Linguistic Norms From Blind Individuals

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Key Points

- Linguistic norms provide standardized benchmarks for researchers to understand language processing, acquisition, and representation.
- Most existing linguistic norms come from sighted individuals, but norms from blind individuals offer insight into how language develops and functions without visual experience.
- Existing linguistic norms from blind individuals are limited in scope (typically either early language acquisition data or adult semantic ratings) and in language coverage (largely English or Italian).
- While some linguistic properties (e.g., concreteness) show strong cross-group similarity, others diverge, requiring careful consideration when applying sighted norms to blind populations.
- Expanding linguistic norms to include diverse languages, developing norms for more linguistic phenomena, and collecting corpus data on language used by and spoken to blind individuals would help address existing gaps.

Abstract

While linguistic norms are crucial for psycholinguistic research, most existing datasets have been collected from sighted individuals. This article describes existing linguistic norms from blind individuals as well as relevant non-normative datasets. Most of the available norms cover semantic representations or early language acquisition. Gaps in linguistic norm coverage, considerations for applying sighted norms to blind populations, and practical guidance for researchers on collecting and employing linguistic norms from blind individuals are discussed.

Introduction

Linguistic norms are standardized benchmarks derived from population-level data that capture various lexical and semantic properties, such as word frequency, concreteness, imageability, and familiarity. These norms are foundational in psycholinguistic research, where they enable researchers to quantify linguistic phenomena, compare populations, and build models of language processing and acquisition. While norms have traditionally been collected from general populations, it is increasingly recognized that norms derived from specific groups, such as blind individuals, are essential for ensuring inclusivity and accuracy in both basic and applied research.

The study of linguistic norms from blind individuals is particularly compelling for several reasons. For psychologists, it offers insights into how sensory differences shape language processing and semantic representations, informing theories of embodied cognition. For computational linguists, these norms present an opportunity to explore fundamental questions about language acquisition: to what extent is visual access necessary for developing semantic knowledge, and can language input alone suffice?

Despite the importance of this work, norms from blind individuals remain limited.

The present article synthesizes existing research on linguistic norms from blind individuals, highlighting available datasets, challenges in collecting and employing this type of data, and considerations for future work. By doing so, it aims to provide a comprehensive overview of this topic and offer practical guidance for researchers navigating this complex and underexplored area.

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Norms From Blind Individuals

Language Acquisition

Research on early language acquisition in blind children has provided valuable insights into the interplay between sensory experience and linguistic development, but such research is sparse. While visual impairment affects 1 in 21 individuals, congenital blindness—particularly profound blindness—is rare, occurring once out of 10,000 births or less (CDC, 2024). As a further complication, many causes of congenital blindness are syndromic, and thus carry other co-occurring disabling conditions (e.g., septo-optic dysplasia, cortical visual impairment, CHARGE Syndrome). Perhaps as a result of this low prevalence, language acquisition norms for blind children have remained elusive, although several datasets, described below, may offer insight into the course of language development for this population.

Fraiberg and Fraiberg (1977) conducted foundational work comparing the ages of communicative milestones in blind and sighted children. In her book, *Insights from the Blind*. Fraiberg reports longitudinal observations of blind infants and toddlers, including analyses of their language development. She compared a sample of approximately 7—9 blind children to a normative sample of sighted children using the language sections of the *Bayley Scales of Infant and Toddler Development*. Her book includes data on the "typical" ages at which blind and sighted children attained items on the Bayley Scales, such as "jabbers expressively" and "forms two-word sentences." These data are available in Figure 5 and Table 6 of Fraiberg's book.

More recently, Campbell et al. (2024) compared the productive vocabulary size and composition of 40 congenitally blind toddlers to a large normative sample of sighted peers (**Fig. 1**), using the American English Communicative Development Inventory (CDI). The CDI is a widely used parent-report instrument in which caregivers indicate the words their children understand or produce. While Campbell et al.'s data were not collected as vocabulary "norms" per se, they are publicly available (https://osf.

