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Predicative reduplication: Functions, their relationships and iconicities

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Abstract: We survey the predicative functions of reduplication and analyze the relationships between them in terms of semantic affinity and iconicity. Forty-five functions are identified in 108 languages. The most frequent ones have to do with repetition/continuity of events, multiplicity of participants, and intensity. Reduplication can be polysemous. Based on high cross-linguistic frequency of expression by a common reduplicative form and cases of ambiguity, we identify semantic affinities among twelve functions, together comprising a semantic map. We also analyze the functions in terms of five iconicities—iconic relationships between specific aspects of form and meaning. An interesting relationship emerges: for any pair of semantically closely related functions, the iconicities of one are always a superset of the iconicities of the other. On the widely-held assumption that initial uses are high in iconicity, the picture is one of monotonic loss of iconicity as use is extended. As well as showing empirically how the functions relate to each other, we also review three earlier proposals which were largely based on reasoning.

Keywords: reduplication, predication, polysemy, semantic map, iconicities

1 Introduction

Reduplication—the repetition of a root, stem, or part of a root or stem to form a new word—is a common means of word-formation in the world's languages. It has been studied in both its formal (Moravcsik 1978; Inkelas & Zoll 2005; Štekauer et al. 2012) and semantic aspects (Key 1965; Moravcsik 1978; Regier 1994; Regier 1998; Fischer 2011), with much attention given to the iconic relation that exists between form and meaning in at least some of its uses (e.g. Haiman 1980; Lakoff & Johnson 1980; Kouwenberg & LaCharité 2001; Fischer 2011). Despite there being several surveys of the functions of reduplication across

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languages, none so far has been carried out in a way that is large in scale, detailed in terms of the functional distinctions made and quantitative in identifying trends with regard to meaning. Previous studies have either been done without quantification (Regier 1998; Fischer 2011), have been based on small samples (Bybee et al. 1994), or have considered only a small range of functions (e.g. Kajitani 2005). In one case where coverage is large and there is quantification over different functional types—Michaelis et al. (2013)—the classification used is too broad to give an idea of the full range of uses. The present study seeks to give a thorough account of the functions of reduplication, both in terms of breadth of coverage and in terms of the functional distinctions that are made, and it seeks to quantify the functions. To keep the scope of the study manageable, attention is restricted to the functions of reduplication in just one propositional act (Croft 1990; Croft 2001): predication.[1] The present study of the predicative uses of reduplication covers 108 languages and distinguishes 45 functions.

As well as identifying the functions within this one propositional act, and quantifying trends in terms of function, the study also aims to identify relations of affinity between the different functions. This is done by exploiting the expression of different functions under a common form (Croft 2003; Haspelmath 2003): functions that are expressed by a common form in many languages are more likely to be closely related than are functions that are expressed by a common form in a small number of languages or no languages at all. However, expression with a common form can arise for reasons other than semantic affinity. We therefore supplement evidence from expression with a common form with evidence from ambiguity: functions that both occur frequently under the same form and occur ambiguously in recorded examples—thus demonstrating the possibility of semantic extension—are taken to be closely related. A number of earlier works, principally Bybee et al. (1994), Regier (1998), and Fischer (2011), have sought to establish a network of the functions of reduplication. The present work also seeks to do this. However, whereas previous networks were established largely on the basis of reasoning, the present one is empirically driven.

We also take up the question of iconicity. There has been debate about how to understand the relation between those uses of reduplication where a clear iconic relation between form and meaning can be found, such as the expression of plurality or repetition, and uses where no clear iconicity is found, such as causativity, intransitivity or randomness. Most accounts make

1 Predication is "what is being said about" a referent (Croft 1990: 248), involving a state of affairs that may be dynamic (an event) or not (a state).

a simple division between iconic and non-iconic uses, and propose that the iconic uses develop first in a given language, while the non-iconic uses develop through semantic extension from these original uses (Bybee et al. 1994; Regier 1998; Fischer 2011). The view explored in the present study is that iconicity can be a matter of degree. Iconicity on this view depends on the relation between form and meaning not in a holistic way, but in terms of speakers' exploitation (knowingly or not) of iconic relations between particular aspects of form and particular aspects of meaning. We identify five formal features that are in an iconic relation to some aspect of meaning displayed in at least one of the predicative functions expressed by total reduplication (see below). From this analysis in terms of iconicity at the level of individual features of form and meaning, an interesting relationship emerges: for any pair of closely related functions (as established with evidence from expression with a common form and ambiguity), the set of formal features exploited iconically by one is always a superset of the features exploited by the other (Section 4.3). This has implications for diachrony, in that it is consistent with the gradual loss of iconicity as use is extended to new functions (as proposed by Bybee et al. 1994).

Reduplication involves the repetition (or copying) of all or part of a root or stem (hereafter referred to as the 'base') to form a new meaningful unit. Reduplication is distinguished from the repetition of morphologically whole words (e.g. Gil 2005).

In forming a morphological word, there may, in addition to reduplication of the base, be addition of affixes to form a complete unit. An example of reduplication is (1).

(1) Swahili (Novotna 2000: 65)
  a. *-imb-a~imb-a*
     -sing-FVL~sing-FVL
     'sing frequently'
  b. *-imb-a*
     -sing-FVL
     'sing'

Strictly speaking, reduplication involves copying the base (or part of it) just once. Bases (or parts of bases) may also be copied two or more times (triplication, quadruplication, etc.). Such cases are relatively rare, and for the purposes of this paper the term 'reduplication' is used as a cover term for all cases, regardless of the number of copies (though in coding our data we do distinguish numbers of copies; see Section 3.1.2.1).

Cases of reduplication where the whole base is copied, such as (1), are termed *total reduplication*. Cases where just part of the base is copied are known as *partial reduplication*. There are several kinds of partial reduplication (Moravcsik 1978: 303ff). One point of variation is whether the copy precedes the base (2), follows it (3), or is embedded (infixed) within it (4).

(2) Rapanui (Du Feu 1996: 191)
   a. *ʼoʼoʼout*
      'burn very much'
   b. *ʼoʼout*
      'burn'

(3) Zialo (Babaev 2010: 137)
   a. *gàdɛ́gɛ́~dɛ́gɛ́*
      'be quite fragile'
   b. *gàdɛ́gɛ́*
      'be fragile'

(4) Chamorro (Topping 1973: 103)
   a. *hu<gá~>gando*
      'playing'
   b. *hugándo*
      'play'

Another point of variation is whether the copy is the initial part of the base (5), some medial part (6), or the final part (7).

(5) Cora (Casad 1984: 300)
   a. *-miʼi~mi-ki*
      -die out~RED-HAB
      'always dying out'
   b. *-miʼi*
      'die out'

(6) Shi (Polak-Bynon 1975: 200)
   a. *óoku<suun~>sunika*
      'push (intensive)'
   b. *óokusunika*
      'push'

(7) Meyah (Gravelle 2002: 145)
a. *aha~maha*
'panting very strongly'
b. *maha*
'pant'

The focus of this paper is on function rather than form. However, formal distinctions of the kind just described must be taken into account for two reasons. First, form is crucial to the question of iconicity: total reduplication offers different possibilities for iconic expression of meaning than do various kinds of partial reduplication. Secondly, since we will be using polysemy in establishing affinities between functions, and since polysemy applies only where form is constant, form must be taken into account.

The predicative use of reduplication (or *predicative reduplication* for short) is defined here as the reduplication of a base that can function as the head of a predication, where the result of reduplicating the base is also used in predication.[2] By this definition we are limiting our attention to cases where the morphosyntactic category of the base is preserved. This excludes cases where reduplication has the effect of changing the category of the base, such as when reduplicating a noun yields a predicate.

Reduplication (including predicative reduplication) is found in both spoken and signed languages. There are many similarities in the uses of reduplication in spoken and signed languages, though signing offers some formal means of expression that are not available in speech and vice versa. For example, signing offers continuous gestures to represent continuous events (e.g. Liddell 2003: 45), variable gesture speed to represent variable event duration (Kuhn 2015), the use of two hands where one is usual to represent emphasis or plurality (Börstell et al. 2016), and reversible gestures to represent reciprocity (e.g. Liddell 2003: 119–121, Börstell et al. 2016), none of which is possible with speech. In the present paper, however, we focus exclusively on spoken reduplication.

The paper seeks to answer the following questions: (a) What is the range of functions of reduplication where it is used in predication? (b) What tendencies are there with respect to how reduplication is used in predication? (c) What iconicities are present in the predicative uses of reduplication? (d) How do the predicative functions of reduplication relate to one another?

Previous cross-linguistic work on the functions of reduplication is reviewed in Section 2, with a particular focus on works that have made concrete proposals on the relations between functions. Questions (a)-(c) are addressed with a

2 This definition is meant as a comparative concept of the formal/semantic kind (Haspelmath 2010).

cross-linguistic survey, described in Section 3. With regard to question (b), the survey confirms earlier claims about the nature of predicative functions, finding that they tend to be concerned with the repetition of events, the plurality of participants in events, and the intensity of events. Question (c), concerning the ways in which reduplication is used iconically in predication, is approached by treating iconicity as a matter of degree. In addressing this question we focus on total reduplication (whereas for the other questions we cover both total and partial reduplication). We identify five iconicities—aspects of form that can be exploited iconically to express aspects of meaning—and we investigate which uses of total reduplication exploit which iconicities. Some of the iconicities are found to be dependent on others. The most important turn out to be the two most discussed in the literature: iconicity of identity (similar forms for similar events or participants) and iconicity of magnitude (more form for larger events, a greater number of participants, or greater intensity). These two iconicities have previously been treated as inseparable. It turns out, however, that in some functions one may occur without the other. Question (d), concerning the relations between functions, is addressed in Section 4 by the use of evidence from expression by a common form together with evidence from ambiguity. By these means we create a semantic map of 12 of the predicative functions. In Section 4 we also discuss the relationship between semantic affinity, iconicity and frequency. The main finding here is that for any of the pairs of functions found to be closely related, the iconicities of one function are always a superset of the iconicities of the other, a finding that is consistent with monotonic loss of iconicity as use is extended to new functions. Section 5 concludes the paper.

2 Previous studies of the functions of reduplication

There have been several previous cross-linguistic studies of the functions of reduplication. Some have sought to cover all possible functions across different propositional acts (Pott 1862; Key 1965; Moravcsik 1978; Regier 1994; Regier 1998; Rubino 2005; Fischer 2011; Michaelis et al. 2013), while others have covered a restricted range of functions (e.g. Bybee et al. 1994 on aspectual functions and Kajitani 2005 on meanings of augmentation, diminution, intensification, and attenuation). All of these surveys have been led in their sampling by what information is available from grammars, the so-called 'convenience sampling' method.

Table 1: Sample size in previous studies.

Bybee et al. (1994)	16 languages
Kajitani (2005)	16
Haiman (1980)[3]	24
Fischer (2011)	29
Key (1965)	47
Moravcsik (1978)	59
Atlas of pidgin and creole language structures online (Michaelis et al. 2013)	76
Graz database on reduplication (Hurch 2005)	82[4]
Regier (1998)	87[5]
Rubino (2005)	367

Sample sizes have varied widely, from 16 to 367 languages (Table 1). Some samples have been designed specifically with reduplication in mind, while others, such as Bybee et al. (1994) and Michaelis et al. (2013) have not. Bybee et al.'s (1994) sample is designed for studying tense, aspect and modality, regardless of the morphological means used, and Michaelis et al.'s sample is the APiCS database, designed for studying all aspects of pidgin and creole language structures.

Most previous surveys of the functions of reduplication have not been conducted quantitatively. Exceptions are Bybee et al. (1994) and Kajitani (2005)—which happen also to be based on the smallest samples—and Michaelis et al. (2013), which quantifies over a large number of languages but uses very broad categories.[6] Rubino (2005) gives the frequencies of three broad formal categories, but he does not quantify functions.[7]

Although most surveys have not been quantitative, some authors have nevertheless made claims about tendencies regarding function. Sapir (1921: 79) observes, for instance, that reduplication is "generally employed, with self-evident symbolism, to indicate such concepts as distribution, plurality, repetition, customary activity, increase in size, added intensity,

3 Haiman's survey focuses on functions that exhibit iconicity.

4 Of which 65 are relevant to predicative reduplication.

5 Of which 12 are from original sources, and the rest are from Moravcsik (1978), Niepokuj (1991), and Bybee et al. (1994).

6 Three categories are used by Michaelis et al. (2013) in the *Atlas of pidgin and creole language structures*: 'iconic', 'attenuating', and 'word-class-changing' (see Section 2.1 for details).

7 The three broad formal categories used by Rubino (2005) to classify languages are 'productive full and partial reduplication', 'full reduplication only', and 'no productive reduplication'.

continuance". Key (1965: 100) comments that "it seems evident that reduplication functions in many languages to indicate emphasis, or some shade of plurality or augmentative". Moravcsik (1978: 316) notes that the meanings of reduplication "strikingly recur across languages". And Regier (1998: 887) notes that "there is a core set of meanings [of reduplication] which recur so frequently and in so many languages as to demand explanation", referring to meanings of contempt, small, scatter, lack of control, plurality, intensity, affection, baby, continuity, and completion. And many authors have noted that iconicity motivates at least some of the functions of reduplication (see Section 2.1).

Some authors have identified particular functions as being in some way special. Moravcsik (1978: 317), for example, sees increased quantity as "the most outstanding single concept" expressed by reduplication, where what is increased in quantity may be "quantity of referents" or "amount of emphasis". And Regier (1994: 2) singles out repetition as the prototypical function of reduplication.

Functions that are most commonly mentioned in relation to predicative reduplication are aspectual meanings (especially repetition (8) and continuation (9)), the plurality of participants (10), and intensity (11). These functions may be expressed by various forms of reduplication, including both total and partial reduplication. Here they are illustrated with examples of partial reduplication.

(8) Repetition (Tonkawa; Hoijer 1946, cited by Key 1965: 89)
   a. *sa~salke*
      'to pull out repeatedly'
   b. *salke*
      'to pull out'

(9) Continuation (Siriono, Bolivia; Key 1965: 89)
   a. *erasi~rasi*
      'he continues being sick'
   b. *erasi*
      'he is sick'

(10) Plurality of participants (Samoan; Pratt 1862, cited by Moravcsik 1978: 301)
   a. *ma~mate*
      'they die'
   b. *mate*
      'he dies'

(11) Intensity (Arapesh; Conrad and Wogiga 1991, cited by Dobrin 2001)
a. *ri~ripok*
'hack up'
b. *ripok*
'cut'

A number of distinctions have been made among the uses of reduplication. Regier (1998) distinguishes between those meanings that are iconically motivated from those that are the result of semantic extension of iconically motivated meanings. Fischer (2011) makes a similar distinction between transparent and opaque functions—transparent functions being those that involve a clear iconic form-meaning relationship. Bybee et al. (1994) and Regier (1994) both distinguish between concrete meanings and attitudinal ones. The concrete meanings are ones that have to do with the observable properties of states of affairs (repetition, multiplicity of participants, and so on), and in that sense are objective, while the attitudinal ones are subjective (Traugott 2010), having to do with the speaker's (or some other conceptualizer's) experience of a state of affairs or stance towards it. Regier cites 'small' and 'baby' as "concretely referential" and 'contempt' and 'affection' as examples of "the attitudinal". Fischer (2011) distinguishes between denotative and connotative meanings, which again tend to be objective and subjective meanings.

