figure 3**), despite differences in their overall propensities. Individual differences were also observed for pure lexical inner language: while 82.0% of participants showed low to no propensity, 10.5% showed a high propensity for experiencing words without associated sensorimotor forms. Moreover, the recruitment of pure lexical forms was significantly negatively correlated with auditory inner language ($r=-0.27$, $p<0.001$) (**Figure 3**).

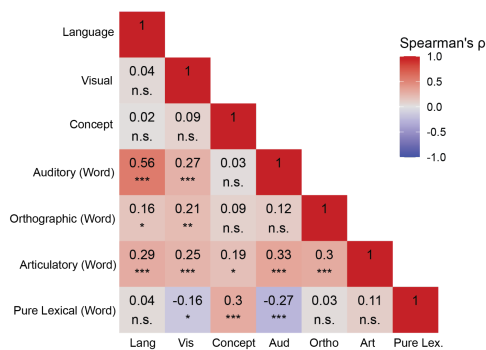


Figure 3: Correlations between thought forms during Thinking block * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; n.s., not significant.

Regarding nonverbal concepts, the majority (56.6%) of participants showed low to no propensity, whereas 25.0% showed a high propensity to think in abstract thoughts or ideas. Notably, the reported frequency for concepts was significantly positively correlated with the pure lexical forms ($r=0.29$, $p<0.001$) (**Figure 3**).

Finally, most participants (88.2%) also showed a high propensity for visual imagery, but 3.9% showed low to no propensity. The use of visual images was significantly positively correlated with all the sensorimotor forms of inner language ($ps<0.001$), but significantly negatively correlated with pure lexical forms ($r=-0.15$, $p<0.05$) (**Figure 3**), further validating the sensorimotor/lexical distinction.

Inner Language Ability

In Block 1, 95.6% of participants reported inner language in at least one trial, indicating that most people have the ability to think in language, even if they are not all equally prone to do so. For the remaining 4.4% of participants who reported no propensity to think in language, do they still have the ability to do so? To answer this, we explicitly asked participants to imagine saying or hearing specific sentences, probing their inner language ability.

We found that, while 10 participants did not experience language at all in the Thinking block, this number drops to six in the General blocks. In the Specific blocks, only one participant reported no inner language (**Figure 4**), corresponding to 0.4% of our participants. This suggests that the complete inability to experience inner language may be extremely rare, but a study with a larger sample size is required for prevalence estimates.

Interestingly, we also found individual differences in the ability to experience inner language (**Figure 4**). While most (82.0%) participants reported experiencing language in all Specific block trials, indicating a high inner language ability, 7 participants reported the presence of words in only 10-30% of the Specific trials, indicating low inner language ability. Participants with a weak ability to use inner language also showed a weak propensity during Thinking block, as indicated by a significant correlation between Thinking and Specific blocks ($r=0.39$, $p<0.001$).

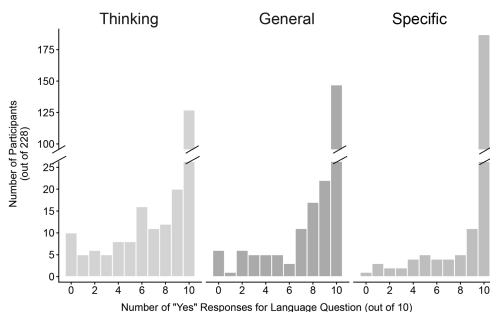


Figure 4: Frequency distribution of language by block.

Thinking vs Imagined Inner Language

We also investigated the extent to which inner experiences varied depending on whether we are thinking freely about a topic (Block 1), imagining talking or hearing someone talk about a topic (Block 2) or imagining saying or hearing specific sentences (Block3) (**Figure 5**). Overall, as expected, when prompts got more explicit about the expected use of language (i.e., from Thinking to General to Specific blocks), inner language use increased gradually but significantly ($ps<0.001$), while visual imagery and concepts significantly decreased ($ps<0.001$, except for Thinking vs. General speaking for concepts). A similar upregulating effect of prompt specificity was found across different forms of inner language. Specifically, a specificity block effect was observed for auditory inner language in both hearing and speaking blocks ($ps<0.001$, except for General

