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# Alternative criteria for writing system typology

## Cross-linguistic observations from the German and Japanese writing systems

<https://doi.org/10.1515/zfs-2021-2030>

**Abstract:** In essence, typologies of writing systems seek to classify the world's diverse writing systems in principled ways. However, against backdrops of early, misguided assumptions (Gelb 1969 [1952]) and stubborn term confusions, most proposals have focused primarily on the dominant levels of representational mapping (i. e., morphemic, syllabic, or phonemic), despite their shortcomings as idealizations (Joyce 2016, forthcoming; Joyce and Borgwaldt 2011; Meletis 2018). In advocating for exploring a more diverse range of criteria, either as alternatives or complementary factors, this paper outlines a promising framework for organizing typology criteria (Meletis 2018; 2020), which consists of three broad categories; namely, (a) *linguistic fit*, (b) *processing fit* and (c) *sociocultural fit*. Linguistic fit concerns the match between a language and its writing system and, thus, relates closely to the traditional criterion of representational mapping. Processing fit pertains to the physiological and cognitive aspects of a writing system, such as word spacing. Finally, sociocultural fit addresses the communicative and social functions of writing systems, such as implementing orthographic reforms. In singling out a particular parameter from each category, the paper illustrates its potential application as a typology criterion with cross-linguistic observations from the German (GWS) and the Japanese writing systems (JWS).

**Keywords:** writing system typology, linguistic fit, processing fit, sociocultural fit, German writing system, Japanese writing system

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# 1 Introduction

Underlying all typologies of writing systems is the worthy goal of developing a framework, or tool, that is sufficiently practical to enable scholars to appropriately classify the diverse writing systems of the world. The driving sentiment is palpable in Coulmas' (1996b: 1380) claim that "the task of a typology of writing systems is to establish criteria for assigning any writing to one of a number of meaningful types". However, faced with the sheer multitude of ways in which written language is materialized across various writing systems, a major challenge for this well-motivated enterprise is to effectively distinguish between the characteristics of writing systems that represent significant differences, such as principles of representational mapping, and those that are more superficial in nature, such as symbol-shape variations. Moreover, even with suitable properties identified, typologies inevitably entail a considerable degree of arbitrariness in terms of determining the number of categories to recognize, where having too few may conceal vital differences but key similarities may be missed with too many categories (Coulmas 1996b).

However, as the brief outlines of a few influential proposals in Section 2.1 seek to stress, the classification criterion that has been utilized by most typologies to date has been the dominant principle of representational mapping, where, in general, only a limited set of categories are acknowledged, such as the morphemic, syllabic and phonemic levels. Moreover, as Section 2.2 seeks to emphasize, given both the focus on only the dominant mapping relationship and that, in reality, such mappings and their associated spelling principles (graphematic representation) interact in complicated ways, most writing systems are, to varying degrees, mixed in nature (Gelb 1969 [1952]; Joyce 2016; Meletis 2018; 2020). Thus, even though representational mappings are of immense significance in terms of understanding how writing systems actually function, it is also vital to realize that they are essentially idealizations, which renders them far less satisfactory as the primary criterion for truly meaningful classifications of writing systems. Accordingly, in seeking to contribute to the realization of more appropriate writing system typologies, this paper advocates the merits of exploring a more diverse range of classification criteria, which can potentially serve as either alternative or complementary factors. More specifically, Section 3 outlines a promising framework (Meletis 2018; 2020) for organizing candidate criteria and for coherently apprehending the wealth of characteristics associated with writing systems, which is exemplified with cross-linguistic observations from the German (GWS) and the Japanese writing systems (JWS).

Before progressing to those two main sections, however, it is beneficial at the very outset to briefly acknowledge another serious issue, which, notwith-

standing various recent efforts to redress (Gnanadesikan 2017; Joyce and Masuda 2019; Meletis 2018), remains as a thorny matter for writing systems research, or grapholinguistics. Simply stated, as Gnanadesikan (2017: 15) frankly remarks, there “is, in general, significant variation in the basic terminology used in the study of writing systems”. Indeed, as differences of interpretation and application attend to a considerable number of grapholinguistic terms, the problem arguably extends beyond the basic terminology, but, unquestionably, variations are particularly conspicuous surrounding what Joyce and Masuda (2019) refer to as writing systems research’s elusive trinity of core terms; namely, writing system, script and orthography.