All of these distinctions (iconically motivated/semantic extension, transparent/opaque, concrete/attitudinal, denotative/connotative) are interpreted as also having a diachronic dimension, the iconically motivated, concrete and denotative meanings being assumed to develop earlier in any given language, while the semantic extensions and attitudinal and connotative meanings are assumed to develop later.

Despite there being certain commonalities with regard to meaning, it has been remarked that the meanings of reduplication cannot all be united. Moravcsik notes that "the meanings that [reduplication] is an expression of [are not] all subsumable under general classes" (1978: 325), and Regier finds that there is "no simple abstraction over the set of meanings" (1998: 887). Indeed, it has often been noted that among the functions of reduplication there are some that are roughly opposite, e.g. augmentation/diminution, endearment/contempt, intensity/attenuation (e.g. Moravcsik 1978: 317, 322), although in most cases cited in the literature such opposite meanings either do not occur in the same language or if they do they are expressed by different forms of reduplication (e.g. Moravcsik 1978: 322, note 12).

2.1 Iconicity

The relation between form and meaning in language may be arbitrary or motivated. One important motivation is iconicity, which may be 'imagic', involving direct similarity between form and meaning, such as when animals are named by approximations of the sounds they make (e.g. *cuckoo*), or 'diagrammatic', where there is co-variation between aspects of form and aspects of meaning but no direct similarity between the two (Peirce [Buchler 1940]). Examples of diagrammatic iconicity are: the ordering of clauses according to the order of events referred to (Haiman 1980), variation as to how close the expression of semantic elements is according to how mutually relevant they are (Bybee 1985), and a greater or lesser degree of syntactic integration of clauses according to how semantically integrated they are (Givón 1980). Fischer (2000: 150) describes iconicity as "a natural resemblance or analogy between the form of a sign [...] and the object or concept [...] it refers to in [...] our perception of the world", where resemblance refers to the imagic kind of iconicity and analogy refers to the diagrammatic kind. Diagrammatic iconicity "is based on a *relationship* between signs that mirrors a similar relation between objects/concepts or actions" (Fischer 2000: 150; emphasis original). Imagic and diagrammatic iconicity both occur in predicative reduplication. However, in the present study we are concerned only with reduplication of items that are meaningful in their own right (see Section 3.1.1), and this effectively rules out cases of imagic iconicity, where the repeated elements are individually meaningless, as in many ideophones.

Bybee et al. (1994) treat iterative (i.e. repetition of actions on the same occasion, with no intervals between cycles), repetitive (i.e. repeated actions that occur on different occasions) and frequentative (i.e. frequently repeated action that occurs on different occasions) as being the most iconically coded of the aspectual functions of reduplication, because in these functions "repetition of the verb signals repetition of the action described by the verb" (1994: 167). Functions that are less iconically coded, according to them, include continuative, where the meaning is one of keeping on doing something, whether repetition of discrete actions or extendedness of non-discrete action is involved. For Regier (1998), reduplication iconically motivates three meanings equally: baby, repetition, and plural (these being the ones he also sees as original). The use of reduplication to express the meaning of 'baby' is motivated by an association between doubling and babies that arises from the fact that "babies themselves reduplicate extensively in learning to speak" (Regier 1998: 887), and adults mimic this with 'baby talk', a case of imagic iconicity. Regier treats the use of reduplication for meanings of repetition and plurality as 'self-explanatory'. He probably has in mind the kind of relationship that Bybee et al. (1994) describe,

where the repetition of forms reflects the repetition of events or—in the case of plurality—the multiplicity of things. Fischer (2011: 67) follows Moravcsik (1978) in treating reduplication as iconically expressing the general meaning of increase in quantity, but divides this into increase across space (meanings such as repetition, plural, spread) and increase within the same space (intensity, augmentation).

Like Regier, Moravcsik (1978), Bybee et al. (1994) and Fischer (2011) all treat iconic uses of reduplication as being the first to emerge in any given language. Bybee et al. single out the iterative function in particular as being the earliest meaning to develop, based on the fact that it is the most frequent function in their small sample. The *Atlas of pidgin and creole language structures online* (Michaelis et al. 2013) makes a broad distinction between 'iconic functions' (intensity, iteration, plurality and distributivity) and 'attenuating functions' (meanings of "to a reduced degree"). They find iconic functions to be considerably more frequent among pidgin and creole languages than attenuating functions (iconic uses in 43 languages, attenuating in 14 languages).

In many discussions of iconicity, including in relation to reduplication, iconicity is treated as a binary phenomenon: the expression of a particular meaning with a particular form is either iconic or not. If it is not iconic it is arbitrary. However, both form and meaning have various aspects to them, and in principle, any aspect of form may iconically express some aspect of meaning. Speakers may exploit more or fewer aspects of form iconically in expressing various aspects of meaning. On this view, iconicity can be a matter of degree.

Some authors have alluded to the possibility of degrees of iconicity, but as far as we are aware there are no precise accounts of what it means for one function to be more iconically expressed than another. With regard to reduplication, Bybee et al. (1994: 167) suggest that cases of total verb reduplication "are maximally iconic at their origins", with repetition of the verb describing repeated action. Functions such as continuative that subsequently develop through extension of use involve a lesser degree of iconicity. Kouwenberg & LaCharité (2001: 80) also imply that iconicity in reduplication is a matter of degree, saying that there is "a continuum with iconic and non-iconic interpretations at its extreme ends". However, they are not explicit about how the different functions are positioned on that continuum.

Perniss & Vigliocco (2014: 3) discuss degrees of iconicity in relation to imagic iconicity. They note that an iconic mapping

> can exhibit varying degrees of *abstraction*. That is, the iconic form can differ in the extent or degree to which it resembles its referent (from more direct to more indirect resemblance).

Discussing British Sign Language signs like those in Figure 1, they note that a sign like PUSH (Figure 1a) is directly imitative, involving almost the same gesture as would be involved in an actual act of pushing, while the sign for TREE (Figure 1b) involves a greater degree of abstraction, with scaling down from tree-size to body-size and selective representation of parts of the tree. In these terms, PUSH would involve a higher degree of iconicity than TREE. However, the diagrammatic kind of iconicity that is the concern of the present paper is not addressed.

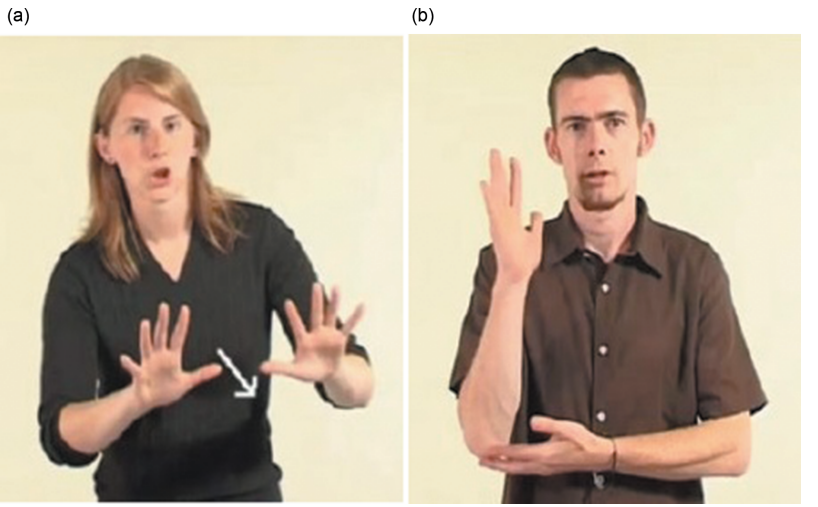

Figure 1: Degrees of abstraction in British Sign Language signs (Perniss & Vigliocco 2014). a. PUSH; b. TREE

In Section 3.2.4 we describe an approach to iconicity in terms of relationships between individual formal features and individual aspects of meaning, and we apply this approach in analyzing the iconicity of the predicative functions of reduplication.

2.2 Previously proposed networks of functions

There have been several previous attempts to establish relationships between the functions of reduplication. Four works are of particular interest because they make precise proposals about the relationships among a relatively large number

of functions. These are Bybee et al. (1994), which focuses on aspectual functions (a subset of the predicative functions), and Regier (1994, 1998) and Fischer (2011), which cover reduplication across all morphosyntactic categories. Regier's 1998 proposal supersedes his 1994 one, and will therefore be focused on here. Each of these works includes a network of functions in which nodes represent either individual functions or (for some nodes in Fischer's network) groups of functions, and connections between nodes represent various kinds of relation between the functions (semantic affinity, semantic extension/semantic shift, and in Fischer's case also categorization). In Section 3 we will present a network of our own, covering the predicative functions, and so these earlier proposals will be of particular interest, since they cover some of the same ground as we seek to do.

Bybee et al. (1994) propose the network in Figure 2 for the aspectual functions of reduplication.

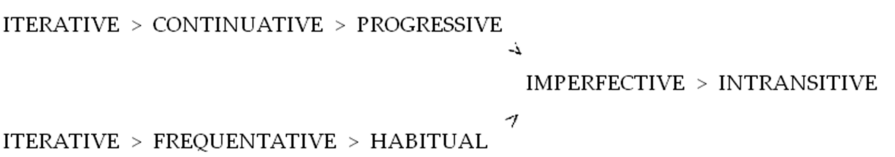

Figure 2: Bybee et al.'s (1994: 172) network. 'X > Y' means 'X develops earlier than Y' or 'Y develops later than X'.[8]

Regier (1998) and Fischer (2011) seek to cover the use of reduplication across all propositional acts (a superset of the domain covered by the present study). Their networks are shown in Figures 3 and 4 respectively.

Regier and Fischer do not define their functions precisely (although they do give examples). This makes comparison between the proposed networks somewhat difficult. Bybee et al. (1994) do give precise definitions of the functions they work with. There is further discussion of their functions in Section 3.2.1.

All of the accounts of the relations between functions focus on diachronic development—Bybee et al.'s (1994) "semantic development" and "extension", Regier's (1998) "semantic extension", and Fischer's (2011) "pathways" and "metonymic shifts".[9] However, these diachronic connections between functions may also represent the synchronic relation of semantic affinity—Bybee et al.'s

8 We infer these interpretations from the way Bybee et al. use '>'. There is no explicit statement of what it means.

9 Diachronic relations between two functions are indicated by Bybee et al. and Fischer with '>' and by Regier with arrows. In Fischer there are also diachronic relations between the functions that precede and follow the words "via semantic shift" in Figure 4.

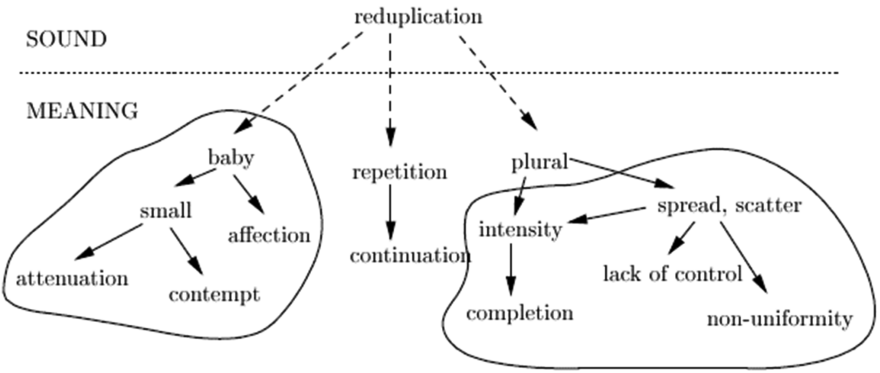

Figure 3: Regier's (1998: 888) network. The dashed arrows represent iconic sound-meaning relationships, and the solid arrows indicate semantic extension. (The two circled sets of functions represent polysemies that are attested in non-reduplicative constructions.).

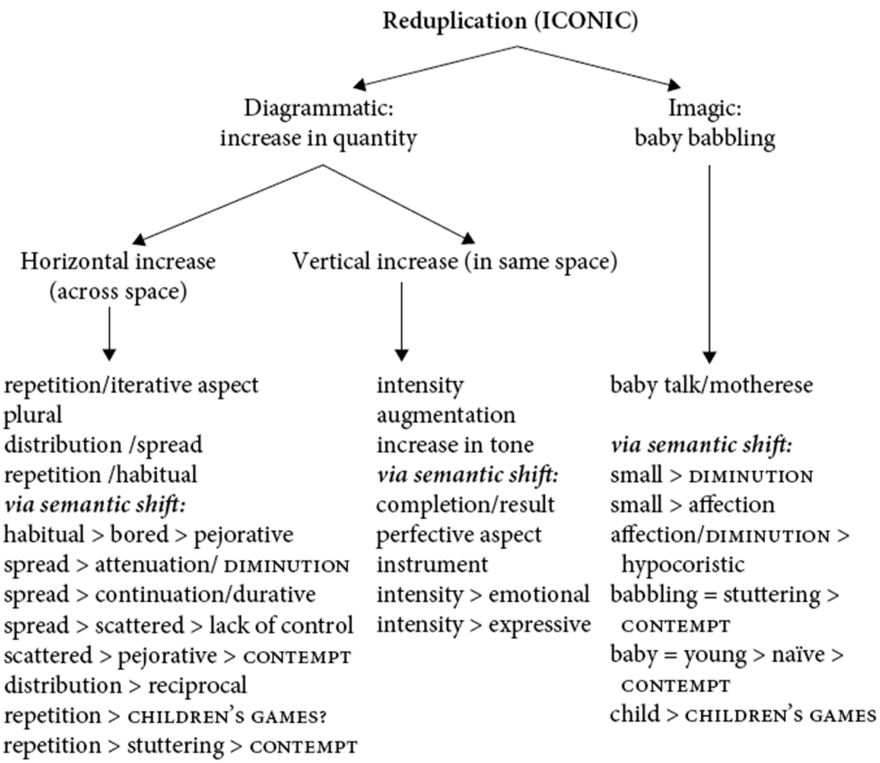

Figure 4: Fischer's (2011: 67) network. The arrows indicate subcategories within the overall category of iconicity, and '>' represents semantic shift.