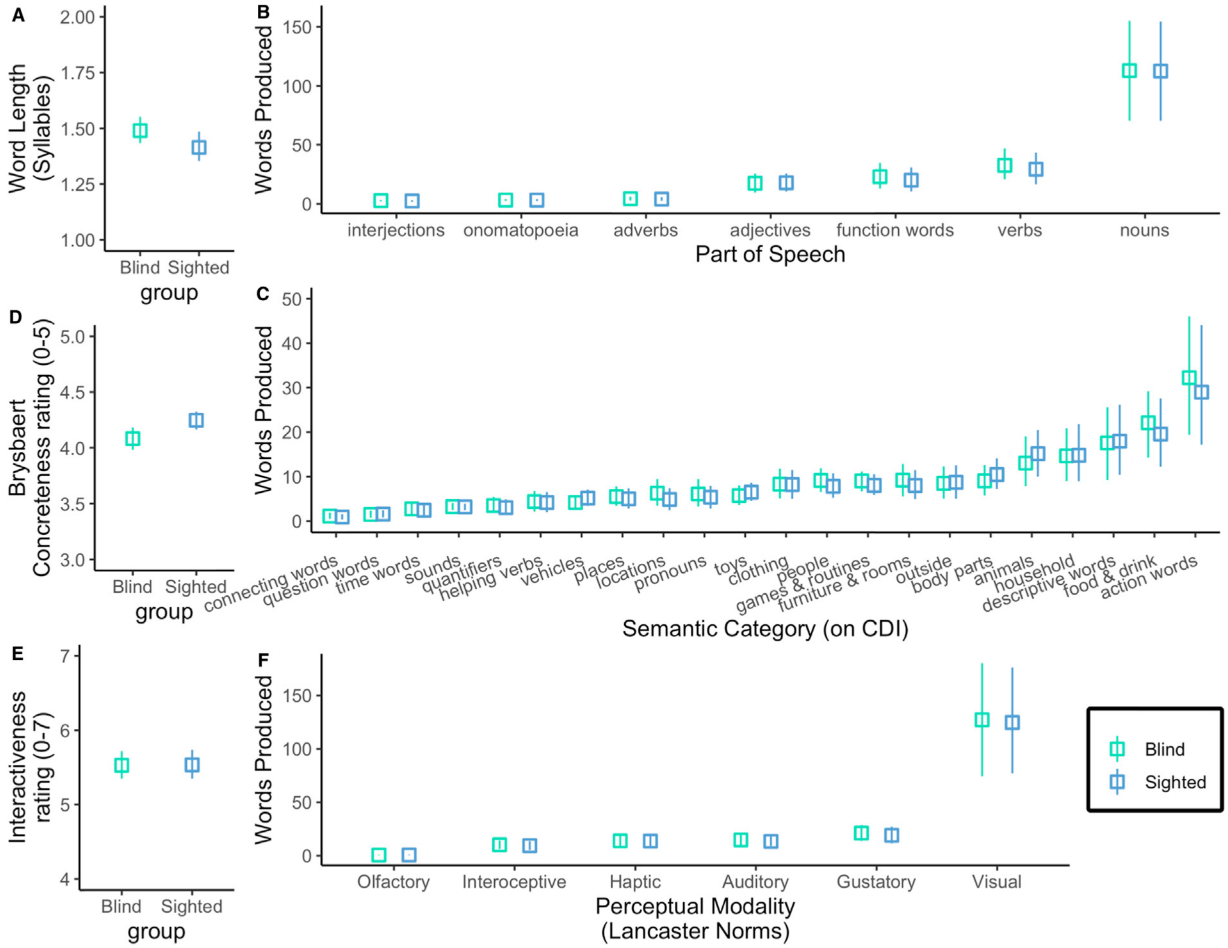


Fig. 1 Comparisons of blind and sighted children's vocabulary composition across 6 dimensions. Whiskers represent 95% CIs around the mean (A): Mean length (syllables) for sighted versus blind participants (B): Mean N of words produced by blind and sighted children from each part of speech on CDI (C): Mean N of words produced by blind and sighted children from each semantic category on CDI (D): Mean concreteness rating 1 (abstract)—5 (concrete) for sighted versus blind participants (E): Mean child-body-object interaction rating 1 (not interactive)—7 (highly interactive) for sighted versus blind participants (F): Mean N of words produced by blind and sighted children for each perceptual modality (modality with highest perceptual rating on Lancaster Sensorimotor Norms). Reproduced from Campbell et al. (2024).

io/uw6zm/) and provide a valuable resource for understanding vocabulary composition in blind children. Complementing this work, Landau and Gleitman (1985) provided detailed case studies, including a list of the first fifty words produced by two blind toddlers and measures of mean length of utterance (MLU) across toddlerhood for three English-learning participants.

Clinical tools can provide a complementary perspective of early language development. The Rowland Communication Matrix is an assessment designed to measure emerging expressive communication among children with "severe or multiple disabilities" (Rowland & Fried-Oken, 2010). Given the high incidence of co-occurring diagnoses among blind children, this instrument is commonly used clinically among certain bubbles of the blind population, because the assessment does not require or assume vision. Clinicians mark the communication behaviors exhibited by the child (e.g., facial expression, squealing, gesture, multi-word utterance) and the communicative intent (e.g., to