Exploiting Orthography-free Phonological Evidence in Orthography-rich Language

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Abstract

In modern linguistics where natural spoken language has been the main, if not the sole, target of research inquiry, one area in which orthography becomes as yet at issue is phonology. This should be the case because (a) writing systems encode phonological structure, syllables in particular, as shown in Gnanadesikan (2011), accordingly (b) the orthographical knowledge of a language may merge into the knowledge of that spoken language, and finally (c) once the knowledge at the two levels merge in the language user's brain, it is hard to separate the two levels. Strictly speaking, then, it is not possible to retrieve phonological evidence for purely spoken language from members of orthography-rich communities. This paper nonetheless demonstrates that there are atypical occasions when orthography-free phonological evidence can be observed. Specifically, it reports on a remarkable performance in a Japanese word-reversing *ludling* (Latin *ludus* 'game' + *lingua* 'language'), which was demonstrated by an individual born with a genetic disorder called Williams syndrome. The paper contends that written evidence, of syllables in particular, may constitute evidence for their linguistic reality but only at the time of the orthography invention. Purely phonological evidence that is free of orthographic and prescriptive influences is vital and ideal in that it encodes and reveals far more dynamic phonological structures of the language.

Exploiting Orthography-free Phonological Evidence in Orthography-rich Language

Fusa Katada*

1 Introduction

In modern linguistics, writing systems have been largely ignored as a research subject for understanding linguistic structure; it is spoken natural language that has been the main, if not the sole, target of research inquiry. However, one area in which orthography becomes at issue is phonology. This is the case because (a) writing systems encode phonological structure, syllables in particular as shown in Gnanadesikan (2011), accordingly (b) the orthographical knowledge of a language may merge into the knowledge of the spoken language, and crucially (c) once the knowledge at the two levels merge in the language user's brain, it is hard to separate the two levels. Strictly speaking, then, it is not possible to retrieve phonological evidence for purely spoken language from members of orthography-rich communities. This paper nonetheless demonstrates that there are atypical occasions where orthography-free phonological evidence can be exploited. Specifically, it reports on a remarkable performance in a Japanese word-reversing *ludling* (Latin *ludus* 'game' + *lingua* 'language'), which was demonstrated by an individual born with a genetic disorder called Williams syndrome. The paper contends that written evidence of a language may constitute evidence for its linguistic reality but only at the time of the orthography's invention. Purely phonological evidence that is free of orthographical and prescriptive influences is more vital and ideal in that it encodes and reveals a far more dynamic nature of phonological structures of the language.

This paper is organized as follows. After the present introductory remarks in section 1, section 2 discusses issues surrounding orthography in linguistic theories. Section 3 overviews key terms and concepts of this paper, namely ludling, a genetic disorder called Williams syndrome, with which the case of this paper was born, and a notion of auditory working memory. Section 4 reports on the remarkable performance in word-reversing ludling and its significance as orthography-free phonological evidence. It also analyses the ludling data and demonstrates their vital nature as evidence for the internal structure of the words in Japanese. Finally, section 5 concludes the paper by giving remarks on the nature of atypical data in linguistic theories.

2 Issues Surrounding Orthography in Linguistic Theories

2.1 Theories of Linguistic Structure and Writing Systems

In recent literature on syllables, Gnanadesikan (2011) claims that a writing system is by its nature a theory of processing in that in writing, language is analyzed into discrete structures, encoded into signs, and then decoded into language again by the reader, usually on the phonological basis. It follows then that a writing system, which is justified as a theory of processing, encodes linguistic structures and provides evidence for linguistic reality.[1] She points out that the encoded structures must be ones that the reader and writer can access and manipulate, and that becoming literate requires becoming consciously aware of some of the linguistic structures in one's language. Specifically, most early writing systems are syllabaries or logosyllabaries, and thus the syllable must be available to both explicit and tacit knowledge.

*This research is supported by Japan Society for Promotion of Science, Grants-in-Aid for Scientific Research: No. 22520411. I would like to acknowledge the audiences of several conferences for their valuable comments and interests, including OCP10, ICPP 2013, Penn Linguistics Colloquium 37, and CIL 19, where I presented materials that are related to the issues addressed in this paper. My sincere appreciation goes to the subject of this paper and his family for their understanding of and cooperation for this research. All shortcomings are mine.

[1]This is in accordance with Jackendoff's (1983:5) contention that one crucial test of a theory of linguistic structure is whether it can be integrated into a theory of processing.