(1994) "overlap" in meaning, Regier's (1998) "conceptually closely related" meanings, and Fischer's (2011) "cognitive connections", "related" meanings, and "meaning associations".

2.2.1 Basis for establishing connections

The connections in all of the proposed networks are established primarily on the basis of reasoning about semantic affinity. Regier (1998: 888), for instance, says of his network that "[l]inks between senses are initially posited on the basis of apparent conceptual relatedness".

Another possible means of establishing relations between functions is expression by a common form. Anderson (1986: 279) describes the basis for this approach as follows: "If two particular meanings are often expressed by the same surface form (across a random sample of languages), then we can generally infer that the two meanings are similar for the human mind." This is the basis of the semantic map approach (e.g. Haspelmath 2003), described in Section 4.1.2 and applied to predicative reduplication in Section 4.2.5. Bybee et al. (1994) make use of expression by a common form among the aspectual functions of reduplication in establishing diachronic relations between them, saying that "multiple overlapping uses" of forms are used "in order to postulate paths of development" (1994: 49)—'overlapping uses' implying semantic affinity. Fischer (2011) makes limited use of expression by a common reduplicative form, citing an {aspectual, plural, reciprocal} polysemy in German Sign Language in support of part of her network.

Regier (1998) and Fischer (2011) also both make use of expression by a common form in an indirect way. They seek to corroborate the connections they posit between reduplicative functions by appealing to connections found between the same functions in non-reduplicative constructions. By this method "we may expect to find a non-reduplicative linguistic form that expresses an entire subtree of the senses in this graph" (Regier 1998: 888).[10] Regier uses the Russian prefix *raz-*, expressing meanings {scattering/spreading out, completive, lack of control}, to corroborate one region of his network of functions (the functions circled on the right of Figure 3), noting that "the semantic sharing of an entire cluster of senses with a linguistic form that is not itself doubled [i.e. reduplicated—YL/DP] suggests a conceptual basis for the particular set of senses

10 This is the principle behind Croft's (2001) Semantic Map Connectivity Hypothesis, which says that "any relevant language-specific and construction-specific category should map onto a CONNECTED REGION in conceptual space" (2001: 96).

observed" (Regier 1998: 888). Underlying this approach is a view that conceptual relatedness is robustly tested only if the functions concerned are expressed by more than one formal means. Fischer uses German *ge-*, expressing {perfective, result, collective, repetition, deverbal noun, instrumental noun, pejorative}, to corroborate part of her network.[11] It should be stressed, however, that neither Regier nor Fischer implements this approach systematically. Rather, they apply it in support of just a few connections in their proposed networks.[12]

Differences in the frequency with which functions are attested across languages are not addressed by Regier (1998) or Fischer (2011). Bybee et al. (1994) do seek to draw one conclusion based on cross-linguistic frequency. Given that iterative is the most frequent function in their sample (as well as being iconically expressed by reduplication), they conclude that it is the original function (i.e. the first to develop in any given language) and therefore make it the start node in their directed network. However, in view of the small size of their dataset (16 languages for reduplication), this cannot be seen as a robust conclusion.

While Bybee et al. make use of the frequency of individual functions in establishing their network (albeit based on very small counts), neither they Regier nor Fischer use the frequency of expression by a common form in establishing the relationships between functions. We return to this topic in Section 4.2.3.

2.2.2 Network topology

All of the proposed networks (Bybee et al. 1994; Regier 1998; Fischer 2011) include at least one node that has more than one parent node. That is, none of the networks is strictly radial (or tree-like). But Fischer's network stands out as being somewhat more interconnected than the others (despite being presented visually as a tree).[13] Fischer has five functions that are dominated by two or more other functions: diminution < {spread, small}, contempt < {pejorative, stuttering, naïve}, children's games < {repetition, child}, pejorative < {bored, scattered}, and stuttering < {repetition, baby talk/motherese}. These are

11 In fact, only two of these functions—collective and repetition—turn out to be relevant.

12 It is not clear why Regier and Fischer find it necessary to appeal to expression by a common form *outside* the domain of reduplication when other work in semantic mapping does not do this.

13 It is worth noting that in Bybee et al.'s case, they included functions on their network diagram only if evidence of diachronic connections was found, a requirement that does not apply to the other networks discussed here.

described as "associative links between [...] two roots" (Fischer 2011: 67). Another feature of Fischer's network is that some of its nodes represent groups of functions, rather than individual functions. The functions in these groups—{repetition, plural, distribution/spread, habitual} and {intensity, augmentation, increase in tone}—are not ranked in terms of how closely related they are; nor are the functions ordered in terms of diachrony.[14]

In Regier's (1998) network, baby, repetition, and plural are all child nodes of a 'reduplication' node. Fischer's (2011) network divides reduplication into two branches, representing two kinds of iconicity—diagrammatic 'increase in quantity' and imagic 'baby babbling'—the diagrammatic branch splitting into functions involving "[increase] across space" ('horizontal increase') and "[increase] in [the] same space" ('vertical increase'). Bybee et al. (1994) have a single root function—iterative—but, for reasons that are not clear, their network is drawn with two separate root nodes, both labelled 'iterative'. Two divergent paths converge on a single terminal node (intransitive). Bybee et al.'s, Regier's and Fischer's accounts all recognize meanings relating to repetition as being among the original functions in a given language.

It is worth noting that in all three proposals all functions are connected in a single network. This need not be the case: in principle some functions might bear no identifiable relation to other functions in terms of semantic affinity or diachrony. But according to Bybee et al., Regier and Fischer, all functions *are* related.

2.2.3 Differences between proposed networks

There are a number of differences between the networks proposed by Bybee et al., Regier and Fischer, in terms of the sets of functions they recognize and in the way the functions are arranged in the network. Those differences that are of relevance to predicative reduplication are presented below.

D1 Regier treats plural as distinct from repetition, whereas Fischer treats the two functions as belonging to a single category.
D2 Fischer treats continuative as an extension of spread, whereas Bybee et al. and Regier both treat it as an extension of iterative (or repetition).
D3 Bybee et al. treat iterative as diachronically earlier than habitual, whereas Fischer treats habitual as being equally as early as iterative.

14 It is unclear whether all the functions in each group appear simultaneously, whether extension is multidirectional, or whether Fischer is simply leaving aside the question of diachrony among these functions.

D4 Bybee et al. cover intransitive, whereas Regier and Fischer do not.
D5 Regier treats spread/scatter as an extension of plural, whereas Fischer treats spread as being among the original functions and scattered as derived from spread.
D6 Regier treats intensity as an extension of both plural and spread/scatter, whereas Fischer treats it as original (and in a different category from plural).
D7 Although Regier and Fischer both treat completive as an extension of intensity, in her text, Fischer (2011: 66) treats it also as an extension of iterative, whereas Regier does not make this connection.

These differences will be reviewed in Section 4.4 in light of the findings of the present survey, which is described next.

3 Survey of the uses of reduplication in predication

In this section we survey the predicative functions of reduplication across a relatively large sample of 108 languages. Following methods described in Section 3.1, we identify the set of functions and compare the present results with those of previous surveys (Section 3.2.1). We also describe the frequency with which each occurs cross-linguistically (Section 3.2.2). On the basis of the results of the survey we discuss trends as to the semantic nature of the functions (Section 3.2.3) and we detail how reduplication is used iconically in the domain of predication (Section 3.2.4). The results will provide the basis for investigating the relations between functions in Section 4.

3.1 Method

3.1.1 Data collection

The data for the survey come from grammars of individual languages (including information from grammars in the Graz Database on Reduplication [Hurch 2005][15]) and from literature on reduplication (see Appendix A for details). In

15 The starting point for the Graz database is the 100-language sample of the WALS database (Haspelmath et al. 2005). According to our counting, the Graz database covers reduplication in 82 languages, of which 65 involve predicative reduplication. It provides details on the

this survey we are interested in both the range of predicative functions and their frequency across different languages. It was clear at the outset of the study that the predicative use of reduplication does not occur in all languages. Therefore, sampling was led by which languages use reduplication in predication, rather than imposing a prior selection of languages. This approach is advocated by Bybee et al. (1994: 173–74) for studying reduplication and is followed by a number of previous surveys. In fact, sampling is also constrained by what grammars are available (which in turn depends on what languages have been studied). The approach followed was to gather data from any language that was found to use reduplication in predication. As a result of following this approach, a number of language families (e.g. Australian, Austronesian, Uto-Aztecan) are represented in the sample by several languages.

Certain problems arise in using grammars for information on the functions of reduplication. One is that treatments of reduplication often focus on formal aspects, with function being either covered briefly or not at all. Even when function is addressed, given space limitations and the constraints of fieldwork, only a subset of the range of uses may be recorded. A reviewer notes, for instance, that expressive functions are seldom covered in grammars. We make the assumption that possible unrepresentativeness at the level of individual languages is compensated for by sampling over a large number of languages.

Examples of reduplication are included in the present database where they meet certain criteria. These are: (a) the base form must be meaningful in its own right; (b) a specific semantic contribution must be identifiable for reduplication, from glossing or translation[16]; and (c) reduplicated and base forms must both be used predicatively (excluding, for example, cases of action nominalization, where the reduplication of a predicate construes an event as an entity).

Data collection following this method yielded examples of the predicative use of reduplication from 108 languages. The languages are distributed over five Ethnologue areas (Lewis 2009) and 38 language families, according to WALS (Haspelmath et al. 2005) and Ethnologue. For each language there are one or more examples of reduplication in the database, where 'example' is a

"functions, meanings, formal properties, and [...] distribution" of the phenomenon of reduplication (Hurch & Mattes 2009: 302).

16 In some cases reduplication leaves the meaning of the base form unchanged. This meets the requirement here, because the contribution to meaning (none in this case) is clearly identifiable. We call this the 'no change' function.

reduplicated form with known functions, possibly supported by an example sentence. Each example exhibits one or more functions.[17]

3.1.2 Coding

Each example is coded for form and function. As noted in Section 1, function is the main focus, but in order to investigate iconicity (Section 3.2.4) and the semantic relations between functions via expression by a common form (Section 4.2) it is necessary to distinguish between different kinds of reduplicative form within a language. Coding of function was done collaboratively by the two authors for all examples following the process described in Section 3.1.2.2 below.

3.1.2.1 Form

Each example is coded according to the four formal parameters mentioned in Section 1:

- number of copies of the base
- total vs. partial reduplication
- copy before, after or embedded within the base (partial reduplication only)
- copy is initial, medial or final part of base (partial reduplication only)

In Section 4 we use these distinctions in identifying cases of polysemy, where language users employ the same form to express distinct but related meanings (see Section 4 for details). The third and fourth parameters above (position of copy with respect to base, portion of base that is copied) are broad formal distinctions within partial reduplication which we assume are salient for language users. Further formal variation, such as between the copying of one syllable or of two, is also found (see Moravcsik 1978: 308–314 for details), but we assume that such distinctions will be treated by language users as less salient. Therefore, in our methodology, uses of partial reduplication within a language that differ on the third and fourth parameters are treated as involving different forms, and therefore not relevant to polysemy. Examples of partial reduplication that differ in other ways will be treated as having the same form, therefore having the potential for polysemy.

17 It is imaginable that further functions may be identified for a language based on data outside our database. Therefore, the functions in each language should not be taken as exhaustive.

3.1.2.2 Function

Functions are pairings of a label and a definition. The functions adopted here are chosen for the purpose of identifying trends in the predicative uses of reduplication across languages (question (b) in Section 1).[18] The procedure for arriving at the set of functions involves two steps. First, preliminary labels are assigned to the examples collected. Second, these preliminary labels are revised, and labelling is standardized. Both steps depend on identifying the contribution that is made by reduplication to the meaning of an example. This is done by comparing the glossing/translation of the reduplicated and the base-form meanings, possibly supported by the information provided by an example sentence. At each stage in this two-stage procedure the authors arrived at an agreement on the coding of each example.

Moravcsik (1978: 316) observes that reduplication tends to add to the meaning of the base form (her relation of 'proper inclusion'). Where this is the case, a specific contribution by reduplication to the meaning of an utterance can be identified by excluding the contribution of the base form itself (in the present case, a predicate). In some cases meaning is added not by reduplication alone, but jointly by reduplicating the base and adding other elements, such as affixes, particles, or adverbials. For example, in (12) below, reduplication and *-tuk* jointly contribute the meaning of continuity. In the approach taken here, if reduplication jointly contributes in this way to achieving a certain meaning, then it is taken as having that meaning, and the contribution of other elements is ignored.

(12) Pochutla (Langacker 1977: 129)
  a. *ko~koš-tuk*
     RED~sleep-PROG
     'is sleeping'
  b. *koš*
     'sleep'

In labelling functions, the grammarian's own label is sometimes used, while in other cases a different label is used. There are two reasons why the grammarian's original label is not always used. First, different grammarians may use the same label for different functions. For example, Mithun's (1999: 475) "repeated motion" corresponds to our ITERATIVE, and Kuipers' (1967: 101) "repeated action" corresponds to our DURATIVE-ITERATIVE. Second, different grammarians may use different labels for the same function. For example, our function of FREQUENTATIVE is sometimes referred to as 'plurality' (Wolfenden 1971), and

18 They are comparative concepts of the semantic kind (Haspelmath 2010).

sometimes as 'frequentivity' (Haji-Abdolhosseini et al. 2002). In some cases functions are illustrated in grammars without being labelled or defined. In such cases it is necessary either to create a new function (label-definition pair) or to use one already used elsewhere in the literature or already part of the coding system.

The choice of functions, and in particular, decisions on whether to make meaning distinctions or not, is a balance between the needs of quantification, which favours fewer distinctions, and the need to capture the full range of meanings, which favours more distinctions. These decisions were partly guided by (a) whether the distinction is repeatedly made in non-reduplicative constructions cross-linguistically, and (b) whether a distinction has a formal reflex in at least one language (Bybee et al. 1994; Croft 1998; Haspelmath 2003).[19] For example, a distinction between DURATIVE-CONTINUATIVE and CONTINUATIVE is justified on the basis that in Mokilese these functions are distinguished formally: DURATIVE-CONTINUATIVE is expressed by total triplication (example (13a)), and CONTINUATIVE is expressed by total reduplication (example (13b)).