request an action from a caregiver, to show affection). The Rowland team has aggregated these data for several common etiologies of blindness (e.g., septo-optic dysplasia, optic nerve hypoplasia, cortical visual impairment) and deafblindness. For example, Communication Matrix data is available from N=1,130 children with cortical visual impairment (see **Fig. 2**). These data are publicly accessible: https://www.communicationmatrix.org/Community/SharedSciencePages.

Semantic Representations:

Philosophers and scientists have long posed thought experiments regarding how blind individuals might construct meaning in the absence of vision. These questions have driven research efforts to collect semantic norms from blind adults.

When Paivio (1970) released a study of mental imagery (defined as the vividness of "a mental picture, or sound, or other sensory experience."; Paivio, 1970), it sparked a flurry of papers examining mental imagery among blind individuals (Paivio & Okovita, 1971): is visual experience necessary for visual imagery?

For example, Cornoldi et al. (1979) study solicited imagery ratings from 19 blind young adults and a set of 19 demographically-matched sighted adults (see **Table 1**). Participants were asked to rate thirty Italian nouns on a 7-point likert-type scale. Nouns had been categorized *a priori* into high imageability nouns for all participants (e.g., body, cat, milk), low imageability nouns for all

Fig. 2 Screenshot taken January 31, 2025 from the Shared Science page of the Communication Matrix website of the aggregated data Communication Matrix data for children with Septo-Optic Dysplasia (N=59). Boxes depict the percentage of children with Septo-Optic Dysplasia who had mastered a given skill. For example, 39% of children had mastered using early sounds (whine, squeal, fuss, coo) to request attention (C8).

Table 1 Mean ratings of imagery.