The writing systems analyzed in Gnanadesikan (2011) for her claim are naturally constrained to those that represent some string of segments potentially encoding structures, called syllabaries. These included: Akkadian, Mayan glyphs, Linear B, and Cypriot from ancient times; Japanese kana from medieval times, and Cherokee, Vai, Pahawh Hmong, and Bopomofo from modern times. The syllabaries are opaque, except Japanese kana, in that there are discrepancies between graphemes and their representing phonetic value. Specifically, long vowels and geminates are usually not represented in signs. Nonetheless she has shown that the syllabaries in fact provide evidence of syllabic units; they may encode detailed structural properties of syllables, including onset-over-coda preference, extrasyllabicity of /s/, moras, and the onset/rhyme distinction. Writing systems, in other words, have been shown to justify the theoretical construct syllable, which Chomsky and Halle (1968) did not acknowledge in the SPE (Sound Pattern of English) period.

Her claims, in short, are the following:

(a) writing systems are learnable and usable as ways to transmit language; hence, there is a relationship between what writing systems encode and the structures of language itself,[2] and
(b) many writing systems have stood the test of time; hence, written evidence offers evidence for the linguistic reality of syllables (onset-coda asymmetry, internal structures of moras, onsets, and rhymes).

Specifically concerned with and replying to (b), this paper points out a static nature of the writing systems in that they reveal the linguistic structures of only the time when they are invented; it further contends that, for claim (b) to hold, written evidence must serve as a window to linguistic reality, the sufficient condition which is hard to prove. This point is extended to more detailed discussion in the following subsection 2.2.

2.2 Orthographic and Prescriptive Influences on the Natural Linguistic Knowledge

The writing systems may reflect linguistic structures but only at the time of their invention. Due to their conservative nature, they are not able to accommodate the changing nature of spoken language. Syllabaries from ancient times, for example, are not sufficiently reaching to use as evidence for spoken language of later times. Moreover, written evidence can be vital and appropriate only under the assurance that orthography serves as a window to linguistic reality and not vice versa; that is, linguistic reality in the mind should be reflected in writing system; it should not be the case that written evidence is reflected in the language user's mind as linguistic reality. This sufficient assurance, however, is difficult to hold in linguistic communities, especially where literacy inculcation is part of the culture and starts as early as 2, 3 years of a child's age. This should be the case since in such early ages the first language (L1) acquisition is ongoing in the child's mind and brain, and in the process of L1 acquisition the orthographic knowledge can merge in his/her natural linguistic knowledge. Strictly speaking, then, pure evidence in phonology, which is free of orthographic and prescriptive influences, is not retrievable from members of orthography-rich communities, of which Japanese is one representative.

The issue of orthographic and prescriptive influences constitutes one shortcoming of Katada (1990), where she argued for the autonomous nature of a mora from that of a syllable and for the representation of a mora in which an onset consonant is syllabified under a mora node, behaving as part of the CV moraic unit. Her claim was based on the children's unit-matching game called 'Shiritori' (tail-taking) in Japanese. The game is taught to children of as early as 3, 4 years of age by example, long before their entering primary school. In this game players take turns giving a word that begins with the last sound unit of a word given by the previous player, until the word ending in [N] is given, as illustrate in (1). Examples are given in (2).

(1) player 1: [..... x_i]
player 2: [x_i.....x_j]
player 3: [x_j.....x_k]
player 4: [x_k.....N] (game-over)

[2]The causal relationship between learnability/usability and the existence of language structures in (a) is not all clearly explained in her paper, to my understanding.

(2) [tˢubame]
[medaka]
[kao]
[oNgaku]
[kusuri]
[riNgo]
[gohaN] (game-over)

The game is over as soon as a player gives a word that ends in a syllabic nasal [N] as in [gohaN]; it has to end since Japanese has no word that begins with [N]. This fact itself indicates that the game is played under the word structure constraints in Japanese. Evidence that favors a mora over a syllable comes from words that ends in or begin with a syllable containing a diphthong, a long vowel, or a syllabic nasal [N], whose treatment differs depending on whether the game system is mora-based or syllable-based. In (1) the single syllabic word [kao] is treated as two units [ka] and [o]; likewise a single syllable [riN] in [riNgo] is treated as two units [ri] and [N]. Katada has also shown that long vowels in the game are treated as two separate units. Based on this observation, the conclusion was drawn that the mora, consisting of CV as a single unit,[3] is the only operating unit in the game, and hence in the Japanese language as well.