(13) Mokilese (Harrison 1976)
  a. *roar~roar~roar*
     'to continue to shudder'
  b. *roar~roar*
     'to be shuddering'
  c. *roar*
     'to shudder'

Each example is coded with one or more functions. An example has more than one function in either of the following cases: (a) the meaning described by the grammarian corresponds to more than one meaning in our set of functions (in example (14) below, the grammarian's original description of the function is "action was or is being performed to excess" (Dixon 1972: 251), whereas our labels are DURATIVE-ITERATIVE and EXCESS); (b) the use of reduplication is ambiguous between two or more meanings (see examples (19)-(20) in Section 4.2.4).

(14) Dyirbal (Dixon 1972: 251)
  a. *balgabalgan*
     'hit too much'
  b. *balgan*
     'hit'

19 The rationale for this is that speakers are likely to use distinct forms to code what they perceive to be distinct meanings, which is the corollary of the principle discussed in Section 2.2.1.

3.2 Results

3.2.1 Set of functions

Following the coding procedure described above, a set of 45 functions was arrived at. These are listed in Appendix B. The set is larger than any previous classification of the predicative functions of reduplication.

Functions that are found in the present survey but not reported in previous studies are OSCILLATING and PURPOSIVE, both low in frequency. One function that overlaps with functions reported in the literature but which is given a different label here is SCENE-SETTING (an imperfective backgrounded situation), which overlaps with imperfective in Bybee et al.'s categorization. We use the label 'continuative' differently from Bybee et al. For them it means "keep on doing what is being done" (1994: 317). We use it only in cases involving non-discrete (non-cyclic) events. Bybee et al.'s continuative covers our DURATIVE-ITERATIVE (discrete) and DURATIVE-CONTINUATIVE (non-discrete). We split Bybee et al.'s progressive function into ITERATIVE and CONTINUATIVE, distinguishing the ongoing meaning of repetition of a discrete event (ITERATIVE) from the ongoing meaning of continuation of a non-discrete event (CONTINUATIVE).

Finer distinctions are made in the present survey than in previous studies among functions involving plural participants. We recognize: MULTIPLE SUBJECT, MULTIPLE OBJECT, MULTIPLE LOCATION, DISTRIBUTIVE SUBJECT, DISTRIBUTIVE OBJECT, EXHAUSTIVE SUBJECT, and EXHAUSTIVE OBJECT. (See Appendix B for definitions.)

Finally, apart from surveying a larger range of functions, the present survey differs from previous ones in yielding information on the relative frequency of functions across languages.

3.2.2 Frequency of functions

Large differences in frequency are found between the functions. The most frequent function, ITERATIVE[20] (i.e. repetition of an event on the same occasion), occurs in 44 languages, while at the opposite end of the frequency ranking there are eight functions which are found in just one language each (PERFECT, CAUSATIVE, PAST, NEGATIVE, EXHAUSTIVE SUBJECT, DUAL LOCATION, DUAL SUBJECT, OSCILLATING). The frequencies of all the functions are given in

20 We use small capitals to distinguish our functions from those used in the literature, which may be differently defined.

Appendix B. The distribution of the functions in terms of frequency follows a power law.

3.2.3 Nature of functions

As claimed in the literature for reduplication in general, many of the predicative functions of reduplication can be characterized as involving an increase in quantity. This covers both increase in the quantity of discrete entities (plurality) and events (repetition) and of non-discrete properties (intensity) and events (continuity), with functions such as those illustrated in (8)-(11). In addition there are other meanings in the sample that do not fit these broad categories, including meanings of attenuation (of intensity or tone), pretence, randomness, perfectivity and negation. An example involving attenuation is (15).

(15) ATTENUATIVE OF EXTENT (Plateau Malagasy; Keenan and Polinsky 2001)
   a. *hadìno~díno*
      'forget a bit'
   b. *hadíno*
      'forget'

Meanings having to do with repetition of some sort are: ITERATIVE (44 languages), DURATIVE-ITERATIVE (41), FREQUENTATIVE (18), HABITUAL (11), REPETITIVE (6), CONSECUTIVE (2), and OSCILLATING (1). Those having to do with a multiplicity of participants are: MULTIPLE SUBJECT (20), MULTIPLE LOCATION (19), MULTIPLE OBJECT (9), DISTRIBUTIVE OBJECT (9), RECIPROCAL (9), DISTRIBUTIVE SUBJECT (4), EXHAUSTIVE OBJECT (4), EXHAUSTIVE SUBJECT (1), DUAL LOCATION (1), and DUAL SUBJECT (1).[21] And meanings having to do with the extended (continued) nature of non-discrete events are: CONTINUATIVE (28),[22] DURATIVE-CONTINUATIVE (24), and GRADUAL (2). It is clear from this that aspectual meanings[23] to do with repetition and extendedness are important as they are frequently expressed by predicative reduplication across languages. Also important are meanings having to do with the multiplicity of participants in an event.

21 Note that some of these meanings also have to do with the spatial distribution of actions or participants.

22 Differences between the present definition of continuative (see Appendix B) and that of Bybee et al. (1994) are discussed in Section 3.2.1.

23 Following Comrie's (1976: 3) definition of aspect as being concerned with "different ways of viewing the internal temporal constituency of a situation".

INTENSIVE meaning stands out as being frequent (occurring in 38 languages) but involving neither repetition, plurality, nor extendedness. The opposite meaning, ATTENUATIVE OF INTENSITY, is also quite common (17 languages). The meaning of intensity that is coded in the present survey as intensive may pertain either to the event itself or it may have to do with the result of the event (see also Fischer 2011: 66).

There are other meanings too that have to do with the results of events: COMPLETIVE (16 languages), PERFECT (1), and EXCESS (2). An example of COMPLETIVE is (16).

(16) COMPLETIVE (Tagalog; Schachter and Otanes 1972: 339)
  a. *magka-basag~basag*
     'get thoroughly broken'
  b. *ma-basag*
     'get broken'

Among the more minor areas of meaning are attitudinal meanings in which a subjective attitude towards an event or state of affairs is expressed.[24] EXCESS falls into this category, as do RANDOM (4 languages) and PRETENCE (3). ATTENUATIVE OF TONE (3) may be seen as an intersubjective meaning in Traugott's (2010) sense of "speaker's attention to addressee self-image" (2010: 32). Like meanings to do with the results of events or states of affairs, meanings to do with attitude towards an event or a state of affairs may be regarded as less centrally involved in the main business of predication, being peripheral to the event or state of affairs itself.

There are also various low-frequency functions that do not belong to any of the above groupings.

As observed in the literature, a number of pairs of functions have roughly opposite meanings, e.g. INTENSIVE/ATTENUATIVE OF INTENSITY, EMPHATIC/ATTENUATIVE OF INTENSITY, CONTINUATIVE/COMPLETIVE, and TRANSITIVE/INTRANSITIVE. Moreover, the INTENSIVE/ATTENUATIVE OF INTENSITY pair of opposites are expressed by the same form in six languages in the sample, showing that a single form can have seemingly contradictory uses.

24 A reviewer suggests that the low frequency of such meanings may be due to under-reporting in grammars. However, an alternative explanation is that the more cross-linguistically frequent meanings are the original functions in any given language, and these less frequent meanings are ones that develop through later extension of use. Such a scenario is proposed in Section 4.3.

3.2.4 Iconicity

As noted in Section 2.1, discussions of iconicity in the use of reduplication generally treat it as a binary matter: the use of reduplication to express a given meaning is either iconic or not. Regier (1998) and Fischer (2011) both treat iconicity this way. In fact, however, there are several different aspects of reduplicative forms that may each be in an iconic relationship with some aspect of the meaning that is expressed. In a given use of reduplication these individual *iconicities* may then be exploited singly, multiply, or not at all. Focusing on *total* reduplication we identify here five formal features that bear an iconic relationship to some aspect of meaning in at least one of the functions found by our survey. These features were arrived at by going through all the functions and asking, for each, what specific aspects of total-reduplicative form are in an iconic relationship with some aspect of meaning in that function. Form is thus held constant, and what varies is the nature of the form-meaning relation. The result is the set of five iconicities in Table 2. All five iconicities are mentioned in the literature, but only two (which we call Identity and Magnitude) are mentioned in relation to reduplication.

For example, the REPETITIVE meaning ("episodes happening repeatedly with intervals in between"—see Appendix B) expressed with total reduplication involves Identity (identical forms corresponding to similar episodes), Magnitude (repetition of the form corresponding to a larger overall event), Discreteness (discrete forms corresponding to discrete episodes), and Sequentiality (sequentially uttered forms corresponding to episodes occurring in sequence). But it does not involve Proximity, since the repeated episodes happen at intervals, despite the reduplicated copy and the base being uttered close together.

The five iconicities—Identity, Magnitude, Discreteness, Proximity, and Sequentiality—are not necessarily of equal importance. In particular, they may not be equally salient, and so perhaps not equally readily exploited. The iconicity of Identity is almost unique to reduplication,[25] whereas the other four iconicities are all instantiated by means of expression other than reduplication, such as affixation or compounding. Given the near-uniqueness of Identity in reduplication, it may be that language users may pay special attention to this kind of iconicity.

A number of authors observe that reduplication is often used to express a meaning of increase. Moravcsik (1978: 317), for example, sees reduplication as

25 The only other means of expression we are aware of that exploits Identity are alliterative agreement, such as is found in Bantu noun-class prefixes and European (e.g. Italian, Russian) number/gender suffixes, and lengthening, as in "He is bi-i-i-i-ig!" (Lakoff & Johnson 1980: 127).

Table 2: Iconicities attested in the uses of total reduplication.

Identity	The identical form of the base and the copy of it may reflect identical events, entities, etc.[26]
Magnitude	The increase in phonological bulk when the base is reduplicated may reflect an increase in the magnitude of the event, entity, or quantity that is expressed, or of a group of events or entities.[27]
Discreteness	The discreteness of the base and its copy may match discreteness in the events, entities, etc. that are denoted.[28]
Proximity	The adjacency of the base and its copy may reflect the close temporal proximity of events or spatial proximity of entities.[29]
Sequentiality	The uttering of the base and its copy in sequence may reflect the occurrence of events in sequence. (Limited to events.)[30]

having to do with increased quantity, while Fischer (2011: 55) notes that reduplication expresses "a cognitive increase of some sort", the nature of the increase depending on the semantic class of the reduplicated item. Such meanings of increase are what we treat under the label of Magnitude. Lakoff & Johnson (1980: 128) say that in all uses of reduplication known to them "MORE OF FORM stands for MORE OF CONTENT". 'More of content' may be understood to mean more of *the same kind* of content. So, for example, if the meaning of the base form has to do with an event of some kind, then 'more of content' means more of that kind of event. The meaning of sameness comes under our heading of Identity. Thus Lakoff & Johnson's formula involves two iconicities in our

26 Haiman (1980: 516, footnote 3) cites Anttila (1972: 89) as saying that "language has a general iconic tendency whereby semantic sameness is reflected also by formal sameness".

27 For Magnitude to be perfectly exploited, the number of tokens of the stem/root would have to exactly match the number of events or entities expressed. In actuality this rarely happens. By far the most common case is the imprecise relation where two tokens stand for two or more events/entities. One exception is the use of reduplication in Luiseño (Rubino 2005: 115) to express doing something exactly twice. Magnitude is somewhat related to Givón's (1994) 'quantity principle'. One kind of iconicity under this heading is where "[a] larger chunk of information will be given a larger chunk of code" (1994: 49).

28 Conradie (2003: 214) briefly discusses how "the end of one lexeme and the beginning of another in the middle of the unit, i.e. a clear morphological break [...] can be employed to signal an interruption in durative action" in verb reduplication in Afrikaans.

29 Compare Haiman's (1983: 782) iconicity of distance and Givón's (1994) 'proximity principle'.

30 Compare cases of word-order iconicity mentioned by Haiman (1980), with references to Jakobsen and Greenberg cited there, and Givón's (1994) 'semantic principle of linear order'.

analysis—Identity and Magnitude—and we treat them as potentially exploitable separately.[31]

In order to discover precisely what kinds of iconic relationship are involved in the predicative uses of reduplication, we coded which of the five iconicities listed in Table 2 occur in the expression of each function. We restricted our attention to total reduplication, coding only those functions that are expressed in at least one language by total reduplication. This was done because it is clearer with total reduplication than with partial reduplication that the doubling of the base is noticeable to speakers and therefore in principle manipulable by them for expressive purposes. Coding was done separately by the two authors, and differences were then resolved. There were 35 functions that were expressed by total reduplication in at least one language. This multiplied by 5 (the number of iconicities) gives 175 total iconicity values to be coded by each coder. There was initially agreement between the coders on 157 (89.7%) of the values. Cohen's Kappa of 0.789 (95% CI: from 0.696 to 0.881) indicated strong agreement. The results of the coding, following resolution of differences, are shown in Table 3.

First, we may note that the number of iconicities ranges from five (in the expression of CONSECUTIVE, DURATIVE-ITERATIVE, ITERATIVE, and OSCILLATING meanings) to none (ten different functions). Second we may observe that Identity and Magnitude occur in a larger number of functions (22 and 20 respectively) than the other features:

Identity	22
Magnitude	20
Discreteness	15
Proximity	9
Sequentiality	9

It turns out that the five iconicities are not all independent of each other. Three of them—Discreteness, Proximity, and Sequentiality—occur only if one of the other two features—Identity or Magnitude—also occurs ('→' means 'implies'):

Discreteness	→	Identity *or* Magnitude
Proximity	→	Identity *or* Magnitude (often both)
Sequentiality	→	Identity *and* Magnitude *and* Discreteness

31 Compare Fischer (2011: 64–65) who argues that identity of form is needed for there to be an iconic notion of increase: "the isomorphism (and thus the 'increase') only works if the stem itself [is] repeated, not when some other morpheme […] is added to the stem".

Table 3: Iconicities found in the uses of total reduplication. '+' means that the particular kind of iconicity occurs in the function in question. '-' means that it does not occur in that function.