Categories of words	*Words*	*Imagery Ratings by Group*		
		blind	*sighted*	*sighted (norms)*
High Imagery Experienced	corpo (body)	6.6	6.6	6.2
	gatto (cat)	6 2	6.6	6.1
	latte (milk)	6.5	6.5	6.1
	padre (father)	6.1	5.9	6.4
	palla (ball)	7.0	6.9	6.1
	radio (radio)	6.6	6.6	6.3
	sasso (stone)	6.1	6.7	6.0
	terra (earth)	6.1	6.4	6.0
	testa (head)	6.7	6.5	6.0
	vetro (glass)	6.6	6.6	5.8
High Imagery Not Experienced	belva (wild animal)	3.5	5.4	6.0
	bivio (cross-road)	4.3	4.8	5.7
	brace (embers)	4.3	6.2	6.2
	corvo (raven)	2.8	6.1	5.9
	drago (dragon)	2.3	4.8	5.7
	forca (gallows)	5.7	6.3	6.0
	mitta (tommy-gun)	3.3	6.2	5.7
	palma (palm-tree)	4.6	4.8	6.1
	sposa (bride)	6.0	6.3	5.5
	tigre (tiger)	2.4	6.6	6.2
Low Imagery	bando (announcement)	2.7	3.5	3.5
	danno (damage)	5.7	4.2	4.1
	ditta (firm, company)	4.6	6.0	3.9
	forma (form, shape)	5.8	4.9	4.0
	pezzo (piece)	5.9	4.1	3.5
	prova (proof)	5.1	3.8	3.6
	sosta (halt, pause)	5.0	4.3	4.2
	stima (estmate)	4.6	3.2	3.6
	turno (turn)	5.7	4.3	3.8
	volta (time)	4.4	3.2	3.5

Note.—Blind and sighted participants were asked to rate words in three categories: Wwords of high imagery that were presumed to be experienced by blind individuals (HIE) words of high imagery presumed not to be experienced by blind individuals (HINE), and words of low imagery (LI).

Table 1. Reproduced from Cornoldi et al., 1979. Italian word stimuli and their English translations, mean imagery ratings from blind and sighted participants, and a comparison to sighted norms.

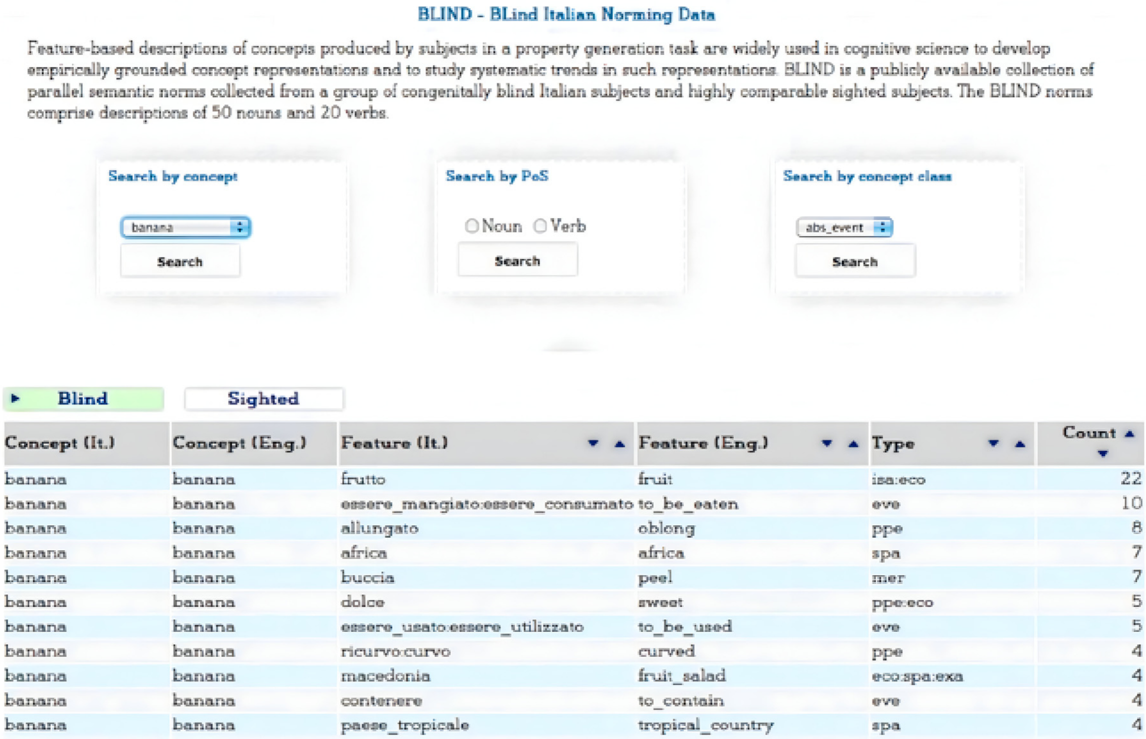
participants (e.g., damage, piece, proof, time), and high-imageability nouns not experienced by blind individuals (e.g., dragon, embers, tiger, and curiously: bride[1]).