The issue of orthographical and prescriptive influences on the game arises, which lowers reliability of the data used as evidence for the claim. Japanese is a language of orthography-rich culture and as noted earlier, literacy inculcation starts as early as 2, 3 years old when the first language acquisition of Japanese is still ongoing. Such early literacy inculcation is easier to take place when orthography of a language is transparent, that is, any gap between graphemes and their corresponding sounds is minimal. Table 1 below is the Japanese kana matrix notoriously known for its transparency; the name of each character is identical to its phonetic value, which is moraic (CV). The character か'ka', for example, is always pronounced as [ka] and in no other ways.[4] Pronunciation practice via language games such as Shiritori appears to be linked directly to literacy inculcation, and vice versa.

ん N	わ wa	ら ɾa	や ya	ま ma	は ha	な na	た ta	さ sa	か ka	あ A
		り ɾi		み mi	ひ hi	に ni	ち ɕi	し ʃi	き ki	い I
		る ɾɯ	ゆ yɯ	む mɯ	ふ ɸɯ	ぬ nɯ	つ tˢɯ	す sɯ	く kɯ	う ɯ
		れ ɾe		め me	へ he	ね ne	て te	せ se	け ke	え e
	を wo	ろ ɾo	よ yo	も mo	ほ ho	の no	と to	そ so	こ ko	お O

Table 1: Japanese Kana Matrix, called 50-Sound Diagram.

Though formal literacy education will not start till the age of primary school, it is likely the case that the orthographical knowledge merges in the child's natural linguistic knowledge. Once the two types of knowledge merge in the child's mind, it is hard to separate the two. It is not possible, then, to retrieve phonological evidence in Japanese that is free of orthographical and prescriptive

[3]From the articulatory phonetics/phonology point of view, CV conceptualized as such is equivalent to in-phase coupling of C gestures to V (Goldstein, Byrd, and Saltzman 2006), or C being a coarticulation of V (Vergnaud 2007).

[4]There are, however, a few exceptions. For example, the latter part of a long vowel [oo] is phonetically [o] but spelled as う[u], such as [budoo](ぶどう[bu.do.u]), or [soodaN](そうだん[so.u.da.N]). (The relevant portions are underlined.) As we see in section 4.4, exceptions are where we may observe whether oral performance is influenced by orthography.

influences. In other words, it cannot be assured whether the game used in Katada (1990) serves as a window to the child's natural linguistic knowledge of Japanese, a shortcoming of her paper.

Recapitulating the purpose of the present paper, it is to demonstrate that there are still occasions when purely phonological evidence can be exploited.

3 Overview of Key Terms: Ludling, Williams Syndrome, and Auditory Working Memory

3.1 Ludling

Ludling (<Latin *ludus* 'game' + *lingua* 'language') is a general term coined by Laycock (1969, 1972) for a system of word manipulation that renders incomprehensive to the untrained ear, often known as a secret language. They exist in many cultures in various but restricted forms. Examples are: Pig Latin and Gibberish in English, P-taal and Emmer-taal in Africaans, Verlan in French, Löffelsprache in German, and Korakistika in Greek, to name just a few. Linguistically, a ludling is defined as a language which meets the following criteria (Bagemihl 1995):[5]

(3) its morphological system is limited to one or more operations associated with (a) affixing, (b) templatic operations, (c) reversing operations, or (d) replacement,
(4) its affixes (whether fully specified or defined only in prosodic or melodic terms) are limited to one or at most a handful of lexical items, and
(5) its morphology is semantically empty.

Ludlings that meet the above criteria have gained their own right to constitute an integral part of linguistic theory (Sherzer 1970, Cowan, Braine, and Leavitt 1985, Hombert 1986, Campbell 1986, and others). Nowadays, ludlings are considered to have mini-grammars worthy of theoretical investigation in their own right, and used as external evidence for certain constructs in phonological theory (Yip 1982, Lefkowitz 1988, Bagemihl 1987; 1989, Vago 1985, Tateishi 1989, and Bagemihl 1995 for a comprehensive summary, among others).

Note, however, that such studies based on ludlings lose credibility unless they are shown to be orthography-free. This is because there is a possibility in which orthography affects spoken language. The credibility issue is relevant especially to languages with transparent orthography in orthography-rich communities, from reasons we saw in the previous section.