Function	Identity	Magnitude	Discreteness	Proximity	Sequentiality
ATTENUATIVE OF EXTENT	-	-	-	-	-
ATTENUATIVE OF INTENSITY	-	-	-	-	-
ATTENUATIVE OF TONE	-	-	-	-	-
CAUSATIVE	-	-	-	-	-
COMPLETIVE	-	+	-	-	-
CONSECUTIVE	+	+	+	+	+
CONTINUATIVE	+	-	-	+	-
DISTRIBUTIVE OBJECT	+	+	+	-	-
DISTRIBUTIVE SUBJECT	+	+	+	-	-
DURATIVE-CONTINUATIVE	+	+	-	+	-
DURATIVE-ITERATIVE	+	+	+	+	+
EMPHATIC	-	+	-	-	-
EXCESS	+	+	-	-	+
EXHAUSTIVE OBJECT	+	+	+	-	-
EXHAUSTIVE SUBJECT	+	+	+	-	-
FREQUENTATIVE	+	+	+	-	+
GRADUAL	+	-	-	-	+
HABITUAL	+	+	+	-	+
INTENSIVE	-	+	-	-	-
INTRANSITIVE	-	-	-	-	-
IRREALIS	-	-	-	-	-
ITERATIVE	+	+	+	+	+
MULTIPLE LOCATION	+	+	+	-	-
MULTIPLE OBJECT	+	+	+	+	-
MULTIPLE SUBJECT	+	+	+	+	-
NO CHANGE	-	-	-	-	-
OSCILLATING	+	+	+	+	+
PRETENCE	-	-	-	-	-
RANDOM	-	-	-	-	-
RECIPROCAL	+	+	+	+	-
REFLEXIVE	+	-	-	-	-
REPETITIVE	+	+	+	-	+
SCENE-SETTING	+	-	-	-	-
STATIVE	+	-	-	-	-
TRANSITIVE	-	-	-	-	-

These facts suggest a special status for Identity and Magnitude. Focusing on these two iconicities, we find that they tend to occur together, though they can also occur separately:

+ Identity	+ Magnitude	17
+ Identity	-Magnitude	5
-Identity	+ Magnitude	3
-Identity	-Magnitude	10

Identity occurs without Magnitude in the expression of CONTINUATIVE, GRADUAL, REFLEXIVE, SCENE-SETTING, and STATIVE meanings, and Magnitude occurs without Identity in the expression of COMPLETIVE, EMPHATIC, and INTENSIVE. Although Identity and Magnitude often occur together—as suggested by Lakoff and Johnson's formula—the two iconicities are nonetheless partially independent, a fact that has not been previously noted in the literature.

4 Relations between predicative functions

In this section we take the data yielded by the survey of predicative functions and use it to determine how the functions relate to each other. In Section 4.2.5 we present a semantic map for the predicative functions. We lead up to this by presenting the method used in establishing the map, involving evidence from frequency of expression with a single form and from ambiguity. In Section 4.3 we use semantic affinity relations, together with our coding of iconicity and information on the individual frequencies of functions, to comment briefly on the diachronic relations between functions. Finally, in Section 4.4 we use the semantic map, established on the basis of a relatively large dataset and an empirically based method, to comment on earlier proposals on the relations between predicative functions.

4.1 Theoretical basis

4.1.1 Constructional polysemy

Reduplication contributes meaning to an utterance over and above what is contributed by the substantive elements in the utterance (the predicate, as well as arguments, affixes, particles, adverbials, etc.). This being the case, reduplication may be seen as a schematic form with meaning of its own. Usually when this is the case reduplication is productive—that is, more than one predicate may be reduplicated within the same formal pattern. The constructional view of language (e.g. Goldberg 1995) allows for forms of different

degrees of substantiveness or schematicity to be recognized as carrying meaning, and is therefore well suited to describing the meaning-bearing potential of schematic forms like reduplication.

Constructions, including reduplicative ones, may be monosemous (with just one meaning) or polysemous (several meanings). That is, there may be constructional polysemy (Goldberg 1995).[32] We assume that polysemy is real for the individual language user, and that at some level language users *recognize* that reduplication may have different functions. Polysemy develops when language users extend the use of a construction to include a new meaning (semantic extension). Extension tends to be to new uses that are closely related to older ones, with change being gradual (Lichtenberk 1991: 39).

In talking about polysemy it is useful to have terms for talking about the relation between the meanings (functions) involved. We introduce the term *co-patterning* for this purpose.[33] We will say that one meaning *co-patterns with* another if the meanings are expressed by the same form. These terms can be applied to the meanings of polysemous constructions of all kinds, regardless of how substantive or schematic their form is, though in the present paper we are concerned only with the meanings associated with schematic forms. As an illustration, in Gayo, total reduplication can be used to express either an EMPHATIC function (17) or an ATTENUATIVE OF EXTENT function (18). The construction is therefore polysemous, and the functions EMPHATIC and ATTENUATIVE OF EXTENT may be said to co-pattern with each other in this construction.

(17) EMPHATIC (Gayo; Eades 2005)
   a. *kunul~kunul*
      'sit (emphasis)'
   b. *kunul*
      'sit'

(18) ATTENUATIVE OF EXTENT (Gayo; Eades 2005)
   a. *maté~maté*
      'die (almost)'
   b. *maté*
      'die'

32 We make no distinction here between polysemy and vagueness (e.g. Tuggy 1993; Tuggy 2007), instead using the term polysemy to cover both.

33 The term is a generalization of François's (2008) term *colexification*, which is restricted to lexical items: "A given language is said to COLEXIFY two functionally distinct senses if, and only if, it can associate them with the same lexical form" (2008: 170).

However, synchronic co-patterning of two functions need not be the result of the direct extension of use from one function to the other, and need not therefore reflect semantic affinity, as will be demonstrated below. If two functions are both extensions from an earlier function, each overlapping with it, and the earlier function is now lost, then the two surviving functions may not overlap in meaning, despite sharing the same form. This state of affairs is illustrated in Figure 5. (Compare Anderson 1986: 281, Malchukov 2010: 193.)

$$\{f1\} \rightarrow \{f1, f2 < f1\} \rightarrow \{f1, f2, f3 < f1\} \xrightarrow{\text{f1 lost}} \{f2, f3\}$$

Figure 5: Loss of an original function. (Braces indicate sets of functions expressed by a single form; '→' indicates transition between stages of development; 'f2 < f1' indicates extension from function f1 to function f2 through f1 and f2 becoming associated with each other under the same form.).

The same effect can also occur if the original function is not among the functions that are recorded by the grammarian.

Co-patterning may also be the result of loss of a diachronically intermediate function (Figure 6). (Compare Haspelmath 2003: 236, Narrog & van der Auwera 2011: 326–327.)

$$\{f1\} \rightarrow \{f1, f2 < f1\} \rightarrow \{f1, f2, f3 < f2\} \xrightarrow{\text{f2 lost}} \{f1, f3\}$$

Figure 6: Loss of an intermediate function.

Again, the same effect can arise through functions not being recorded in grammars.

In view of these and other eventualities (see Malchukov 2010 and references cited there), co-patterning is not in itself a reliable guide to semantic affinity, though it is a good starting point. Additional evidence is needed. The evidence for affinity is stronger if the co-patterning is attested in different languages. Given the principle that closely related meanings tend to be expressed by similar forms, if a particular co-patterning occurs independently in many languages, this suggests that many populations of speakers have found the meanings to be close enough to be expressed by the same form.[34]

34 This is also the view of Kemmer (2003: 90), who writes that "if languages are recurrently found to subsume two meanings under a single form of expression, then this potential for lack

Therefore, the higher the frequency of co-patterning, the better the evidence is that the functions co-pattern due to affinity in meaning.[35] This principle is implemented in Section 4.2.3.

Even when frequent co-patterning strongly suggests semantic affinity, this still does not show that a transition can be made from one function to the other. For this we turn to cases of ambiguity. Given that ambiguity arises in the process of a form gradually being extended from expressing one meaning to expressing another (e.g. Heine 2002), if we can find examples where a form expresses two meanings ambiguously, we can claim with an even greater degree of certainty that the two co-patterning functions are semantically closely related. We apply this principle in Section 4.2.4.

Based on the analysis above, we determine semantic affinity based on two criteria: frequent co-patterning and ambiguity. We operationalize *polysemy* as follows: a construction is polysemous between two functions iff (i) the two functions are expressed by the same form in at least five languages and (ii) in at least one recorded example there is ambiguity between the two functions. Co-patterning is thus a necessary condition for polysemy but not a sufficient one. Cases where two functions are expressed by the same form but these two conditions are not met amount to cases of *homonymy*.

4.1.2 Semantic maps

Semantic affinity may be represented visually with semantic maps (e.g. Haspelmath 2003). A semantic map is a set of nodes, each representing a meaning (or function). Attested polysemies are plotted on the map by marking connections between nodes. Semantic maps can be used to represent semantic affinity within a single language or across different languages.

Neighbouring functions on a semantic map, topologically speaking, are ones that are conceptually close to each other, and the principle underlying semantic maps, and also tested by them, is that while a form may express a larger or smaller number of functions, the functions will always be contiguous on the map (Croft's Semantic Map Connectivity Hypothesis; see Section 2.2.1). As

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of differentiation is [...] significant: it suggests that the meanings are cognitively closely related". Kemmer attributes this notion to Ferguson (1970). See also Anderson (1986: 282).

35 Here we adopt a more conservative interpretation of co-patterning frequency than François (2008: 172) who suggests that frequency might be taken to reflect the degree of semantic affinity. We take high frequency merely as an indication of semantic affinity, without suggesting a monotonic correlation between frequency and the *degree* of semantic affinity.

well as having the synchronic interpretation that neighbouring functions are conceptually close to each other, semantic maps may also be interpreted as representing diachronic adjacency: functions are neighbours on the map as a result of speakers extending the use of a construction from one function to the neighbouring functions. Connections between functions are sometimes also treated as having direction, such that whenever extension occurs between one function and another, it is always in one direction rather than the other.

Traditional manually created semantic maps work well where (a) the number of constructions represented is small, and (b) the functions are fairly general ones, such that the number of functions is not large and the diagram is not cluttered (see Cysouw's 2007 discussion of Haspelmath's 1997 semantic map of indefinite pronouns). Where large numbers of constructions are involved, other methods for representing semantic affinity may be used (Cysouw 2007; Croft & Poole 2008; Wälchli 2010; Regier et al. 2013; Levshina 2016).

As noted in Section 4.1.1, co-patterning is not always due to semantic affinity. This means that in semantic maps constructed from co-patterning alone, adjacent functions are not necessarily closely related. This is why polysemy was operationalized in Section 4.1.1 in terms of frequency of co-patterning and attested cases of ambiguity, rather than simply in terms of co-patterning. We apply that definition of polysemy in the following section.

4.2 Towards a semantic map of the predicative functions

4.2.1 Co-patterning functions

We use co-patterning here as the basis for establishing affinity between the predicative functions of reduplication. The use of a single form for different meanings is taken as a first indication of affinity between the meanings. Unlike most semantic map work, which tends to be concerned with meanings of phonologically substantive forms (lexical items, morphemes), we are concerned here with forms that are at least partly schematic (reduplication viewed as a pair of open slots in a predicative construction).

We recognize co-patterning in two situations: (i) where the use of reduplication in a single example is ambiguous between two or more functions (see (19)-(20) below), and (ii) where two examples from the same language *and of the same formal type* (both involving total reduplication or both involving the same kind of partial reduplication) have different functions (see (17)-(18) above). These

two cases may be thought of as co-patterning within an example and co-patterning within a construction.[36] On the other hand, functions do not co-pattern if they are expressed by different reduplicative form types in the same language. For example, in Twi (Christaller 1875, cited by Moravcsik 1978: 318–320), total reduplication may be used to express INTENSIVE, e.g. *bubu* 'bend/break a thing in many places' < *bu* 'bend/break', and partial reduplication of the initial part of the base may be used to express ITERATIVE, e.g. *tẽetẽem* 'to cry out (repeatedly)' < *tẽem*' 'to cry out (once)'. As INTENSIVE and ITERATIVE are expressed by different reduplicative form types in Twi, we say that the two functions do not co-pattern in this language.

There are 286 co-patterning pairs of functions (pairs of functions expressed by the same form in one or more languages) in the data, according to our coding. These are listed, together with their frequency, in Appendix C. The distribution of the co-patterning pairs in terms of frequency follows a power law.

4.2.2 Connectivity

Of the 45 functions identified, all but one occur in at least one co-patterning pair. The one function that does not co-pattern with any other function is DUAL SUBJECT. The full set of attested co-patternings is shown in the network diagram in Figure 7.[37] It can be seen that although nearly all of the functions form a single connected network, there are in fact two components. Two functions—DUAL LOCATION and PAST—are not connected to the main cluster. These are functions that co-pattern with each other but not with any of the other functions. Both are low-frequency functions. The position of a node (i.e. a function) relative to the centre of the diagram reflects the degree of connectivity of the function in question: more connected functions (i.e. those co-patterning with a greater number of other functions) are more centrally placed, while less connected functions are placed towards the periphery. The width of each connecting line reflects the frequency with which the co-patterning it represents is attested (i.e. the number of languages it occurs in).

36 The assumption is that language-users associate each particular form with its own particular range of meanings, but they are less likely to associate meanings across different reduplicative patterns (e.g. across total and partial forms of reduplication).

37 Figures 7–10 were produced using a force-based algorithm provided by the Gephi network visualization software (gephi.org).

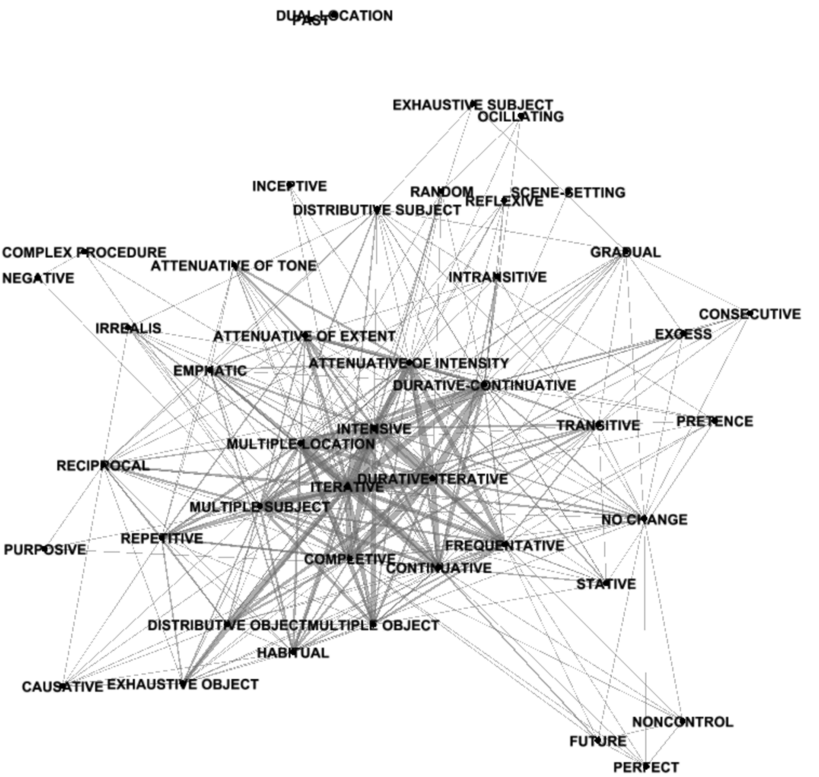

Figure 7: Co-patterning functions.