Accordingly, it is expedient to briefly set out our working definitions of these key terms (for fuller discussions of the variant terminology, see Gnanadesikan 2017; Joyce 2016, forthcoming; Joyce and Masuda 2019; Meletis 2018; 2020). While the situation is admittedly far from ideal, by conventions within the research literature, the first term of writing system is associated with two distinct senses (Coulmas 2013; Joyce 2016). The first refers to the range of abstract relations, such as morphographic, syllabographic and phonemic, that mediate between linguistic units and graphic units; a meaning that is essentially synonymous with levels of representational mapping. The second common sense of writing system refers to the set of signs and conventions used for a particular language (Coulmas 2013; Daniels 2018). The second key term of script refers to the specific set of material signs used for a particular language (Coulmas 2013; Joyce 2016; Meletis, 2018; Weingarten 2011). When juxtaposed in this way, the differences between the second sense of writing system and the meaning of script may seem rather minimal, which, in part, explains why the two terms are so often confused, as Weingarten (2011) rightly laments. It is, however, highly preferable to restrict the reference of script to only the material set of signs and their forms, because usage conventions are always language-specific and often complex in nature. This point connects directly to the third term of the trinity, orthography, which also has a range of connotations. Consistent with its Greek etymology, orthography denotes the prescriptive determining of correctly written words. In this sense, it refers to the correspondence between an abstract writing system (i. e., a representational mapping) and a material script. Unfortunately, however, due to an historical lack of alternative terms, it has also come to refer more inclusively to all the complicated forms of mediation necessitated by the diverse conventions, both linguistically and socio-historically derived, that underlie both standard and variant written representations. Fortunately, because there is also considerable merit in differentiating between these senses of orthography, a suitable alternative for the more inclusive meaning has recently emerged within the grapholinguistic approach; namely, graphematic representation (Neef 2015). In being unencumbered

by any prescriptive nuances, graphematic representation is undoubtedly a preferable term to cover the wider range of interrelated conventions, allowing orthography to signify only the prescriptively sanctioned written norms.

## 2 Writing system typology

### 2.1 Descriptive perspective of existing typologies

No matter how abridged by necessity, any outline of influential typology proposals must acknowledge, at least briefly, Gelb's (1969 [1952]) seminal classification, which essentially set the trajectory for most subsequent proposals. Gelb's typology consisted of five categories in total, but it also implemented a fundamental division between two main categories. Thus, although the first category included both (1) pictorial representations and (2) mnemonic devices, which Gelb regarded as forerunners of writing, it was differentiated from a second category of full writing. The full-writing category was further subdivided into the three classes of (3) word-syllabic (mixing logography and syllabography), (4) syllabic, and (5) alphabetic. However, despite the key insight regarding the significance of full writing, Gelb's typology was undeniably flawed by his misguided zeal to portray the evolution of writing as teleological in nature, holding that all writing systems invariably transform via logography and syllabary to become alphabets in their final stages (Coulmas 1996a; Daniels 1990; 2001).

The next classification proposal that warrants singling out is that advanced by Sampson (2015 [1985]), because, although it largely conforms structurally with Gelb's (1969 [1952]), even if the similarities are partially obscured by terminological differences, it has also been of special importance for the historical development of writing systems research. Within Sampson's classification, the first division is between semasiographic (included on the basis of conjecture and, thus, not subdivided further) and glottographic writing systems, with the latter divided into logographic and phonographic writing systems. Even though Sampson acknowledges that writing systems based on polymorphemic units do not exist, also on a conjectural basis, the logographic category is subdivided into polymorphemic and morphemic units. Finally, the phonographic category is divided into the three subcategories of syllabic, segmental and featural. Of these, the first two of syllabic and segmental correspond to Gelb's (1969 [1952]) categories of syllabic and alphabetic, respectively, with segmental being a preferable term that avoids labelling a category after its exemplar, but Sampson proposed the featural category solely for Korean Hangŭl, based on the correlations between graphic components and phonetic features.

Although the classification proposed and developed by Daniels (1990; 2001; 2018) has, arguably, been the most influential over the last three decades, it too is firmly rooted in the legacy of Gelb (1969 [1952]). Indeed, as Daniels readily acknowledges, the initial motivations for his typology were to resolve the inadequacies that he perceived in Gelb's tripartite classification, which stemmed directly from Gelb's fallacious belief in the teleological nature of writing system evolution. Thus, more specifically, while Daniels' typology has always recognized Gelb's three categories of full writing (albeit with slightly modified terms)—(1) logosyllabary (morphosyllabary), (2) syllabary, and (3) alphabet (Greek-type script), respectively—it also expanded on that range by including two other categories. Modeled on the term alphabet, Daniels (1990) coined two new terms for these categories. The first was abjad (Semitic-type script) to refer to writing systems where each character stands for a consonant (with the term derived from the first signs of the Arabic script). The second new term was abugida (Sanskrit-type script), where each character stands for a consonant accompanied by a particular vowel with other vowels indicated by additions to the character (with the term derived from the initial signs of Ethiopic). Finally, it should also be noted that prior to Daniels (2018), the classification has also recognized featural as a sixth category, but it now treats Korean Hangŭl as an alphabet.

The last typology proposal to include within the present selective outlines is that recently advanced by Gnanadesikan (2017), because, while it focuses solely on phonemic writing systems, it seeks to categorize them according to more detailed classification descriptions. Significantly, Gnanadesikan treats all phonemic writing systems as segmentary types, defined as “a script all or most of whose signs are used in such a way as to encode individual phonological segments, or phonemes” (Gnanadesikan 2017: 21). Accordingly, the range of typology categories is determined by a small set of factors, including phonological unit size (i. e., syllable, mora, feature), representation of higher-order structure (i. e., syllabically arranged/space, linear) and degree of vowel inclusion (i. e., all, most, some, none). To illustrate the more nuanced descriptions that this typology yields compared to previous proposals, the Phoenician writing system is, for example, categorized as “consonantal linear segmentary”, Devanāgarī as “mostly vowelled āksharik segmentary”, and Hangŭl as “fully vowelled syllabically arranged featural segmentary” (Gnanadesikan 2017: 29).