3.2 Williams Syndrome (WS)

Williams syndrome (WS) or Williams-Beuren syndrome (WBS) was so named after two cardiology groups in the early 1960s: Williams, Barratt-Boyes, and Lowe (1961) and Beuren, Apitz, and Harmjanz (1962). It is a genetic disorder, its prevalence being 1 in 7,500 births, caused by a hemizygous microdeletion at 7q11.23 (a long arm of one of the two copies of chromosome #7), involving multiple genes, most notably ELN (a marker gene for WS). Individuals with WS demonstrate an array of neurobehavioral peaks and valleys, including deficits in visuospatial ability, mathematics, and attention, along with relative preservation of facilities for music, spoken language, facial recognition, and affect (Bellugi, Marks, Bihrle, and Sabo 1988; Karminoff-Smith 1992; Lenhoff, Perales, and Hickok 2001; Hsu and Karmiloff-Smith 2008, among others). They often possess superior auditory working memory, which is directly relevant to the present issue of orthographic influence on speech. The next subsection briefly views types of memory focusing on functions of auditory working memory.

3.3 Auditory Working Memory (AWM)

Most theoretical models of memory distinguish three types of memory based on duration of use:

[5]Strictly spearking, Shiritori used in Katada (1990) is not a ludling since it is a simple unit-matching game and does not meet these criteria.

(a) sensory memory, which lasts a fraction of a second. It refers to the initial, momentary recording in our sensory systems which function outside of awareness.
(b) working memory,[6] which lasts 1.5 to 2 seconds. It stores information temporarily and it allows manipulation and use of the stored information. It is critical to mental work or thinking.
(c) long-term memory, generally for memories more than one minute old. It can refer to facts learned a few minutes ago, memories that are many decades old, or skills learned with practice.

Among the three types of memories, working memory is most relevant to the present issue. Working memory consists of the central executive system and two slave systems: the phonological loop and the visuo-spatial sketch pad. The phonological loop consists of a subvocal rehearsal component and the phonological short-term store (which is assumed to be not an empty storage, but stored with distinctive features of language specific phonological items). Subvocal rehearsal is necessary for linguistic inputs to be stored in the phonological short-term storage (Baddeley 1997).

There seems a difference between processing of visual stimuli and auditory stimuli. For visual linguistic stimuli, subvocal rehearsal takes place automatically before the stimuli go into the phonological short-term store. This is to say, visual stimuli such as written numbers, characters, and words are encoded into phonological codes, like spoken language, once before maintained in the phonological short-term store (since Atkinson and Shiffrin 1968). Conrad (1964) reports that experiments using tachistoscope showed that normal subjects tend to recall alphabets of similar phonological structure (g → c, b, or p), while deaf subjects did not show this tendency. This accords with the processing of visual stimuli, that is, encoding them into phonological codes.

For auditory linguistic stimuli, on the other hand, subvocal rehearsal is not necessary. The stimuli go directly into the phonological short-term store, and classified (processed) according to the distinctive phonological features. It must be the case then that the moment the auditory stimuli are perceived, their recording takes place automatically. This leaves the possibility that performance in working memory associated with auditory stimuli is orthography-free. This is regardless of the subject being literate or illiterate. Ideal, however, is the case which meets both conditions, namely, illiterate subject's responses within auditory working memory. This brings us to atypical occasions which this paper has exploited and reports in the next section; namely, the subject with superior auditory memory and demonstrates remarkable linguistic behavior in ludling. The subject was born with Williams syndrome.

4 Orthography-free Ludling Performance

4.1 Profile of the Subject and His Ludling Performance

The subject, KT, is a Japanese-native male born with Williams syndrome (WS). He was diagnosed as having WS at the age 11. He shows all symptoms typical of WS such as severe deficits in visual-spatial recognition evinced by his inability to delineate cubic objects integrally. He is practically not functional in writing or reading.

KT, however, demonstrates remarkably unique sensitivity to sounds in general, which is linked to his superior auditory working memory, evinced by his ability to reproduce words backward as soon as he hears them. As we will see in the following subsections, KT's word-reversing performance satisfies all criteria (3)–(5) listed in section 3.1, thus it is entitled to be a ludling which can offer external evidence for theoretical construct.

Particularly significant is his response time (RT) averaging 320 ms, since this indicates that his ludling is the direct output from his sensory memory (out of his awareness), or from the phonological short-term store (to say the least), thereby relying very little on his lexical memory. His word-reversing performance associated with phonological loop, together with his illiteracy, makes it sensible to assume that his ludling offers highly reliable evidence that is free of orthography.