4.2.3 Frequency of co-patterning

The frequency with which a pair of functions co-pattern with each other may be taken as a measure of confidence that the co-patterning is due to semantic affinity, rather than a historical accident of the kind described in Section 4.1. The higher the frequency with which two functions co-pattern, the stronger the evidence is that co-patterning is due to affinity in meaning. Conversely, the lower the frequency of co-patterning, the weaker is the evidence that co-patterning is due to affinity. Where a pair of functions co-pattern frequently, this is an indication that many different populations have found the functions in question to be sufficiently close to warrant expression with the same form, and have extended the use of a construction expressing one to include the other. The full set of co-patterning frequencies in the data is given in Appendix C.

The starting point for our semantic map of the predicative functions is high co-patterning frequency. This approach to determining semantic affinity contrasts with the approach of Regier (1998) and Fischer (2011), whose networks are constructed largely on the basis of reasoning, together with occasional use of (single attestations of) co-patterning pairs in non-reduplicative constructions. For a co-patterning pair to be included in the map, we require that it be attested in at least five languages in the sample.[38] We also required that the minimum five languages should belong to different genera (groupings within families).[39]

4.2.4 Support from ambiguous examples

Although high frequency of co-patterning between two functions provides good evidence for affinity between them, the evidence is stronger still where examples can be found that exhibit ambiguity between the functions. Such ambiguities show concretely how the use of reduplication that is intended by the speaker to have one meaning has the potential to be reinterpreted by the hearer as having the other meaning. We therefore subject the highest-frequency co-patterning pairs of functions (those with frequency ≥ 5) to a test for whether ambiguous examples can be found (Li 2015: Ch. 4). Only those pairs that meet the frequency requirement and are attested as ambiguous in at least one example of usage are included in our semantic map (Section 4.2.5). Where no such examples can be found, we treat the relatedness of the functions as being unproven. Examples of the use of reduplication that meet both requirements are shown in (19)-(20). In (19) the use of reduplication can be interpreted as having either an INTENSIVE meaning or a COMPLETIVE meaning, or both. And in (20) reduplication can be interpreted as having either an ITERATIVE meaning or a MULTIPLE LOCATION meaning, or both.

(19) INTENSIVE/COMPLETIVE ambiguity (Zialo; Babaev 2010: 137)
   a. *ɲiya~ɲiya(g)*
      'destroy completely'
   b. *ɲiya(g)*
      'break'

38 This is an arbitrary cut-off point.

39 We follow the WALS definitions of 'family' and 'genus' (http://wals.info/languoid/genealogy).

(20) ITERATIVE/MULTIPLE LOCATION ambiguity (Arapesh; Conrad & Wogiga 1991)
a. *su~su*
'touch all over, paw'
b. *su*
'touch'

4.2.5 Semantic map for the predicative functions

After filtering out co-patterning pairs that occur in less than five languages and those for which no example can be found that exhibits ambiguity between the functions, we are left with 12 functions from 56 languages (see Appendix A). These are the functions that we have now established as being involved in polysemies, and which we include in our semantic map, shown in Figure 8. The languages in which these polysemies occur are listed in Appendix D. As with Figure 7, the position of a function relative to the centre of Figure 8 reflects the connectedness of the function—i.e. the number of different polysemies it takes part in. The width of the connecting lines reflects the frequency with which the polysemy occurs cross-linguistically in our data.

It is worth pointing out that while most semantic maps impose no restriction on form, the present one involves a highly restricted range of forms, covering only reduplicative forms of various kinds.

The functions form a single connected cluster. It can be seen that some functions are more connected than others. The most connected function is ITERATIVE, forming polysemies with eight other functions. This is followed by DURATIVE-ITERATIVE, forming polysemies with seven other functions. Since

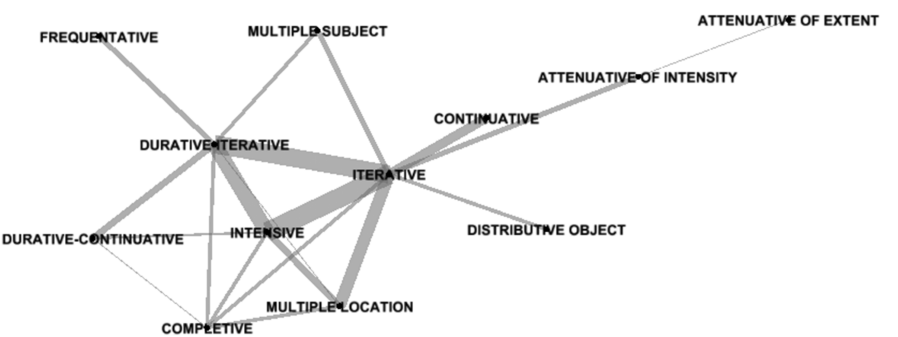

Figure 8: Semantic map of the predicative functions of reduplication.

ITERATIVE and DURATIVE-ITERATIVE (and also FREQUENTATIVE) involve the repetition of events, this suggests that repetition is fundamental to the predicative use of reduplication. It is also consistent with Bybee et al.'s proposal that meanings to do with repetition are the first to develop in a given language. Starting with the expression of repetition, the use of reduplication is then extended to include other meanings. These have to do with the intensification of events (INTENSIVE), discrete events occurring in different locations (MULTIPLE LOCATION), the extendedness of non-discrete events (CONTINUATIVE, DURATIVE-CONTINUATIVE), the multiplicity of participants (MULTIPLE SUBJECT, DISTRIBUTIVE OBJECT), the attenuation of some aspect of an event (ATTENUATIVE OF INTENSITY, ATTENUATIVE OF EXTENT) and the completion of an event (COMPLETIVE).

Most of the functions here are ones where reduplicative expression exploits one or more features of form iconically, a point we take up next.

4.3 Iconicity, co-patterning and frequency

In this section we look at the relations between members of co-patterning pairs of functions in terms of iconicity and individual frequency. Whereas the map in Figure 8 covers cases of co-patterning under both total and partial reduplication, Figure 9 is concerned only with total reduplication (for the reason given in Section 3.2.4, that complete doubling of the base is assumed to be more noticeable, and therefore manipulable, by language-users than partial doubling). It happens that all of the co-patternings in Figure 8 are expressed in at least one language with total reduplication, so the functions in Figure 9 are the same as those in Figure 8. However, the co-patterning frequencies (and the widths of connecting lines) are somewhat different here. Added to each function in Figure 9 are the set of iconicities that occur when the function is expressed with total reduplication (as given in Table 3). The following abbreviations are used: I = Identity, M = Magnitude, D = Discreteness, P = Proximity, S = Sequentiality.

What Figure 9 reveals is that for any co-patterning pair of functions, the sets of iconicities of the two functions are in a superset-subset relation: one set is always a subset—proper or otherwise—of the other. For example, if we take the pair < ITERATIVE {I,M,D,P,S}, CONTINUATIVE {I,P} >, the iconicities of the CONTINUATIVE function are a proper subset of those of the ITERATIVE function, with the expression of CONTINUATIVE not exploiting Magnitude, Discreteness or Sequentiality, all of which are exploited in expressing ITERATIVE. This same superset-subset relation holds for all of the 19 other pairs. In some cases the subset is a proper subset, while in other cases the sets are identical (which is

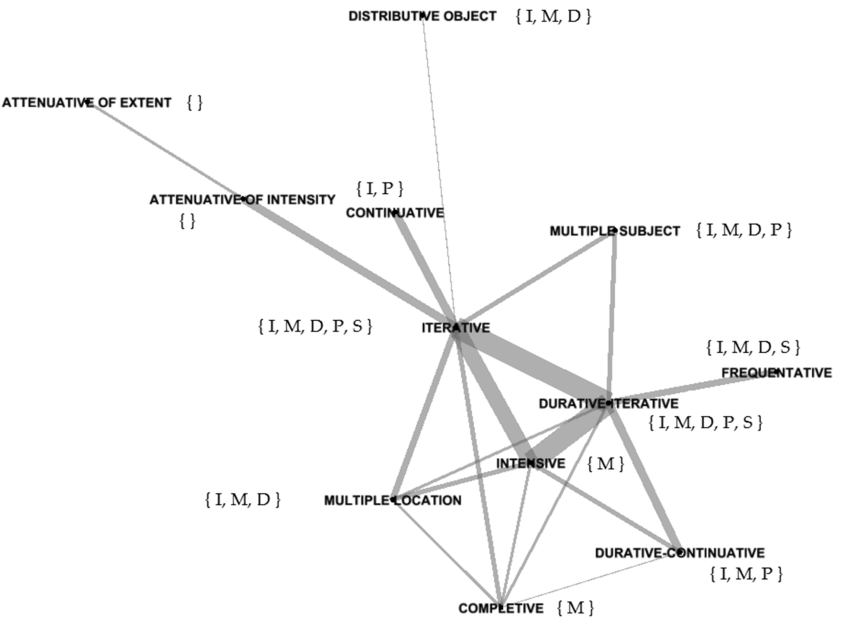

Figure 9: Semantic map showing iconicities (total reduplication only).

itself a subset relation). This means that where two functions differ in terms of their iconicities, the difference is always in one direction; there are no cases where the expression of each function involves some iconicities that expression of the other does not involve.

We might ask how surprising it is to find that all pairs are in a superset-subset relation. If random subsets of {I,M,D,P,S} were assigned to pairs of functions, how likely is it that they'd be in a superset-subset relation anyway? For a set A of n elements, there are $2^n(2^n+1)/2$ possible pairs of subsets of A. Of these, 3^n will be in a superset-subset relation. So for our set of five iconicities, there are $2^5(2^5+1)/2=528$ possible pairs of subsets. Of these, $3^5=243$ are in a superset-subset relation with each other. This leaves 285 pairs (i.e. more than half) that are *not* in a superset-subset relation. That is, there is a greater than 50 % chance that any randomly selected pair of subsets of {I,M,D,P,S} will not be in a superset-subset relation. Since in the actual data we find that there are *no* pairs of subsets that are not in a superset-subset relation, the distribution is non-random, and requires explanation.

This situation where neighbouring functions are in a superset-subset relation is consistent with a diachronic scenario in which the extension of use of

reduplication to include a new function involves either loss of iconicity or gain in iconicity but not the simultaneous loss of iconicity in certain respects and gain in others. Change is unidirectional for any given pair of functions within a language. Change involving loss of iconicity might be seen as involving a generalization (Bybee et al. 1994) or broadening of the use of reduplication, while change involving gain in iconicity would involve specialization or narrowing of use.

On certain assumptions, frequency may be used as a guide to the order in which functions appear within a language. The first assumption is that the primary reason for reduplication to be first used in a language is in order to exploit its iconic expressive potential. On this assumption, iconically motivated uses will be the first to appear in a given language. Bybee et al. make a connection between iconicity and frequency in discussing the iterative function, one of the most iconically motivated uses of reduplication:

> Iterative is the meaning we find most commonly associated with total reduplication. Thus the evidence for iterative as the original meaning of reduplication is strong. (1994: 169)

The second assumption, which we take to be uncontroversial, is that semantic extension involves an overlap between earlier and newer uses (with polysemy a consequence of this). The third assumption is that semantic extension follows different courses in different languages, which in cross-linguistic terms results in a diversification of function, with new meanings developing in different directions in different languages. This means that, whereas there is a common functional starting point—the iconic expression of meanings like repetition or plurality—later-developing meanings are less homogeneous across languages, and therefore individually less frequent. On these assumptions, earlier functions will be ones that are expressed with a higher degree of iconicity (in terms of the number of individual iconicities).

Figure 10 repeats the information from Figure 9, but adds the frequencies of each individual function.

With the sets of iconicities and the frequency of each function shown together, we can see that (with two exceptions) whenever one member, f1, of a co-patterning pair involves more iconicities than the other member, f2, f1 is also the more frequent function cross-linguistically. For example, as seen above, the iconicities of ITERATIVE use are a superset of those of CONTINUATIVE. At the same time, ITERATIVE also occurs in more languages than CONTINUATIVE (25 vs. 10). The same holds true for most of the other pairings. This finding is broadly consistent with a scenario in which early uses of reduplication in a given language are both iconically motivated and

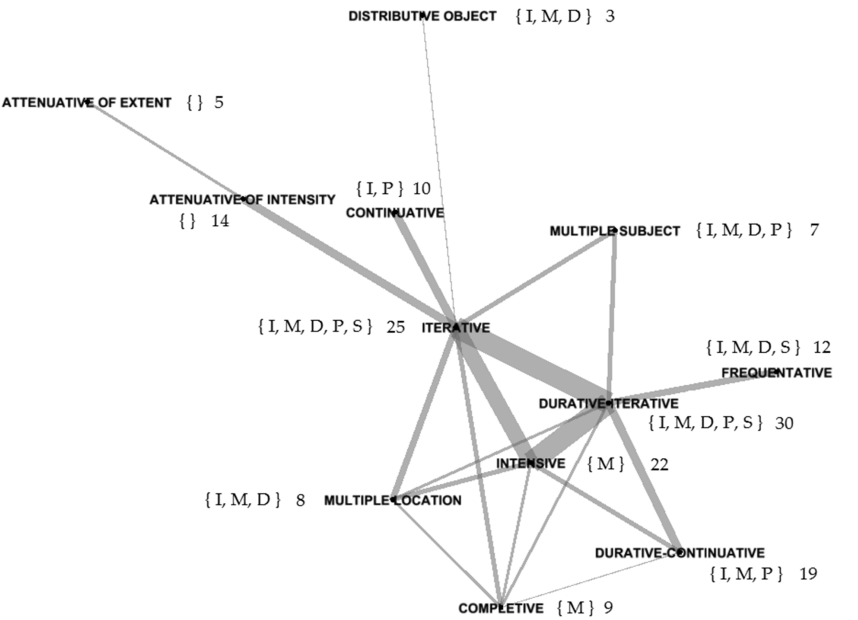

Figure 10: Semantic map showing iconicities and individual frequency of functions (total reduplication only).

similar to the uses in other languages (due to a common motivation) and therefore relatively frequent cross-linguistically. As new functions develop, they develop in different directions in different languages, and because (in cross-linguistic terms) there is a diversification of function, later functions occur in fewer languages.

The two exceptions, for which we do not attempt an explanation here, involve the INTENSIVE function. The expression of INTENSIVE exploits only the iconicity of Magnitude and has a frequency of 22. It co-patterns with two functions whose expression involves a larger number of iconicities, but which are lower in frequency—DURATIVE-CONTINUATIVE and MULTIPLE LOCATION.