## 2.2 From descriptive to evaluative considerations

While both select and brief in nature, the short outlines of influential typologies in Section 2.1 vividly underscore one key point; all typology proposals to date have

adopted the notion of representational mapping as either their sole or primary criterion for classifying writing systems. Indeed, the very distinctions between writing system types (abstract sense) hinge on identifying the dominant level of representational mapping. Such descriptive classifications certainly highlight the crucial relations between a writing system (or, rather, what are assumed to be its basic, or “default”, units) and the language represented (or, rather, its linguistic units). They are, however, highly reductive in nature. Firstly, by focusing only on the dominant level of representational mapping, such as the grapheme-phoneme-mappings of segmentaries (Gnanadesikan 2017), other levels of representation (for example, morphography) are either neglected or completely discounted. This leads to the situation where typologies generally fail to account for the fact that most writing systems are mixed in nature (Günther 1988: 43). As languages and scripts both undergo changes over time, the consistency of the basic mapping relations between them can become greatly attenuated, particularly in terms of lexical consistency (Sampson 2018). The mixed nature of writing systems is discussed further in Section 3.1 with respect to both the GWS and the JWS. A second reason why the exclusive focus of typologies on representational mappings is problematic is that it fails to acknowledge features of writing systems that are unrelated to representation, such as those that emerge when using writing systems for writing and reading. Section 3.2 considers how different approaches to marking visual boundaries influence the psychological processes of visual word recognition within reading.

As with general linguistics, description is foundational for grapholinguistics, but evaluation has, for quite some time, also assumed a prominent role within the relevant literature. Unlike languages, which are seldom compared in terms of “quality”, writing systems have often been the targets of various kinds of evaluative assessments, as epitomized by Rogers’ (1995: 31) claim that “some writing systems are better than others”. Indeed, the notions of assessing and contrasting the ‘quality’ of diverse writing systems are blatantly manifest in a number of criteria lists, ranging from teleological assumptions (Gelb 1969 [1952]) to unequivocally evaluative labels, such as “ideal” (Bauernschmidt 1980), “optimal” (Rogers 1995), “practical” (Venezky 1977) and even “perfect” (Venezky 2004). Moreover, although some criteria lists have emerged within the context of literacy development to explicitly guide the creation of writing systems for yet unwritten languages (i. e., Smalley 1964; Bauernschmidt 1980; Cahill 2014), others seek to explain how different characteristics of writing systems influence processing, especially reading (i. e., Daniels and Share 2018). Highly illustrative of the second motivation, Daniels and Share (2018: 101) enumerate ten “dimensions of complexity” within writing systems that they identify as posing particular processing challenges, especially for dyslexics. The dimensions are (1) linguistic distance, (2) non-

linearity, (3) visual complexity, (4) historical change, (5) spelling constancy despite morphophonemic alternation, (6) omission of phonological elements, (7) allography, (8) dual purpose letters, (9) ligaturing, and (10) inventory size. However, the list's major flaw is its unsystematic nature, in failing to distinguish between criteria that differ categorically. Consequently, synchronic features, such as non-linearity, are mixed with diachronic ones, such as historical change. Moreover, some graphetic features (i. e., pertaining to formal and material aspects), such as visual complexity, are mixed with graphematic ones (i. e., pertaining to the relation between graphic and linguistic units), such as omitting phonological elements, while other features are simultaneously relevant at both levels, such as allography and inventory size, which can be interpreted both graphetically and graphematically. Naturally, no list claims to be exhaustive, which is undoubtedly true. For instance, consistent with its focus on processing issues, criteria that are elsewhere treated as “sociolinguistic” (Bauernschmidt 1980) and “cultural” (Rogers 1995) attributes are completely absent from Daniels and Share's (2018) dimension list.

### 3 Alternative criteria

As an approach to simultaneously differentiating and organizing the criteria included across different lists, we propose an overarching framework comprised of three major categories: linguistic fit, processing fit, and sociocultural fit (Meletis 2018; 2020). As the designations imply, these categories are intrinsically evaluative in perspective but they can afford meaningful comparisons of writing systems, in terms of being more or less suitable, or “fit”, on different dimensions, with the first category relating to the match between a writing system and its language and the latter two concerned with the use of writing systems. *Linguistic fit* captures the extent to which a given writing system suits its underlying language and is, thus, purely descriptive, being within the domain of grapholinguistic analyses. In contrast, the other fit categories are use-oriented and, thus, require external corroborating evidence, such as experimental data. Psycholinguistically-oriented *processing fit* assesses how well a writing system is suited in terms of the physiological and cognitive processing demands on its users in both reading and writing, while sociolinguistically-oriented *sociocultural fit* considers how writing, as a cultural technology, can be evaluated in terms of the socio-communicative needs of users, as well as their cultural identities and ideologies. It is, however, paramount to immediately acknowledge that the three kinds of fit are also basically idealizations, rather than constituting discrete categories with clear boundaries. Indeed,

as the broad fit categories are closely interconnected in nature, many criteria, including those discussed below, are potentially of some relevance to more than just one category. Thus, even though we seek to coherently contextualize each specific criterion addressed from the perspective of the most salient fit category, such as word-boundary demarcation under processing fit, it would be beyond the scope of this paper to delineate all mutual implications.