Kerr and Johnson (1991) conducted an imagery rating study in English, involving 12 blind adults and a sighted group who rated 161 words on various linguistic and sensory dimensions. Participants evaluated word familiarity, concreteness, meaningfulness, and imageability on a 1 to 7 scale. They were also asked to specify the dominant sensory modality evoked by each word—choosing among visual, auditory, tactile, taste, smell, spatial, or no imagery at all—and to provide the first related word that came to mind (*For instance, when hearing the word "penny," a participant might immediately think of "coin."*). The aggregated ratings are provided in the article's Appendix; see **Figure 4**. The article also includes comparisons to sighted norms, for these dimensions.

Several other studies have collected lexical ratings from blind subjects (e.g., Jonides et al., 1975; Sholl & Easton, 1986; inter alia), but these word-level ratings appear to have been lost to time and the file drawer.

Lenci et al. (2013) recently constructed a set of semantic feature norms from blind and sighted individuals for Italian nouns and verbs. Semantic feature norms are typically constructed by asking multiple individuals (here, 22 congenitally blind individuals and 24 sighted individuals) to list semantic features that come to mind for various concepts, and retaining features that are mentioned by a reasonable proportion of individuals (typically at least 10—20%), resulting in a list of features that constitute canonical understanding of concepts across individuals, processing, and representation of concepts. This task was conducted orally with all participants. These features can then be categorized: Taxonomic ("is a ___", coordinate, example, synonym, antonym, instance), entity (meronym, holonym, made of, perceptual property, nonperceptual property), situation (event, abstract associated entity, manner, time), quantity, introspective. The features are publicly available: http://sesia.humnet.unipi.it/blind_data; see **Figure 3**.

[1]Blind people do get married (Stalvey, 2014).



Concept (It.)	Concept (Eng.)	Feature (It.)	Feature (Eng.)	Type	Count
banana	banana	frutto	fruit	isa:eco	22
banana	banana	essere_mangiato:essere_consumato	to_be_eaten	eve	10
banana	banana	allungato	oblong	ppe	8
banana	banana	africa	africa	spa	7
banana	banana	buccia	peel	mer	7
banana	banana	dolce	sweet	ppe:eco	5
banana	banana	essere_usato:essere_utilizzato	to_be_used	eve	5
banana	banana	ricurvo:curvo	curved	ppe	4
banana	banana	macedonia	fruit_salad	eco:spa:exa	4
banana	banana	contenere	to_contain	eve	4
banana	banana	paese_tropicale	tropical_country	spa	4

Fig. 3 Screenshot of the semantic feature database from Lenci et al. (2013), showing semantic feature norms collected from blind and sighted participants.

Additionally, participants were asked to rate their familiarity with the concept, though the authors did not find any group differences on this familiarity level.

Gaps in Coverage

Despite these valuable contributions, significant gaps remain in our understanding of linguistic norms from blind individuals. In the domain of language acquisition, most research has focused on early childhood, leaving language development trajectories after toddlerhood largely unexplored. Existing linguistic norms have predominantly concentrated on imagery, driven by the assumption that blind individuals' perceptual-semantic representations differ from those of sighted individuals. However, this focus has left other dimensions, such as affective properties and other lexical-semantic variables, underrepresented. Complementary resources, such as corpora of language spoken to blind individuals, would inform input frequency, while corpora of language produced by blind individuals could shed light on unique linguistic patterns or preferences within this population. Additionally, there is a lack of norms for Braille, which could provide insights into orthographic and tactile language processing. Lastly, many languages lack any linguistic norms from blind individuals. As highlighted above, the limited datasets that do exist are primarily available for English or Italian, underscoring the need for cross-linguistic expansion.