4.4 Review of earlier proposals in light of the present findings

The semantic map we propose (Figure 8) differs somewhat from previous proposals in terms of the degree of interconnectivity between functions. In earlier proposals—particularly Bybee et al. (1994) and Regier (1998), but to some extent

also Fischer (2011)—the functions form chains, each function having just one parent node. In Figure 8 there is a greater degree of interconnectivity. There is one cluster of five functions that are all interconnected: {ITERATIVE, DURATIVE-ITERATIVE, INTENSIVE, COMPLETIVE, MULTIPLE LOCATION}. In other words, there are polysemies involving each pairing within this set. There is also a cluster of four interconnected functions: {COMPLETIVE, DURATIVE-CONTINUATIVE, DURATIVE-ITERATIVE, INTENSIVE}, and a cluster of three: {DURATIVE-ITERATIVE, ITERATIVE, MULTIPLE SUBJECT}.

Since the connections in Figure 8 are based on robust evidence from frequency of co-patterning and ambiguity, it is reasonable to use them to comment on the arrangement of functions in earlier proposals. However, it is important to note that the coverage of these various networks is not the same. The present domain (predicative functions) subsumes that covered by Bybee et al.'s network (aspectual functions), but is itself subsumed by the domain covered by Regier's and Fischer's networks (all functions). Therefore, while Figure 8 can be used either to support or reject the links in Bybee et al.'s network, it can only be used to support the other two networks, Regier's and Fischer's.

As noted in Section 3.2.1, Bybee et al.'s definition of continuative is different from ours. Theirs ("keep on doing what is being done") covers both discrete and non-discrete events, while ours ("sustained non-cyclic situation") covers only non-discrete events. Bybee et al.'s iterative/continuative link is supported by the ITERATIVE/DURATIVE-ITERATIVE link in Figure 8 (though not by ITERATIVE/DURATIVE-CONTINUATIVE, which are not connected). The direct link between iterative and frequentative proposed by Bybee et al. is not supported by Figure 8. Instead, there are links between ITERATIVE/DURATIVE-ITERATIVE and between DURATIVE-ITERATIVE/FREQUENTATIVE. The difference may be accounted for by the fact that Bybee et al. do not have a function that specifically covers the repetition of discrete events lasting beyond normal duration (our DURATIVE-ITERATIVE). The remaining connections proposed by Bybee et al. are ones that are not covered by Figure 8 (due to our frequency and ambiguity constraints).

Regier's proposed link between repetition and continuity is supported by an ITERATIVE/CONTINUATIVE link in Figure 8, though, as noted above, not by ITERATIVE/DURATIVE-CONTINUATIVE. There is no support in Figure 8 for Regier's proposed link between plural and intensive: neither of the plural participant meanings in Figure 8 (MULTIPLE SUBJECT, DISTRIBUTIVE OBJECT) links to INTENSIVE. Neither is there support for Regier's proposed link between plural and spread/scatter: neither of the plural participant meanings links to MULTIPLE LOCATION (which corresponds to Regier's spread/scatter). There is, however, support for Regier's proposed links between spread/scatter and

intensity (MULTIPLE LOCATION/INTENSIVE in Figure 8) and between intensity and completion (INTENSIVE/COMPLETIVE in Figure 8).

There is no support in Figure 8 for Fischer's proposed link between spread and attenuation. The relevant functions in Figure 8 are MULTIPLE LOCATION and ATTENUATIVE OF INTENSITY and ATTENUATIVE OF EXTENT, the first of which is not connected to either of the latter two. There is some support for the proposed link between spread and durativity (MULTIPLE LOCATION/DURATIVE-ITERATIVE in Figure 8) but no support for the link between spread and continuity (MULTIPLE LOCATION does not connect with either CONTINUATIVE or DURATIVE-CONTINUATIVE). There is no support for the link Fischer proposes between distribution and reciprocal. There is support, though, for the link (that Fischer apparently intends, though it is not made explicit) between intensity and completion (the link between INTENSIVE and COMPLETIVE in Figure 8).

In Section 2.2.3 a number of differences (D1-D7) were identified between the accounts of Bybee et al. (1994), Regier (1998) and Fischer (2011). We revisit those differences here, in light of the findings presented in Figure 8. Table 4 addresses each of the differences in turn.

Finally, a number of connections between functions are made in Figure 8 that are not covered by the other proposed networks. There are important links between meanings of extendedness (repetition, continuity) and intensity: ITERATIVE/INTENSIVE, DURATIVE-ITERATIVE/INTENSIVE, DURATIVE-CONTINUATIVE/INTENSIVE. A number of links involving completion have been neglected: a link between spatial distribution and completion (MULTIPLE LOCATION/COMPLETIVE), and links between extendedness and completion

Table 4: Points of difference between Bybee et al., Regier, and Fischer in light of present findings.

D1	Meanings of repetition often occur without there also being a meaning of multiple participants, supporting Regier's treatment of plurality and repetition as distinct, rather than Fischer's treatment of them as belonging to a single category.
D2	There is no support for Fischer's treatment of continuative as an extension of spread, but there is support (from ITERATIVE/CONTINUATIVE) for Bybee et al.'s and Regier's treatment of it as an extension of iterative (or repetition).
D3	Differences between ITERATIVE and HABITUAL in terms of the number of iconicities (greater for ITERATIVE) suggests (with Bybee et al.) that iterative tends to be diachronically earlier than habitual, in any given language, rather than the two functions being equally early (as implied by Fischer's account).
D4	INTRANSITIVE is attested in the present data in 7 languages, and is clearly therefore a recurring function of reduplication (with Bybee et al.).

(*continued*)

Table 4: (*continued*)

D5	There is no support for Regier's suggestion that spread/scatter is an extension of plural. With regard to Fischer's treatment of spread (= MULTIPLE LOCATION in our terms) as being among the original functions of reduplication, the number of iconicities suggests that in the predicative domain at least, it tends instead to develop through extension from ITERATIVE (repetition). Fischer's distinction between spread and scattering is not made in our set of functions.
D6	There is no support in our data for a connection between intensity and plural-participant meanings. Regier's treatment of intensity as an extension of plural is therefore not supported. With regard to Regier's proposal that intensity is also an extension of spread/scatter (MULTIPLE LOCATION), the connection is supported by co-patterning between INTENSIVE/MULTIPLE LOCATION. The direction, from MULTIPLE LOCATION to INTENSIVE, is also supported by the fact that MULTIPLE LOCATION involves a larger number of iconicities than does INTENSIVE. With regard to whether intensive is an original function, as suggested by Fisher, evidence from the number of iconicities suggests that it is an extension from meanings to do with repetition (ITERATIVE) and extendedness (CONTINUATIVE, DURATIVE-CONTINUATIVE), rather than an original function.
D7	Our data show a connection between ITERATIVE and COMPLETIVE. Given that there is evidence for this connection, Fischer's suggestion that completive is an extension from iterative is plausible. The fact that the (single) iconicity exploited by COMPLETIVE is a subset of the iconicities of ITERATIVE points to completive being an extension from iterative.

(DURATIVE-ITERATIVE/COMPLETIVE, ITERATIVE/COMPLETIVE, DURATIVE-CONTINUATIVE/COMPLETIVE). A link between repetition and attenuation has gone unmentioned (ITERATIVE/ATTENUATIVE OF INTENSITY). And the link between two kinds of attenuation—ATTENUATIVE OF EXTENT and ATTENUATIVE OF INTENSITY—has also not been mentioned.

5 Conclusion

This paper has presented the first quantitative study to date of the predicative functions of reduplication. It has revealed something about the nature of how reduplication is used in predication, and it has made systematic use of frequency of co-patterning along with evidence from ambiguity in establishing relations of semantic closeness (as well as likely diachronic adjacency) between functions. In using this systematic method to establish the relations

between functions, it has also provided a relatively objective way of appraising earlier proposals.

The survey revealed that aspectual functions, having to do particularly with the repetition and extendedness of events, are the most frequent cross-linguistically, followed by functions having to do with the plurality of participants in events. The expression of intensity was also found to be an important function. These findings support previous claims in the literature, but are verified here over a large sample of languages. The survey also found that meanings having to do with the results of events, attitudes towards events and other states of affairs are less frequent than meanings pertaining directly to events themselves.

The present survey also supports earlier accounts in their claims that many reduplicative forms are in an iconic relationship with the meanings they express. It approached the question of iconicity by looking in detail at the way particular formal features that are present in total-reduplicative forms are exploited for iconic expression in particular uses of reduplication. We identified five formal features that bear an iconic relationship to some aspect of meaning in one or more of the functions expressed with total reduplication in our dataset. We found that the five iconicities—Identity, Magnitude, Discreteness, Proximity, and Sequentiality—are not of equal status: the two that have received most attention in the literature—Identity and Magnitude—are indeed more important than the others, since Discreteness, Proximity and Sequentiality are only exploited when one or other of Identity and Magnitude is also exploited. This suggests that speakers exploit Identity and Magnitude more readily for iconic expression than Discreteness, Proximity or Sequentiality when total reduplicative form is used. It is also the case, as is suggested by previous work, that Identity and Magnitude tend to occur together. What the survey revealed that has not previously been noted is that although frequently exploited together, Identity and Magnitude can be exploited separately.

In establishing relations of semantic affinity between the predicative functions of reduplication, we used frequency of co-patterning (imposing an arbitrary minimum of five languages in which the co-patterning pair had to be found for the pair to be considered closely related), supported by examples of ambiguity that demonstrate the possibility of semantic extension. The resulting network, which constitutes a semantic map of the predicative functions, shows a greater degree of interconnectivity than previous maps.

The study showed an interesting property in terms of the iconic exploitation of total reduplication: all neighbouring pairs of functions in the network

are in a superset-subset relation in terms of the iconicities they involve. This is consistent with proposals that the original uses of reduplication in any given language are iconically motivated and that change involves loss of iconicity, rather than gain. In other words, the direction of change is towards greater arbitrariness in the form-meaning relation. The present data also support Bybee et al.'s suggestion that the frequency with which a reduplicative function occurs cross-linguistically is an indication of whether the function develops early or late. We found that functions exploiting larger numbers of iconicities are also the more frequent functions cross-linguistically. This is consistent with a scenario where earlier, more iconically motivated uses are cross-linguistically more homogeneous, and therefore more frequent, while later, less iconically motivated uses are more diverse, and therefore less frequent.

Finally, information gleaned from frequency of co-patterning, the existence of ambiguous examples, and sets of iconicities was used in reviewing earlier proposals (by Bybee et al. 1994; Regier 1998; Fischer 2011) about the relations between the functions of reduplication. In cases of difference between these earlier accounts, we indicated which account had support from the present dataset. There were also cases where the present data suggested connections that had not previously been proposed.

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Abbreviations: FVL = final vowel; HAB = habitual; PROG = progressive; RED = reduplication.

Appendix A: Languages in the sample

Languages marked with '*' are ones that contribute to the semantic map in Figure 8. Ethnologue's 'Americas' area has been divided into North America and South America. Bibliographical details for the works cited can be found at https://doi.org/10.1515/lingty-2018-0003. The right-hand column gives the functions found in each language. They are numbered as in Appendix B.

Language	Ethnologue area	Family	Works consulted[a]	Functions
Acoma*	North America	Keres	Miller (1965)	1, 2, 4, 6, 7
Afrikaans*	Africa	Indo-European	Botha (1984), Donaldson (1993)	1, 2, 4, 5, 8, 9, 15
Ainu*	Asia	Ainu	Hurch (2005)	2, 3
Alamblak	Pacific	Sepik	Bruce (1984)	1, 5
Alsea	North America	Oregon Coast	Mithun (1999)	14
Amele	Pacific	Trans-New Guinea	Roberts (1991)	1, 8, 14, 18
Angkamuthi dialect of Uradhi*	Pacific	Australian	Crowley (1983)	7, 10, 23
Araki*	Pacific	Austronesian	François (2002)	1, 3, 6, 14, 17, 20, 33
Arapesh*	Pacific	Torricelli	Conrad & Wogiga (1991), Dobrin (2001)	1, 3, 7, 10, 23
Atakapa	North America	Atakapa	Mithun (1999)	2
Aussa dialect of Afar	Africa	Afro-Asiatic	Bliese (1981)	3
Barbareño Chumash	North America	Chumash	Mithun (1999)	5
Berber, Middle Atlas*	Africa	Afro-Asiatic	Basset (1952), Moravcsik (1978)	1, 3, 4, 7
Bikol	Pacific	Austronesian	Mattes (2007)	4, 6, 30
Bilua	Pacific	Solomons East Papuan	Obata (2003)	2
Chamorro	Pacific	Austronesian	Topping (1973)	4
Chuukese	Pacific	Austronesian	Harrison (1973)	16
Classical Nahuatl*	North America	Uto-Aztecan	Canger (1981), Carochi (2001), Langacker (1977)	1, 2, 6, 8, 13, 21
Cora	North America	Uto-Aztecan	Casad (1984)	4, 6, 8, 11, 12
Cree, Plains*	North America	Algic	Ahenakew & Wolfart (1983)	1, 3, 4, 7, 12, 13, 18, 21
Daga*	Pacific	Dagan	Murane (1974)	1, 2, 4, 10, 13
Dagaare, Southern	Africa	Niger-Congo	Bodomo (1997)	8
Diyari*	Pacific	Australian	Austin (1981)	1, 4

(*continued*)

(*continued*)

Language	Ethnologue area	Family	Works consulted[a]	Functions
Djapu, a Yolngu dialect	Pacific	Australian	Morphy (1983)	2, 4, 6
Dyirbal*	Pacific	Australian	Dixon (1972)	2, 5, 29
East Futuna	Pacific	Austronesian	Moyse-Faurie (2007)	16, 36
Fijian*	Pacific	Austronesian	Schütz (1985)	1, 3, 5, 8, 9, 19, 20, 25, 26, 32
Gayo*	Asia	Austronesian	Eades (2005)	1, 4, 5, 7, 15, 17, 25
Georgian*	Europe	Kartvelian	Gil (1988)	1, 13, 20, 21, 31, 41
Gooniyandi*	Pacific	Australian	McGregor (1990)	1, 7
Hawaiian*	Pacific	Austronesian	Elbert & Pukui (1979)	2, 6, 8
Hebrew, Modern	Asia	Afro-Asiatic	Levkovych (2007)	3
Hiligaynon	Asia	Austronesian	Wolfenden (1971)	6, 8, 9, 35
Hmong Njua	Asia	Hmong-Mien	Harriehausen (1990), Lyman (1974, 1979)	3, 8, 11, 17
Hoava	Pacific	Austronesian	Davis (2003)	4, 5, 37
Hopi	North America	Uto-Aztecan	Langacker (1977)	4
Huasteca Nahuatl*	North America	Uto-Aztecan	Beller & Beller (1979)	1, 3, 12
Huichol	North America	Uto-Aztecan	Langacker (1977)	6
Hup	South America	Nadahup	Epps (2008)	2, 4
Ilocano	Asia	Austronesian	Rubino (2000, 2005a)	2, 4, 25
Indonesian*	Asia	Austronesian	Macdonald (1976), Sneddon (1996)	1, 2, 3, 9
Jamaican Creole English*	North America	Creole	Kouwenberg et al. (2003)	1, 2, 3, 11, 22
Karok*	North America	Karok	Bright (1957), Macaulay (1993), Mithun (1999)	1, 2, 3, 8, 10, 12, 19
Kawaiisu	North America	Uto-Aztecan	Langacker (1977)	32
Kiribati	Pacific	Austronesian	Harrison (1973)	11
Koasati*	North America	Muskogean	Kimball (1988, 1991), Mithun (1999)	1, 2, 3, 5, 6, 7, 10, 18
Kosraean	Pacific	Austronesian	Harrison (1973)	2, 16