Although initially proposed within the context of establishing an explanatory theory of writing (Meletis 2020), the fit categories also represent a viable framework for coordinating multiple criteria in ways that can facilitate both the evaluation and comparison of writing systems. More specifically, they can be fruitfully applied to developing typology proposals that do not rely solely on the notion of representational mapping. In theory, any fit-category criterion can serve as a possible candidate criterion for a typology of writing systems. What is imperative, however, when considering the suitability of a particular criterion, either as an alternative basis for a new typology or as a complementary dimension to an existing typology, is that it should be neither too broad nor too narrow in scope, which would result in too few or too many types, respectively. Naturally, prior to proposing a novel typology based on any criterion other than representational mapping, it would also be necessary to demonstrate its applicability and validity for writing systems research.

The following subsections consider one possible criterion from each of the three categories of fit from the perspectives of the GWS and the JWS, respectively. While the juxtaposition of these two writing systems might seem rather arbitrary in nature, it is actually well-motivated in the present context. Although the GWS and the JWS differ in many respects, the intention here is to underscore how the fit categories afford an appealing framework for analyzing diverse writing systems. On the one hand, the GWS is generally classified as being an alphabet (i. e., a phonographic writing system that operates at the phonemic level), even though, due to its pervasive levels of morphography, it is more accurately a mixed system. On the other hand, the JWS actualizes a quite unique mixture of representational mappings by simultaneously combining morphographic kanji, syllabographic kana, and the alphabetic Roman script (Joyce and Masuda 2018; 2019).

### 3.1 Linguistic fit: Mixed representational levels

As Frost (2012: 266) provocatively claims, “every language gets the writing system it deserves”. Naturally, by its very formulation, the comment is overtly evalua-



tive. What does it mean to claim that a language “deserves” a particular writing system? Most succinctly, it expresses the conviction that a writing system should adequately accommodate the specific features of a language, which is precisely what linguistic fit attempts to encapsulate. As a visually-mediated semiotic system, a writing system must be appropriate to the specific language. Obviously, as the sections on both processing and sociocultural fits underscore below, linguistic fit is not the only basis for evaluating writing systems, and is possibly not even the most important.

As a broad category, linguistic fit encompasses the criteria, or parameters, that pertain to the relations between a writing system and ‘its’ language (Meletis 2018). One criterion that has been examined extensively is transparency. Graphematic units (ranging from individual graphemes up to word-length strings) are considered to be transparent if they relate to a single linguistic unit. For instance, the grapheme combination <gh> in English is not transparent, because, at the phonographic level, it can represent a range of phonemes (e. g., /f/ in <enough> and /g/ in <ghostly>). Neef and Balestra (2011) have proposed a value of graphematic transparency (gt-value) as an index of phonographic transparency. In addition to outlining how to assess grapheme transparency for a particular writing system, they also demonstrate the notion’s application by comparing the German and Italian writing systems. However, as gt-values are only applicable to segmental phonographic writing systems, resonating directly with the issues outlined above, evaluating transparency is only possible in terms of the dominant level of representational mapping. For alphabets, such as German and Italian, the mapping is primarily of segmental graphemes onto segmental phonemes. Thus, once more, this approach to assessing transparency effectively neglects the extent to which a writing system may relate to other linguistic units, whether at the syllabic or morphemic levels. Moreover, similar limitations also apply to Katz and Frost’s (1992) influential orthographic depth hypothesis, which only treats writing systems that are phonographically transparent as being orthographically shallow (i. e., transparent). Accordingly, the Chinese writing system is evaluated as being orthographically deep; an assessment that completely ignores the fact that at the morphographic level, which is highly relevant for reading, it is predominately transparent. Measurements of transparency must be “multidimensional” (echoing the sentiments of Daniels and Share 2018). Such measures must acknowledge that (a) writing systems can be transparent with respect to multiple linguistic levels and that (b) different kinds of transparency are mutually exclusive. These points can be illustrated by contrasting the GWS and the JWS.

It seems quite uncontroversial to classify the GWS as an “alphabet”, i. e. a segmental phonographic writing system with separate graphemes for both

