Feet as Neuropsychologically Driven Sense Units

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Since the work on English stress by Liberman (1975) and Liberman & Prince (1977), the metrical foot had been studied largely as synonymous with the *stress foot*, a fundamental isochronous unit of stress-timed languages. The foot in this sense, then, should not be a relevant notion for non-stress-timed languages such as the mora-timed language Japanese. However, a higher metrical unit controlling two moras has been largely recognized in Japanese and this unit is referred to as the *bimoraic foot* (Poser 1990; Tateishi 1989; Inaba 1998 and others). There seems to be two types of *foot*. Fundamental questions then arise: Is it rational to call them both *foot*? Is there any way to unify the notion of *foot* across all languages?

Referring to the work on speech perception and production (Kohno 1992, 2001, 2007; Uemura 1997), I propose to define a *foot* in terms of a grammatical sense unit, called the PSU (see below), across all languages. The PSU, associated with universal human working memory, appears to be equivalent to the *stress foot*, but distinct from the *bimoraic foot*; hence a desire for a new look at related phenomena and terms.

Syllables in stress-timed languages such as English and Swedish are not evenly timed, and thus a principle of end-focus is utilized, in which a stress unifies or signals a senseful unit, called a perceptual or productive sense unit (PSU), which then seems to be equivalent to the *stress foot*. The PSU is a unit which accommodates the amount of materials that can be processed in our direct short-term memory (Kohno 2001, 2007). In other words, the *stress foot* is a neuro-psychologically driven grammatical sense unit. (Syllable-timed languages such as French and Italian, which also have the end-focus principle (Dauer 1983), can be claimed to form a natural class with stress-timed languages.)

Distinctively different are mora-timed languages such as Japanese, in which moras are relatively short and fairly equally timed, and thus mora-counting, instead of the end-focus principle, does the job to signal a grammatical sense unit. In fact moraic trochees are largely found as containing two moras, leading to the notion of foot-binarity (cf. Hayes 1995). The *bimoraic foot*, however, is much smaller than and obviously distinct from the PSU, thus cannot be treated on a par with the *stress foot*.

A bridge between the two types of languages may be sought in Kohno (1992, 2002, 2007), who, in his study of rhythm and intonation, proposed a fundamental temporal unit, "beat," of 330ms, which controls slot units, "pulses" such as syllables and moras; 330ms is a durational boundary to facilitate holistic sound processing by humans. He has shown that all syllabic units of any language occur within 330ms. This unit has a neurological justification; Uemura (1997) has shown that the beat is a rhythmic unit created by contractions of respiratory and related laryngeal muscles to exhale the amount of air necessary to generate one or more syllables. A beat may contain any number of moras depending on the speed of speech. In usual speech it accommodates up to two moras, which seems to be customarily perceived as the *bimoraic foot*. In other words, the *bimoraic foot* is a neurophysiologically driven grammatical unit.

The beat is distinct from the PSU, but there is a correlation; the PSU is equivalent to 7 ± 2 beats in length (Kohno 2003, 2007), which, in turn, is equivalent to the short term memory size of 7 ± 2 first theorized by Miller (1956). I propose that all languages be looked at as having the *PSU foot* and the *bimoraic beat* (instead of *bimoraic foot*). Motivation for this proposal is drawn from Kohno's intriguing claim that the beat is the underlying drive for English irregular past tense verb forms and Japanese poetry having a line template of either 5 or 7 with prolongation.

Finally, I sketch the overall internal structure of the newly proposed *PSU foot*, based on language games played by a Japanese Williams syndrome patient; word-reversing and kana-conversion.

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