Considerations for using existing norms from blind individuals

When using linguistic norms derived from blind individuals, researchers should account for the high variability within this population. linguistic and cognitive patterns can be influenced by the age of blindness onset, degree or etiology of blindness (Campbell et al., 2024), the presence of residual color vision (Shepard & Cooper, 1992), interest and motivation (Saysani et al., 2021), among other factors not yet understood (Kim et al., 2019; Saysani et al., 2021). The distribution of causes of blindness has also shifted significantly over recent decades, reflecting advances in medical care and societal changes (for example, only 15 cases of congenital rubella syndrome, which can cause blindness among infants, were reported in the United States between 2005–2018; CDC, 2025), and accordingly can vary widely by geographic region (Kong et al., 2012). These considerations emphasize the need to carefully evaluate the specific subpopulations from which norms were collected to ensure they align with the populations to whom they are being applied.

APPENDIX

The 161 nouns are listed in alphabetical order, followed by the mean score and below it by the standard deviation for the ratings of familiarity (f), concreteness (c), meaningfulness (m), and imagery (i). The percentage of subjects selecting each modality for imagery (visual, auditory, tactile, taste, spatial, or smell) and the two most frequent associates are presented following the ratings. Additional associates are included in the case of ties, and no associate is listed if there was lack of agreement between at least two subjects.

Noun	Subject Group	f	c	m	i	Modality (%) (v	a	tc	ts	sp	sm)	Strongest Associates	%
Accordion	B	6.25	6.25	5.00	6.50	-	83	17	-	-	-	Instrument	42
		1.14	1.22	1.71	0.80							Music	33
	S	4.75	6.08	3.75	5.58	50	50	-	-	-	-	Instrument	25
		1.76	0.79	1.48	1.24							Monkey	17
Acrobat	B	6.08	4.58	3.42	4.00	25	17	17	-	25	-	Circus	33
		1.16	2.23	1.73	1.86							Gymnast	25
	S	5.00	5.50	4.25	5.58	100	-	-	-	-	-	Circus	33
		1.60	1.45	1.06	1.24							Gymnast	25
Affection	B	6.75	3.83	5.17	4.42	08	-	67	-	-	-	Love	50
		0.45	2.44	1.95	2.47							Feeling	17
	S	5.58	3.92	5.00	3.42	17	-	42	-	17	-	Love	42
		1.73	2.23	1.65	2.23							Care	25
Amplifier	B	5.92	6.00	4.33	5.33	-	75	08	-	-	-	Loud	25
		1.16	1.54	1.78	2.23							Speaker	25
	S	5.00	5.58	3.67	4.75	33	50	-	-	-	-	Music	25
		1.65	1.56	1.23	2.01							Speaker	17
Animosity	B	5.92	2.83	4.00	2.33	-	17	08	-	-	-	Anger	25
		1.38	2.12	1.86	2.15							Hate	25

Fig. 4 Screenshot of the Appendix from Kerr & Johnson, 1991, showing lexical ratings and semantic associates from blind and sighted participants on a set of 161 English words.