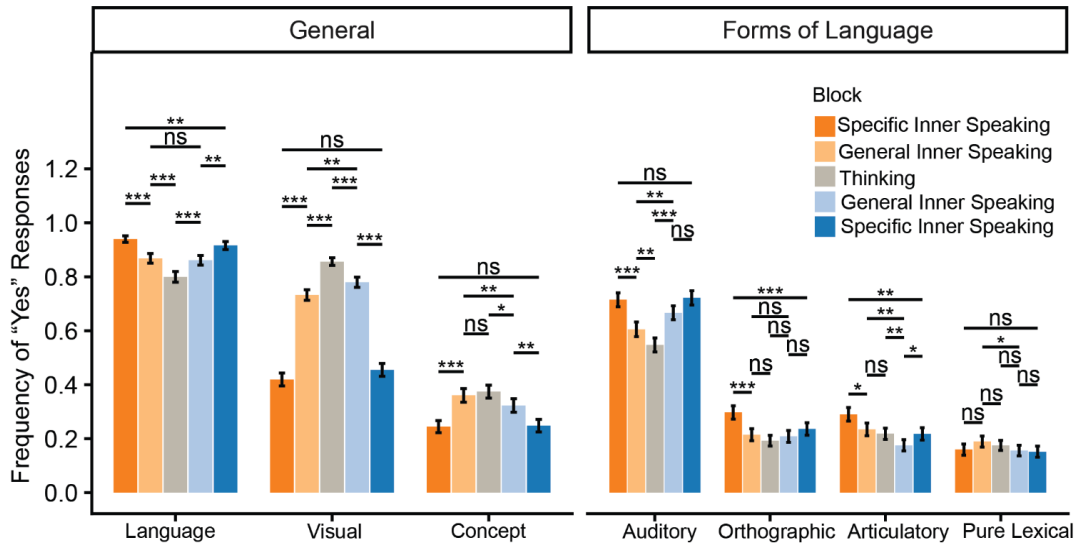


Figure 5: Effect of prompt on the thought forms.

hearing vs. Specific hearing), with a significantly stronger effect in General hearing than General speaking ($p < 0.01$), indicating modality-selective modulation. The modulation of articulatory imagery is more modality-specific; we only observe a meaningful increase from General to Specific in the speaking block ($p < 0.05$), but not in any hearing block. Both General ($p < 0.01$) and Specific ($p < 0.01$) speaking elicited significantly stronger articulatory imagery than their corresponding hearing blocks. This stronger effect of speaking instructions was also manifested in higher overall inner language use ($p < 0.01$) and orthographic imagery ($p < 0.001$) use in the Specific speaking block compared with Specific hearing, as well as stronger recruitment of pure lexical forms in General speaking than in General hearing.

Relation to Mental Imagery Abilities

Finally, we asked whether engagement of specific thought forms is related to general mental imagery abilities, as measured by the Psi-Q. We found that the reported frequency of visual images in our study was positively associated with all of the Psi-Q imagery modalities ($p < 0.05$ only for vision, sound, smell, and touch subscales after the correction). Similarly, auditory inner language use was positively associated with all Psi-Q modalities, although only the correlation with emotional imagery passed the correction ($p < 0.05$). In contrast, the use of non-sensorimotor forms—pure lexical and concepts—showed near-zero correlations with any of the Psi-Q modalities.

Discussion

In this study, we prompted participants to think about different topics and to explicitly imagine speech. Our results revealed variations in inner language forms, capturing both verbal and nonverbal thoughts without associated sensorimotor features. We found that, though less common than thinking grounded in sensorimotor forms, pure lexical

inner language and abstract concepts were reported in a significant proportion of the trials. This finding aligns well with Hurlburt and Heavey's (2006) reports of the existence of worded thinking and unsymbolized thoughts. It also raises challenges to philosophical views which emphasize the sensorimotor nature of conscious thoughts, at times deeming non-sensorimotor thoughts impossible (Carruthers, 2015, Prinz, 2002). Although it is possible that such thoughts may still be grounded in unconscious sensorimotor representations (Barsalou, 1999), we show that, at least at the level of conscious experience, thoughts can be detached from sensorimotor imagery. In addition, the reported experiences of concepts in the absence of words and images also support the view that language and thought can be dissociated (Fedorenko & Varley, 2017).

We also developed a new way of measuring the frequency of forms of thought, asking participants to think about various topics, and then report on the presence of various forms of experiences. This allowed us to measure the frequency of experiences more directly, by looking at how often participants reported them in particular thoughts, instead of relying on participants' ability to retrospectively estimate their frequency. Inner language proved to be quite frequent, being experienced on average 80% of the time when participants were prompted to think about a topic. The difference between our number and the 26% frequency of inner speech reported in Heavey and Hurlburt (2008) is likely due to the fact that we only targeted language use in conscious *thinking*, or reflection, whereas the DES method captures experiences in random moments. Our results thus indicate that, when people are thinking, they are likely to use natural language.