consonant and vowel phonemes. It is, thus, not surprising that analyses have focused on the correspondences between graphemes and phonemes. However, most descriptions of the GWS also acknowledge its so-called *morphological principle* (Dürscheid 2016: 143–146; Karg 2015: 58–60). One pertinent phenomenon is the graphematic non-representation of final (obstruent) devoicing in German. For example, even though the phonological representation of the word *Hund* ‘dog’ is /hʊnt/, it is written as <Hund> with a final <d> (which graphematically relates to /d/), rather than \*<Hunt>, which would be the graphematically transparent spelling. This is because all the other forms across the lexeme’s inflectional paradigm, such as the genitive singular *Hunds* ‘dog.GEN’ or the nominative plural *Hunde* ‘dogs’, include the phoneme /d/ and are transparently written with <d>. Thus, a preference for morphographic consistency across the paradigm is stronger than a propensity for phonographic transparency, highlighting how the two are (often) in conflict. Recently, as the autonomous paradigm within grapholinguistics has gained greater credence, more serious scrutiny has been given to the notions that phonographic representational mappings are central and that morphography should be regarded as either a secondary “intrusion” (if spun negatively) or a “surplus” (if its benefits are stressed), which are effectively reinforced by crude typological classifications such as “alphabet” (Schmidt 2018; Berg 2019). The crux of these criticisms lies in the realization that polysegmental correspondences, rather than segmental phonographic correspondences, should be the basis of graphematic analyses, and that the most important correspondences are those that exist between the written and spoken forms of words. This view holds that morphology and syntax are both modality-neutral aspects of language (Berg 2019: 5), because words can be realized as either speech or writing (or, in the case of sign languages, as signing). Taking the argument further, segmental phonographic correspondences should not be regarded as being primary but rather as being epiphenomenal; the reason why the German word *klar* ‘clear’ (/kla:r̥/) is graphematically represented as <klar> (i. e., includes <r>) is simply because *klare* ‘clear.NOM.F.SG’ /'kla:ʁə/ (with /ʁ/) is written <klare>. As Schmidt (2018: 78, our translation) points out, “the reference system for the interpretation of individual letters and their correspondences is knowledge about [...] pairs of graphematic and phonological words” (cf. also Berg 2019: 7). It also bears mention that blanket classifications, such as “alphabet”, fail to capture the syllab(ograph)ic level, which also plays a role in many segmental phonographic writing systems, as further discussions of the GWS in Section 3.2 observe.

Consistent with the common secondary sense of writing system (Section 1), the JWS refers to the complete set of graphic symbols used to represent written Japanese. As the usual Japanese term <漢字仮名交じり文> /kan-ji-ka-na-

ma.jiri.bun/<sup>1</sup> ‘mixed kanji and kana writing’ patently signifies, the basic graphematic convention, as outlined in Section 3.2, is to simultaneously employ the component scripts in complementary ways (Joyce and Masuda 2018; 2019). Interestingly from the perspective of writing systems research, the JWS constitutes a unique approach to mixing representational mapping principles as materialized by its blend of four scripts. The core script is morphographic kanji (Joyce 2011; 2016), but the morphology of kanji is rather complex, as kanji are associated with both Native-Japanese (NJ) and Sino-Japanese (SJ) morphemes. For example, <山> means ‘mountain’ and is associated with both the NJ word /yama/ and the SJ morpheme /san/. Word-formation processes involve both lexical strata (Kageyama and Saito 2016), such as NJ <山登り> /yama-nobo.ri/ and SJ <登山> /to-zan/ which both mean ‘mountain climbing’, although compounding is particularly productive with SJ morphemes (Kobayashi et al. 2016). Thus, two-kanji compound words (bimorphemic words) are particularly significant within the Japanese lexicon, both as independent words, like <関係> /kan-kei/ ‘relation’, and as the components of longer compounds, such as the three-kanji compound word <可能性> /ka-nō-sei/ ‘potentiality’ (two-kanji compound plus suffix) and the four-kanji compound <自分自身> /ji-bun-ji-shin/ ‘oneself’ (combining two two-kanji compounds) (Joyce and Masuda 2021).

Despite their separate historical developments, the two syllabographic scripts of <ひらがな> /hiragana/ and <カタカナ> /katakana/ are equivalent in terms of their potential to graphematically represent Japanese syllables (mora). Both kana sets have five vowel symbols, such as <あ> and <ア> /a/ respectively, but most kana symbols are consonant-vowel mora, such as the unvoiced <か> and <カ> /ka/ and voiced <か<sup>̣</sup>> and <ガ> /ga/, respectively. As the most recently integrated script (basically from the mid-twentieth century when first taught at elementary school), phonemic <ローマ字> /rōma.ji/ ‘Roman letters’ are more marginal in terms of general usage but they are common in popular media contexts. Moreover, while highly context-dependent, kanji and Arabic numerals are both commonly used to represent numbers (Joyce and Masuda 2018).

Clearly, typologies of writing systems need to adequately account for the complex interactions between different levels of representational mapping. As both the perspective shift towards the GWS and the constitutive mixing of the JWS highlight, the classification of writing systems based solely on the dominant level of representational mapping is essentially untenable.

<sup>1</sup> Within the phonological glosses for JWS examples, kanji-kanji boundaries are indicated by hyphens, other script boundaries by periods, and macrons indicate long vowels, such as /ō/.

### 3.2 Processing fit: Demarcation of boundaries

Admittedly, it may seem quite trivial to claim that writing systems must be suitable for their users' processing needs, but as one of the primary functions of writing is communication, clearly successful communication will be highly dependent on the degree to which a writing system affords efficient processing. Accordingly, processing fit is a broad category that embraces a number of physiological and cognitive aspects, which have become the focus of greater attention since the processing turn within grapholinguistics. One hallmark of that perspective shift has been its deeper appreciation of the mutual constraints between mind and tool that have shaped the evolution of writing systems. As Dehaene (2009: 150) astutely points out, over time writing systems have had to become sufficiently "easy to acquire", with the natural corollary of also becoming "easy to use". Consistently, the category of processing fit aptly accentuates how, as products of the human mind, writing systems are dynamic artifacts.