Considerations for applying norms from sighted individuals to studies of blind individuals

In cases where norms from blind individuals are unavailable, researchers often turn to norms from sighted populations, but this practice requires careful consideration. On many semantic dimensions, blind and sighted individuals appear to have strikingly similar representations. For example, concreteness and imageability ratings are comparable between blind and sighted adults (Kerr & Johnson, 1991). However, the same study found much lower similarity between the groups on measures of familiarity and meaningfulness, highlighting areas of divergence. Similarly, Bedny and colleagues observed remarkable consistency between blind and sighted individuals in semantic similarity judgments for verbs of perception and emission and for knowledge of animal appearance (Bedny et al., 2019; Kim et al., 2019). However, their agreement diminished substantially for specific features, such as animal color. These findings suggest that while norms from sighted populations may be a reasonable substitution in certain contexts, researchers should be thoughtful about when and how lexical representations may be more influenced by visual experience.

Similarly, given that existing norms from blind individuals are in English or Italian, if at all, can norms from other languages be substituted for language-specific norms? Based on cross-linguistic comparisons of word ratings from sighted adults, languages largely show moderate-to-strong correlations on lexical-semantic variables such as concreteness, imageability, affective properties, and sensory imagery (De Deyne et al., 2019; Thompson & Lupyan, 2018; Lee & Shin, 2023, though c.f., Lee & Shin, 2023's auditory and tactile imagery results). The transferability of such norms may be improved by incorporating distributional information (as demonstrated in De Deyne et al., 2019; Thompson & Lupyan, 2018). For other lexical properties, which may be language- or culture-specific (just speculatively, frequency, familiarity), direct translation and substitution of norms is less straightforward and may require additional validation within the target linguistic and cultural context. Researchers should approach such substitutions cautiously, recognizing that even when norms align on broad dimensions, subtle differences in linguistic structure or cultural relevance could impact their applicability.

It is important to bear in mind that linguistic norms are necessarily approximations of individual experience. For example, frequency norms are meant to approximate how often an individual participant has been exposed to a given word; concreteness ratings are meant to approximate the degree to which a word's referent is perceived through the senses. We assume that by using data or ratings from participants who match the demographics of our target participants as closely as possible, we are using linguistic norms that match the individual experience of each of our participants as closely as possible. However, when we rely on norms from sighted participants or from a different language or cultural context, we likely introduce some degree of inaccuracy or mismatch. This discrepancy is difficult, if not impossible, to quantify, as it depends on numerous unmeasured factors, such as individual variation in sensory or linguistic exposure. As a result, researchers must carefully weigh the trade-offs between practicality and precision when selecting linguistic norms, acknowledging that these choices will inevitably affect the degree to which norms truly reflect the target population's linguistic experience. By transparently addressing these limitations, researchers can better contextualize their findings and contribute to more nuanced interpretations of linguistic norms.

Collecting Norms From Blind Individuals

When designing studies to collect norms from blind individuals, researchers must navigate a trade-off between specificity and representativeness. Restricting the sample to individuals who were born completely blind with no co-occurring conditions may yield clearer insights into the role of visual experience in linguistic phenomena. However, this approach also limits the scope of findings, excluding the variability inherent to the broader blind community. Alternatively, adopting a more inclusive sample better reflects the diversity of this population but introduces additional variability, such as differing degrees of visual experience, that may complicate interpretation.

Task design must of course be accessible to blind participants. A common misconception is that all blind individuals use Braille, but this is far from universal. For online tasks, ensuring compatibility with screen readers is essential, as many blind individuals rely on these tools to access digital content. Screen readers vary by operating system and software design, so it is strongly recommended to test data collection platforms on multiple common screen readers (e.g., JAWS, NVDA, or VoiceOver). Additionally, for participants with some residual vision, researchers should ensure that the data collection software allows users to adjust text size and contrast. This list of considerations is not meant to be exhaustive; sighted researchers could consider paying blind beta testers or accessibility consultants, or better yet, including blind researchers as an integral part of the research team.

Conclusion

Tailoring linguistic research to diverse populations, including blind individuals, enriches our understanding of how language develops and functions across varied sensory contexts. Such efforts not only enhance the inclusivity and applicability of linguistic norms but also contribute to the goal of representing the full spectrum of human experience in linguistic and psychological research.

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