We also found that the phenomenology of inner language is not always the same. In line with the common characterization of inner language as an inner voice, auditory inner language was the most common form. But as we showed, this is not the only form of inner language, as

participants also experienced words in a visual-orthographic form, as involving imagined movements and as lacking all sensorimotor imagery. This variation has implications for how inner speech is investigated. For instance, a previous study found that high internal verbalizers' performance during a cue-target matching task was disrupted when there was a phonological distractor but not a semantic distractor (Roebuck & Lupyan, 2020). Does this still hold for individuals who often think in pure lexical forms? Similarly, articulatory suppression effects on other cognitive tasks may arise from either motor disruption or auditory interference (e.g., Fatzer & Roebuck, 2012). The latter may be more likely, given the higher prevalence of auditory inner language.

Our participants showed significant individual differences in the propensity to think in language: while most people showed a high propensity, a few indicated little or no propensity to think in language. This aligns with Nedergaard and Lupyan's (2023, 2024) findings about anendophasia, but we also extend it in important ways, by drawing a distinction between the *propensity* versus the *ability* to think in language. Our results indicate that while some people show no propensity to think in language, they still tend to have the ability to do so. This is important for how we conceive anendophasia. For instance, the prevalence of anendophasia is likely to be higher if understood as a lack of propensity rather than as a lack of ability to think in language. In addition, the behavioral profiles of individuals who lack the ability to think in language may be very different from those who only lack the propensity. Thus, the propensity-ability distinction needs to be taken into account when characterizing anendophasia, and studies with bigger samples should investigate whether total lack of ability for inner language indeed occurs (as we only found one participant in this category).

We also observed individual differences in the propensity to experience both pure lexical inner language and concepts. Although most people showed low or no propensity to use them in thoughts, some showed a high propensity to experience non-sensorimotor formats. Meanwhile, auditory inner language showed the opposite pattern, with many but not all people reporting auditory imagery associated with their inner language. A natural question here is what drives these individual differences. Given what we now know about aphantasia, we hypothesized that they could be partially explained by sensory imagery ability. We thus investigated whether low auditory imagery ability (measured by Psi-Q) correlated with the experience of pure lexical inner language and concepts, and whether high auditory imagery correlated with the experience of auditory inner language. Surprisingly though, we did not find significant correlations that survive multiple comparison corrections. One possibility for the lack of correlations is that we did not have enough participants lacking sensory imagery in our sample. In addition, low auditory vividness on its own may not prevent the occurrence of auditory inner language, but only affect its vividness, or clarity (something

we did not measure). Future work should look in more depth at the relations between imagery ability and forms of thought, ideally focusing on individuals who lack auditory imagery.

Importantly, here we focused on the assessment of sensorimotor features of inner language, but future work could use similar methods to assess the extent to which other features of external language, such as prosody and intonation, are present in inner language, investigating also whether those depend on imagined sounds.

We also found an effect of scenario type on inner experiences, which indicates that forms of thought may depend on whether participants are simply thinking or imagining language, as well as whether the imagined speech is spoken or heard. The gradient-like frequency patterns from Thinking to General to Specific blocks not only highlight the context-dependent nature of the inner experiences, raising the importance of measuring and reporting them in context, but also open up new questions, such as how various topics (e.g., concrete vs. abstract) may elicit different inner experiences.

There are well-known difficulties in relying on self-reports (Hurlburt and Schwitzgebel, 2007), but these are unavoidable when investigating conscious experiences. We thus took important measures to minimize errors: 1) we focused on reports of experiences that had just occurred, minimizing confabulations which are likely to affect estimations of general frequency; 2) we indicated in the preparatory stage that some people never have words as part of their thoughts, while others experience words frequently. This should presumably make participants more comfortable in reporting the lack of language in a thinking task; 3) we presented participants with the option of reporting non-sensorimotor experiences, formulating our questions in a way as not to presuppose that inner language is always auditory. Future work should validate these self-reported differences with behavioral tasks and neural measures.

Overall, our study constitutes a step toward elucidating systematic individual differences in the format of inner language and conceptual thoughts, challenging the assumptions that reflective thought has to be verbal, that inner language always has an auditory component, and that the lack of propensity to think in words is indicative of the inability to do so. Our work provides a foundation for future studies of the behavioral manifestation and neural mechanisms of thought, both in neurotypical and in neurodivergent populations (Alderson-Day & Pearson, 2023).

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