One obvious feature of some writing systems that greatly influences processing, even though it is conspicuously absent from Daniels and Share's (2018) list, despite its focus on (processing) complexity, is word spacing. Most of the world's writing systems insert spaces between "words" (even if that linguistic category is inherently problematic). Word spacing initially developed out of changes in reading practices; specifically, the shift from reading aloud to silent reading and the different processing demands imposed on readers (Parkes 1992; Saenger 1997). Moreover, as most writing systems have been adapted from existing systems (or have, at least, been highly influenced by them), once word spacing was invented, it was adopted by many systems. Reading studies conducted with alphabet users have observed disrupted processing when word spaces are removed, with negative effects for both eye-movement control and word identification (Morris et al. 1990; Sheridan et al. 2016). However, not every writing system has word spacing, with notable exceptions being the Chinese, Japanese and Thai writing systems. Yet, it would be grossly inaccurate to claim that such writing systems are bereft of information that signals word or other boundaries, such as between syllables and morphemes. Accordingly, a binary typology distinction between "spaced vs. unspaced" writing systems alone would also be untenable, as it would be too imprecise and reductionist in nature, similar to existing typologies based solely on the dominant level of representational mapping.

The GWS employs word spacing in the form of blank spaces inserted between units that most often correspond to morphosyntactic words. The notion of word spacing is also fundamental to a proposal for the so-called graphematic word

(Fuhrhop 2008).<sup>2</sup> However, while it is uncontestedly true that morphosyntactic units are salient processing units and that blank spaces are highly visible boundary cues, visual cues also signal graphematic syllables (Fuhrhop and Buchmann 2009; Fuhrhop et al. 2011), even though, admittedly, that concept is not without some controversy and the signaling is not always consistent. Specifically, graphematic syllable boundaries are preferentially occupied by “long” basic shapes, referring to those with either an ascender, such as |d|, or a descender, as in |p|. In contrast, the nuclei of graphematic syllables are occupied by “compact” basic shapes, such as |a|, |e|, and |u|, which are predominantly used to materialize vowel graphemes. Thus, a length hierarchy is certainly discernable, where the shapes at syllable boundaries exhibit length and central shapes are compact. That noted, however, the visual demarcation of graphematic syllables is not as salient as that for graphematic words, given that some consonants that occur at syllable boundaries, such as |s|, violate the notion of length hierarchy constituting a form of visual cueing. However, it is worth stressing that evidence supports the diachronic emergence and evolution of the graphematic syllable in German; an example being the gradual disappearance of long shapes, such as |y|, from the syllable nucleus position (Fuhrhop and Schmidt 2014). Consistent with Dehaene’s (2009) insight noted earlier, cognitive factors have fostered a gradual strengthening of graphematic syllable structures that has been synchronically described for German.

In contrast to the focus on the JWS’s mixture of representational mappings and associated scripts in Section 3.1, the emphasis here is on how the JWS’s graphematic conventions effectively serve to visually differentiate both between content and grammatical words and, to a lesser degree, between lexical strata. To that aim, Figure 1 presents Joyce and Masuda’s (2018: 183) example of an authentic Japanese sentence. Taken from a Wikipedia entry for the Japanese Industrial Standard’s (JIS) main character set, it contains examples of all component script.

As already noted, kanji are used to graphematically represent both SJ and NJ content words, such as SJ <地名> /chimei/ ‘place names’, and the stems of NJ verbs, adjectives, and some adverbs, such as <含む> /fuku.mu/ ‘include (plain-present)’. Hiragana are used primarily to represent functional words and inflections, such as the <含む> inflection, <である> /dearu/ (copula, plain-present) and the grammatical marker <の> /no/ ‘possessive; nominalization’. Katakana are used to represent Foreign-Japanese (FJ) words (loanwords not from Chinese),

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<sup>2</sup> It should be noted that Fuhrhop’s (2008) definition of a graphematic word is specific to German and does not apply to many other alphabetic systems. For example, English compounds often have a space between their constituent elements.

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JIS X 0208 (ジス X 0208) は、日本語表記、地名、人名などで用いられる 6,879 図形文字を含む、主として情報交換用の 2 バイト符号化文字集合を規定する日本工業規格である。

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jisu ekusu rei-ni-rei-hachi (...) wa, ni-hon-go-hyōki, chi-meī, jin-meī nado de mochi.irareru rokusen-happyaku-nanajū-kyū zu-kei-mo-ji o fuku.mu, shu.toshite jō-hō-kō-kan-yō no ni.baito fu-gō-ka-mo-ji-shū-gō o ki-tei.suru ni-hon-kō-gyō-ki-kaku dearu

'JIS X 0208 is a Japanese Industrial Standard that stipulates a 2-byte encoded character set that is mainly used in information exchange that includes 6,879 graphic characters that are used for Japanese language writing, place names and personal names, etc.'