[6]This is Baddeley and Hitch's (1974) notion, developed from Atkinson and Shiffrin's (1968) notion of short-term memory.

4.2 Methodology and Results

KT was directed to turn around words and non-words the examiner gave him orally. Words used are of five types: (i) those consisting of only CVs, and those including (ii) a syllabic nasal [N], (iii) a diphthong [V_iV_j], (iv) a long vowel [V_iV_i], and (v) a geminate [C_iC_i]. The last four types differ in their treatment between the moraic system and the syllabic system. His response was recorded and his response time was calculated by using Praat. Correlation between word length and his response time was also calculated.

The results of his backward ludling of 100 words are the following:

(6) a. RT (41 ms, 957 ms); mean = 323 ms
b. $\rho(x, y) = -0.0623$, where x = the number of moras and y = RT

(6a), showing his response time ranging over 41 ms to 957 ms and the mean being 323 ms, indicates that his ludling is the direct output of his sensory memory or of his auditory working memory. This should mean that in his ludling there is little room for orthographic knowledge or prescriptive influence to come into play. That KT's ludling is free of orthography is evinced also in the data analyzed in the next subsection. (6b) shows that a correlation between a word length as represented in terms of the number of moras of which the word consists and his response time for this word is slightly negative, nearing zero. Thus, it should not be the case that longer words are necessarily more difficult to process than shorter words.

4.3 Data as Orthography-free Evidence

Table 2 gives examples representing five types of words (i) – (v), explained above.

word-type	[oral input] (spelled as)	[oral output]	if orthography-based	if mora-based	if syllable-based
(i) CV	[senatomiya] (せ.な.と.み.や)	[yamitonase]	ya.mi.to.na.se (や.み.と.な.せ)	ya.mi.to.na.se	ya.mi.to.na.se
(ii) [N]	[saNma] (さ.ん.ま)	[maNsa]	ma.N.sa (ま.ん.さ)	sa.N.ma	ma.saN
(iii) V_iV_j	[ɸuruike] (ふ.る.い.け)	[keiruɸu]	ke.i.ru.ɸu (け.い.る.ふ)	ke.i.ru.ɸu	ke.rui.ɸu
(iv) V_iV_i	[tebag$_y$ooza] (て.ば.ぎょ.う.ざ)	[zaag$_y$obate]	za.u.g$_y$o.ba.te (ざ.う.ぎょ.ば.て)	za.a.g$_y$o.ba.te	za.g$_y$oo.ba.te
	[yoosuke] (よ.う.す.け)	[kesuiyo]	ke.su.u.yo (け.す.う.よ)	ke.su.o.yo	ke.su.yoo
(v) C_iC_i	[happa] (は.っ.ぱ)	[pahha]	pa.h.ha (ぱ.っ.は)	pa.h.ha	pa.hap
	[gakkoo] (が.っ.こ.う)	[ugokka]	u.ko.g.ga (う.こ.っ.が)	o.ko.k.ka	koo.gak
	[yappari] (や.っ.ぱ.り)	[ripaaya]	ri.pa.y.ya (り.ぱ.っ.や)	ri.pa.y.ya	ri.pa.yap

Table 2: Examples of backward ludling by KT.

First, examples in (iv) and (v) speak for the non-orthography based nature of KT's ludling performance. In (iv), the latter half of the long vowel [oo] is pronounced as [o], but spelled as [u] as in [te.ba.g$_y$o.u.za] or [yo.u.su.ke]. If his performance is influenced by the kana syllabary, the output should be [za.u.g$_y$o.ba.te] or [ke.su.u.yo], which is not borne out.[7] Moreover, in (v), his performance deviates from orthographic reality of the supposed outputs: [ga.k.ko.u]→*[u.ko.g.ga] and [ya.p.pa.ri]→*[ri.pa.y.ya]. Orthography is not reflected in KT's performance.

[7]How KT treats long vowels is discussed in full detail in Katada (2013d).