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**Figure 1:** Example of a Japanese sentence, with phonological gloss and translation (Joyce and Masuda 2018: 183).

foreign and species names, onomatopoeia, emphases and glosses, such as FJ <バイト> /baito/ 'byte'. Rōmaji are usually used to represent names and foreign words, particularly within advertising and mass media contexts, such as the JIS part of the reference code. Moreover, consistent with the example's technical nature and its horizontal orientation, Arabic numerals are used for the number <6,879>, rather than the kanji equivalent <六千八百七十九>, which requires more space.

As even the short example in Figure 1 plainly attests, the JWS's graphematic conventions effectively serve to vividly signal word boundaries, where a function word in hiragana invariably follows a content word, typically represented by kanji but also by katakana (Taylor and Park 1995; Joyce et al. 2014). Although Japanese texts use both commas (、) and periods (。), as there are no conventions for hyphenation, words simply wrap to the following line, as the compound <符号化文字集合> /fu-gō-ka-mo-ji-shū-gō/ 'encoded character set' indicates.

In contrasting the GWS and the JWS in terms of their approaches to marking syllable and word boundaries, this section has sought to illustrate how it would be overly simplistic to assume that strategies for visually differentiating linguistic units, such as word spacing, might be equally effective across writing systems. However, in light of psycholinguistic evidence that forms of visual demarcation do facilitate reading processes, clearly, further research is warranted into how diverse writing systems deploy various demarcation strategies.

### 3.3 Sociocultural fit: Orthographic regulation and reforms

Sociocultural fit represents the third pillar of the organizational framework, which are all equally important. Indeed, as Cahill (2014) states:

People accept or reject an orthography based on sociolinguistic factors. If a group doesn't *want* to use an orthography, it doesn't matter how linguistically sound it is – they won't use it. So 'what the people want' is not just one more factor; it is the *most critical* factor in *acceptance* of an orthography. (Cahill 2014: 16, emphasis in original)

Although the criteria under sociocultural fit can be analytically more elusive in nature, they are absolutely crucial in terms of actually using writing systems. In light of the stubborn term confusions within writing systems research, as acknowledged in Section 1, it should be stressed that Cahill's use of "orthography" corresponds to the secondary sense of writing system. As explained earlier, it is preferable to reserve orthography to refer to the standardizing regulations that typically fall under the province of external stakeholders, such as authorities for language polices. From the perspective of grapholinguistics, descriptions of how writing systems function in terms of actually implementing their principles of representational mapping should be located at the graphematic level. More specifically, the objective of graphematic analysis should be to elucidate a particular writing system's graphematic solution space (Neef 2015).

According to Neef's (2015) conceptualization of the graphematic solution space, in German, for example, the word *Fuchs* 'fox' could be written \*<Fuks>, \*<Fux>, \*<fuchs>, \*<Vuchs>, \*<vux>, and <Fuchs>. These variants (and others) are all licensed at the graphematic level of the GWS, but, consistent with the asterisk convention of marking unacceptable forms, only <Fuchs> is regarded as orthographically correct. As stressed earlier, the orthographic level is always prescriptive in nature. Of course, that is not to imply that regulating authorities always exist to determine what is "correct", for although the *Rat für deutsche Rechtschreibung* (Council for German Orthography) and various Japanese Ministries, such as the *Bunkachō* (Agency for Cultural Affairs) have such roles for the GWS and the JWS, respectively, there is no such authority for English, for example, which is why English is often called a "self-organizing" system (Berg and Aronoff 2017).<sup>3</sup> Our interpretations of orthographic regulations are often highly Eurocentric in focusing on certain aspects, such as grapheme-phoneme-correspondences, word divisions, hyphenation, capitalization, and the spelling of loan words (Coulmas 1996a: 379); issues that are not necessarily relevant for many writing systems.

Japanese debate concerning the difficulties of the JWS, known as <国字問題>/*koku-ji-mon-dai*/ 'problems of the national script', can be traced back to the Meiji period (1868–1912) when the written language was seen as an obstacle to

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<sup>3</sup> It should also be noted that the codification of "correct" spellings in dictionaries represents a type of external regulation, but in such cases, dictionary publishers are serving as (unofficial or semi-official) regulators.

Japan's modernization (Seeley 1991; Twine 1991). As it has been estimated that there were more than ten thousand kanji in daily use at the start of the Meiji period (Twine 1991), understandably, one focus has been on restricting the number of kanji. Thus, since the mid-twentieth century, the Japanese government has issued a series of guidelines, including the current <常用漢字表> /jō-yō-kan-ji-hyō/ list of 2,136 kanji, as revised in 2010 (Bunkachō 2010). There is also a subset of 1,026 <教育漢字> /kyō-iku-kan-ji/ 'education kanji', which are carefully introduced across the elementary-school years, with the remaining 1,110 kanji covered at high school. While it is true that the guideline revisions have tended to slightly increase the numbers of official kanji, the revisions can be regarded as periodic fine-tuning, rather than signaling a fundamental shift in policy. For example, additions made in 2010 resolved some inconsistencies with proper nouns, such as <藤> NJ /fuji/ and SJ /tō/ 'wisteria (flower)', which is part of many common family names, like <藤原> /fuji-wara/ 'Fujiwara' and <佐藤> /sa-tō/ 'Satō'. On the other hand, because the jōyō kanji list only has guideline status, although newspapers and official publications generally adhere, it is certainly not prescriptive for all written Japanese language. In the era of electronic information, a more realistic imposition on modern kanji usage is the JIS X 0208 character-encoding standard, referred to in Figure 1, which specifies 6,355 kanji.

Moreover, under the <現代仮名遣い> /gen-dai-ka-na-zuka.i/ 'modern kana usage' conventions amended in 1986 (Ministry of Education, Culture, Sports, Science and Technology-Japan 1986), kana-syllable correspondences are generally quite consistent, even though some historical influences remain. Essentially, there are three key exceptions, when <を>, <は>, and <へ> represent the grammatical particles for object /o/, topic /wa/ and destination /e/, respectively, rather than their conventional correspondences to /wo/ (now obsolete), /ha/ and /he/, respectively. Some retained conventions relate to preserving the morphological transparency of compound words. For example, the kana representation of <鼻血> /hana-ji/ 'nose-bleed' [nose + blood] is <はなぢ> /hanadi/ rather than <はなじ> /hanaji/, because the NJ word for 'blood' is /chi/, which is graphematically represented as either <血> or <ち>.

Despite the existence of various official guidelines, which largely codify the lexical strata-script associations, outlined in Section 3.2, as orthographic conventions, there are, unquestionably, profound consequences of the JWS's distinctive mixture of mapping principles and scripts. The most striking is the highly fungible nature of the contemporary JWS, where graphematic variants are ubiquitous (Joyce et al. 2012; Joyce and Masuda 2019). As Joyce and Masuda (2019) seek to elucidate, the notion of the graphematic solution space in the case of the JWS shifts considerably. For example, the graphematic solution space for /watashi/ 'I' (polite first-person pronoun used by both genders but more commonly and less formally



by females) consists of <私>, <わたし>, <ワタシ>, and <watashi>. However, selecting among them depends on numerous interrelated factors of intentionality, such as script sensibilities.

As yet, no typologies of writing systems have attempted to consider the extent to which writing systems can be “meddled with” orthographically by external regulators, such as the Council for German Orthography, but perhaps Neef’s (2015) notion of the graphematic solution space could be suitably expanded in that context. Even though proposed expressly for phonographic writing systems, the basic concept could be applied to potentially analyzing other levels of graphematic representation (Meletis 2020). Unquestionably, writing systems differ in terms of their latitudes towards representational variation, reflecting fundamental differences related to freedoms of choice and creativity that writing systems afford. In the case of the GWS, the degree of graphematic freedom is extremely limited, but the situation is radically different in the case of the JWS.

## 4 Conclusion

As the selective outlines in Section 2.1 undeniably demonstrated, the most influential proposals for writing system typologies to date are all based on the dominant principle of representational mapping between graphic and linguistic units. To the extent that the approach has provided typologies with sound linguistic underpinnings and that it has yielded considerable insights into how writing systems generally function, the approach is certainly not completely without merit. However, as stressed in Section 2.2, the approach also has a particularly serious limitation. As the notion of a dominant principle of representational mapping is fundamentally an abstract idealization, typologies that utilize it as their primary criterion for classifying writing systems are doomed to be little more than broad generalizations that potentially obscure as much as they elucidate. In reality, most writing systems are, to varying degrees, mixed in nature, with different mapping principles interacting in complex ways.

Accordingly, as it is also, unquestionably, worthwhile to investigate a wider range of the characteristics and properties associated with writing systems for their usefulness in terms of serving as candidate typology criteria, either as alternative or complementary factors, Section 3 turned to outline an interesting framework (Meletis 2018; 2020) for organizing candidate criteria. Structurally, the framework consists of three broad categories that seek to encapsulate the different aspects of linguistic fit, processing fit, and sociocultural fit. More specifically, after briefly noting the main characteristics of each category, the respective

subsections also singled out one pertinent criterion; namely, the mixture of representational mapping principles under linguistic fit, the marking of word boundaries as an aspect of processing fit, and orthographic reform as a key concern for sociocultural fit. However, it again bears stressing that, because the broad categories are closely interrelated, candidate criteria may not fall exclusively under a single fit category. For example, even though orthographic reforms relate primarily to sociocultural fit, they also have implications for the other categories. In attempting to underscore the potential usefulness of these various factors, each was considered cross-linguistically from the contrastive perspectives of the GWS and the JWS.

As the paper has sought to convey, we readily concur with Gnanadesikan's (2017: 14) insightful observation that writing system typologies might beneficially consider any of the many components associated with writing systems. However, as the paper has also continually sought to stress, as the components of interest can interact dynamically, there are also certain challenges facing any endeavors to consider a more diverse set of factors. As such, clearly, it is imperative to simultaneously establish a tenable framework for organizing and examining the merits of candidate criteria, in order to effectively realize their potential contributions in terms of developing more comprehensive typologies of writing systems.

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