4.4 The Vital Nature of Oral Data[8]

Apart from the straightforward observation above that KT's performance deviates from orthographic reality, Table 2 furthermore shows the vital nature of spoken evidence, as opposed to written evidence. In (ii) a syllabic nasal [N] is treated as a separate unit: [sa.N.ma]→[ma.N.sa], rather than as a coda consonant forming a rhyme with the preceding V to form a closed syllable: *[saN.ma]→[ma.saN]. Similarly in (iii), the latter part of a diphthong [(r)ui] is treated as an independent unit of the preceding [ru]: [ɸu.ru.i.ke] → [ke.i.ru.ɸu], rather than as a vowel forming a heavy syllable with the preceding [ru]: *[ɸu.rui.ke] → [ke.rui.ɸu]. Moreover in (v), a first half of a geminate [pp(a)] is treated as a separate unit: [ha.p.pa] → [pa.h.ha] (with its phonetic value naturally changing according to the following consonant), rather than as a coda consonant, like [N], forming a rhyme with the preceding V: *[hap.pa] → [pa.hap]. These together show that the operating unit on the *ludling* is a mora, rather than a syllable, and that the positions of their associated moraic units appear in a mirror image between the input and the output: [1.2…n-1.n] → [n.n-1…2.1].

Further significance of KT's oral ludling comes from examples in (v). In [gakkoo] → [ugokka] and [yappari] → [ripaaya], neither output is straightforwardly either mora-based or syllable-based. These are seemingly irregular, but careful analyses reveal KT's linguistically significant behavior. In the former, he seemed to have exchanged the [voice]-feature value between [k] and [g] to avoid the language specific constraint: *voiced obstruent geminates. In the latter, he lengthened the preceding [a], rather than geminating the following [y], most likely to avoid gemination of the half vowel [y], another language-specific constraint.

The above analyses have led to the proposal of a unified structure for long vowels and geminates, as in Figure 1 below with (○) indicating a floating mora (Katada 2013a, 2013b).

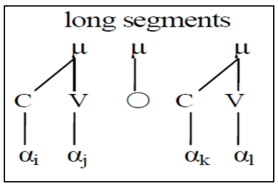

Figure 1: Long vowels and geminates under unified representation.

Detailed discussion of a motivation for and significance of the proposed representation above is beyond the scope of the present issue of orthography.[9] It remains sufficient here to contend that written evidence is unable to reveal the structure of the language in a dynamic way which oral evidence such as this one is able to provide. For the investigation into the structure of language, oral evidence is clearly more vital and ideal than written evidence which is rather static in nature.

4.5 Additional Issues: The Subject's Profile Revisited

Additional significance of the subject KT's profile may be worth noting. First, his mother reports that KT's ludling emerged abruptly when he was 8 years old. This means that KT developed rules of the backward ludling by himself, based solely on his native knowledge of Japanese. To make this claim decisive, linguistic environments surrounding him until the age of 8 need further investigation. The following fact, however, seems to supporting reliability of his mother's report. That is, such a word-reversing game is not common in Japanese culture, and no one around him could or can do the reversing. His ludling acquisition was very likely self-generative without primary data for this ludling .

Second, KT maintains the quality of the ludling in terms of productivity, fluency, and agility into adulthood; he is currently aged 25. The maintenance of such qualities is in the face of losing them in other more cognitive verbal tasks such as story-telling and conversational turn-taking.

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[8]This section is limited to the minimum, to the extent that is relevant to the issue of oral vs. written evidence. Full analyses of the data and theoretical claims are given in Katada (2013d).

[9]Detailed analyses and their implications are given in Katada (2013d).

This may indicate prolonged neuroplastic nature of speech production, which is likely autonomous of plasticity for other cognitive functions (Katada 2013c).

5 Conclusion: Remarks on the Notion of Atypicalities in Linguistic Theories

This paper has shown that atypically developing/developed populations offer an area of breaking new ground of linguistic frontier. KT, the subject of this paper, was born in an orthography-rich community, but is practically illiterate due to his genetic disorder. KT's remarkable backward ludling, supported by his superior auditory working memory, does not match written evidence. His response time averages 320 ms. KT's ludling is thus free of orthographical influence. The internal structure of the language gets revealed from his seemingly irregular outputs. These facts together ensure that purely phonological evidence, though hard to come by in usual linguistic settings, plays vital roles in linguistic theories more than written evidence does. Again, such evidence can only be obtained from atypical members of the linguistic community. The availability of such evidence is, by necessity, not high; however, overlooking sets of data obtained from the limited number of atypical cases is likely to lead to an enormous loss of theoretical contributions. Though the status of atypical linguistic populations in linguistic theories has not been established yet, this paper submits that scientific development begins with one piece of discovery.

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