(*continued*)

(*continued*)

Language	Ethnologue area	Family	Works consulted[a]	Functions
Krio	Africa	Creole	Nylander (2003)	2
Kwazá*	South America	Kwaza	Voort (2003)	1, 2, 3, 4, 6, 9, 12, 26
Kyuquot Nootka*	North America	Wakashan	Mithun (1999)	1, 7
Lavukaleve	Pacific	Solomons East Papuan	Terrill (2003)	2, 14
Luiseño	North America	Uto-Aztecan	Langacker (1977), Rubino (2005b)	39, 44
Mandarin Chinese*	Asia	Sino-Tibetan	Hsu (2002), McEnery & Xiao (2004)	1, 4, 9, 15, 24
Mangarrayi*	Pacific	Australian	Merlan (1982)	2, 5
Maori*	Pacific	Austronesian	Bauer et al. (1993), Biggs (1969), Harlow (1996)	1, 2, 5, 6, 8, 9, 10, 14, 15, 16, 19, 22
Marquesan*	Pacific	Austronesian	Cablitz (2006)	2, 3, 6, 10, 12
Marshallese	Pacific	Austronesian	Byrd (1993), Harrison (1973)	3, 16
Maung*	Pacific	Australian	Capell & Hinch (1970)	2, 5, 8, 10, 11
Maybrat*	Asia	West Papuan	Dol (2007)	2, 3, 23
Meyah*	Asia	East Bird's Head	Gravelle (2002)	2, 3, 8
Michoacán Nahuatl	North America	Uto-Aztecan	Sischo (1979)	4
Mokilese*	Pacific	Austronesian	Blevins (1996), Harrison (1973, Harrison 1976), Harrison & Albert(1977)	1, 3, 4, 5, 16, 26
Mono	North America	Uto-Aztecan	Langacker (1977)	6, 20, 28
Mpakwithi dialect of Anguthimri	Pacific	Australian	Crowley (1981)	5, 9
Ngiyambaa*	Pacific	Australian	Donaldson (1980)	9, 15, 24
Niuean*	Pacific	Austronesian	Haji-Abdolhosseini et al. (2002)	1, 2, 3, 6, 8, 9, 12, 15
North Puebla Nahuatl	North America	Uto-Aztecan	Brockway (1979)	6, 27, 42
Northern dialect of Afar	Africa	Afro-Asiatic	Bliese (1981)	3
Nyangumarta	Pacific	Australian	Sharp (2004)	9, 10

(*continued*)

(*continued*)

Language	Ethnologue area	Family	Works consulted[a]	Functions
Oromo, Eastern*	Africa	Afro-Asiatic	Ali & Zaborski (1990), Owens (1985)	1, 3, 7, 8, 12
Papago*	North America	Uto-Aztecan	Langacker (1977)	1, 13
Papiamentu	North America	Creole	Kouwenberg (2003)	7, 11
Pima Bajo	North America	Uto-Aztecan	Escalante & Fernández (1993)	3
Plateau Malagasy*	Africa	Austronesian	Keenan & Polinsky (2001), Rasoloson & Rubino (2005)	1, 3, 15, 18
Pochutla	North America	Uto-Aztecan	Langacker (1977)	4
Pomo	North America	Pomoan	Mithun (1999)	1
Portuguese	Europe	Indo-European	Kröll (1991)	5
Quechua, Imbabura	South America	Quechuan	Cole (1982)	37
Rapanui*	Pacific	Austronesian	Du Feu (1996)	1, 3, 5, 6, 7, 10, 12, 33
Réunion Creole French*	Africa	Creole	Daval-Markussen (2009)	1, 2, 3, 7, 9
Saisiyat	Asia	Austronesian	Blust (1998), Yeh (1991)	2, 4, 14, 35
Senoufo, Supyire*	Africa	Niger-Congo	Carlson (1994)	1, 2, 5, 10, 13
Serrano	North America	Uto-Aztecan	Langacker (1977)	4
Shi*	Africa	Niger-Congo	Polak-Bynon (1975)	2, 3, 5
Shoshoni	North America	Uto-Aztecan	Langacker (1977)	40
Southern Paiute	North America	Uto-Aztecan	Langacker (1977)	1
Squamish*	North America	Salishan	Kuipers (1967)	2, 3, 4, 5, 6, 7, 10, 14, 19, 22, 28, 29, 31
Sumerian*	Asia	Sumerian	Jagersma (2010)	1, 6, 10, 11, 13, 14, 18, 21, 38
Swahili*	Africa	Niger-Congo	Lodhi (2002), Novotna (2000)	2, 8, 9, 17

(*continued*)

(*continued*)

Language	Ethnologue area	Family	Works consulted[a]	Functions
Tagalog*	Asia	Austronesian	French (1988), Schachter & Otanes (1972)	3, 4, 7, 8, 9, 10, 15, 17, 18, 22, 24, 30, 34, 45
Takelma*	North America	Takelma	Mithun (1999)	2, 6, 11
Tamil*	Asia	Dravidian	Rambai (2009, personal communication)	2, 3
Tetelcingo Nahuatl*	North America	Uto-Aztecan	Tuggy (1979)	1, 3, 7, 10, 11, 13, 27
Thompson	North America	Salishan	Mithun (1999)	34
Tok Pisin*	Pacific	Creole	Nose (2011)	1, 2, 3, 5, 7, 36
Tübatulabal	North America	Uto-Aztecan	Langacker (1977)	8
Tukang Besi*	Asia	Austronesian	Donohue (1999)	3, 5, 9
Ulithian	Pacific	Austronesian	Sohn & Bender (1973)	4
Vietnamese*	Asia	Austro-Asiatic	Nguyen (1997), Srichampa (2002)	1, 3, 5, 9, 23, 43
Wargamay	Pacific	Australian	Dixon (1981)	1, 5
Washo*	North America	Washo	Mithun (1999)	1, 7
Wintu	North America	Penutian	Mithun (1999)	2, 13
Woleaian	Pacific	Austronesian	Harrison (1973), Sohn (1975)	4, 16
Yaqui*	North America	Uto-Aztecan	Haugen (2005), Harley & Amarillas (2003), Langacker (1977)	1, 4, 11, 17
Yidiɲ	Pacific	Australian	Dixon (1977)	2, 3, 5, 14
Yukulta*	Pacific	Australian	Keen (1983)	1, 2, 3, 5
Zialo*	Africa	Niger-Congo	Babaev (2010)	1, 2, 3, 7, 9, 10, 11, 19
Zuni*	North America	Zuni	Mithun (1999), Newman (1965)	1, 2, 4

[a]The complete details of the works cited are available as a supplementary material for this article.

Appendix B: Definitions and frequency of functions

Number	Label	Frequency	Definition
1	ITERATIVE	44	repetitions of identical cycles
2	DURATIVE-ITERATIVE	41	as iterative, plus lasting beyond normal duration
3	INTENSIVE	38	application of force which is greater than normal
4	CONTINUATIVE	28	sustained non-cyclic situation
5	DURATIVE-CONTINUATIVE	24	non-cyclic situation happening non-stop for longer than usual or persistently
6	MULTIPLE SUBJECT	20	multiple subjects collectively performing the same action, experiencing the same state or showing the same quality
7	MULTIPLE LOCATION	19	situation taking place across different locations or at different places within the same location
8	FREQUENTATIVE	18	events happening frequently with intervals between them
9	ATTENUATIVE OF INTENSITY	17	performing an action with less than normal amount of force or possessing a property to a lesser degree than normal
10	COMPLETIVE	16	performing an action to its completion point
11	HABITUAL	11	situation which is characteristic of an extended period of time
12	MULTIPLE OBJECT	9	multiple objects being affected collectively in a single event
13	DISTRIBUTIVE OBJECT	9	plural objects treated as being separate from each other
14	RECIPROCAL	9	doing something to each other
15	ATTENUATIVE OF EXTENT	8	an event taking place to less than its full or normal extent
16	INTRANSITIVE	7	existence of an object implied but not expressed
17	EMPHATIC	6	emphasizing speech acts such as suggestion, command or request
18	REPETITIVE	6	episodes happening repeatedly with intervals in between
19	TRANSITIVE	5	transitive situation (by contrast with intransitive base form)
20	DISTRIBUTIVE SUBJECT	4	subjects construed as separate and individual entities
21	EXHAUSTIVE OBJECT	4	complete involvement of participants (applied to objects)

(*continued*)

(*continued*)

Number	Label	Frequency	Definition
22	NO CHANGE	4	reduplication does not change the meaning
23	RANDOM	4	performing an action in an unplanned manner or doing something aimlessly
24	ATTENUATIVE OF TONE	3	politeness, friendliness or mildness in requests, suggestions or commands
25	PRETENCE	3	performing an action to imitate another action
26	STATIVE	3	a state
27	COMPLEX PROCEDURE	2	complex process made up of different types of processes
28	CONSECUTIVE	2	performing the same action on different patients one by one, or multiple participants perform the same action one by one
29	EXCESS	2	performing an action to an extent that is unnecessary, inappropriate, or undesirable
30	FUTURE	2	the reduplicated form refers to a future situation, in contrast to the base form which makes no reference to the time of the action
31	GRADUAL	2	event progressing incrementally over a period of time
32	INCEPTIVE	2	beginning state of a situation
33	IRREALIS	2	non-actual events
34	NONCONTROL	2	situation where human protagonists do not have control
35	PURPOSIVE	2	doing something for the purpose of something (often in the future)
36	REFLEXIVE	2	performing an action on oneself
37	SCENE-SETTING	2	imperfective situation used to set the background for a perfective situation
38	CAUSATIVE	1	while the base form of the predicate refers to a property, the reduplicated form refers to the process of a subject causing the property to happen
39	DUAL LOCATION	1	performing an action in two locations
40	DUAL SUBJECT	1	two subjects performing the same action as a group
41	EXHAUSTIVE SUBJECT	1	complete involvement of participants (applied to subjects)
42	NEGATIVE	1	negation
43	OSCILLATING	1	movement that goes back and forth repeatedly
44	PAST	1	past tense
45	PERFECT	1	situation viewed as a bounded whole

Appendix C: Co-patterning frequency

INTENSIVE	ITERATIVE	18
DURATIVE-ITERATIVE	ITERATIVE	17
DURATIVE-ITERATIVE	INTENSIVE	14
ITERATIVE	MULTIPLE LOCATION	13
CONTINUATIVE	ITERATIVE	11
DURATIVE-CONTINUATIVE	DURATIVE-ITERATIVE	9
INTENSIVE	MULTIPLE LOCATION	9
ATTENUATIVE OF INTENSITY	ITERATIVE	8
DURATIVE-ITERATIVE	FREQUENTATIVE	8
ITERATIVE	MULTIPLE SUBJECT	8
ATTENUATIVE OF INTENSITY	DURATIVE-ITERATIVE	7
COMPLETIVE	MULTIPLE LOCATION	7
COMPLETIVE	ITERATIVE	7
COMPLETIVE	DURATIVE-ITERATIVE	7
COMPLETIVE	INTENSIVE	7
CONTINUATIVE	DURATIVE-ITERATIVE	7
DISTRIBUTIVE OBJECT	ITERATIVE	7
DURATIVE-CONTINUATIVE	ITERATIVE	7
DURATIVE-ITERATIVE	MULTIPLE SUBJECT	7
ATTENUATIVE OF INTENSITY	FREQUENTATIVE	6
ATTENUATIVE OF INTENSITY	INTENSIVE	6
DURATIVE-CONTINUATIVE	INTENSIVE	6
FREQUENTATIVE	ITERATIVE	6
INTENSIVE	MULTIPLE OBJECT	6
ATTENUATIVE OF EXTENT	ATTENUATIVE OF INTENSITY	5
COMPLETIVE	DURATIVE-CONTINUATIVE	5
DURATIVE-ITERATIVE	MULTIPLE LOCATION	5
INTENSIVE	MULTIPLE SUBJECT	5
ITERATIVE	MULTIPLE OBJECT	5
ATTENUATIVE OF EXTENT	ITERATIVE	4
ATTENUATIVE OF INTENSITY	DURATIVE-CONTINUATIVE	4
COMPLETIVE	MULTIPLE SUBJECT	4
CONTINUATIVE	DURATIVE-CONTINUATIVE	4
CONTINUATIVE	MULTIPLE SUBJECT	4
DISTRIBUTIVE OBJECT	DURATIVE-ITERATIVE	4
DISTRIBUTIVE OBJECT	EXHAUSTIVE OBJECT	4
DURATIVE-CONTINUATIVE	MULTIPLE SUBJECT	4
DURATIVE-CONTINUATIVE	MULTIPLE LOCATION	4
EXHAUSTIVE OBJECT	ITERATIVE	4
HABITUAL	ITERATIVE	4
ITERATIVE	REPETITIVE	4

(*continued*)

(*continued*)

MULTIPLE LOCATION	MULTIPLE SUBJECT	4
MULTIPLE OBJECT	MULTIPLE SUBJECT	4
ATTENUATIVE OF EXTENT	INTENSIVE	3
ATTENUATIVE OF EXTENT	ATTENUATIVE OF TONE	3
ATTENUATIVE OF EXTENT	CONTINUATIVE	3
ATTENUATIVE OF EXTENT	DURATIVE-CONTINUATIVE	3
ATTENUATIVE OF INTENSITY	CONTINUATIVE	3
ATTENUATIVE OF INTENSITY	ATTENUATIVE OF TONE	3
COMPLETIVE	TRANSITIVE	3
COMPLETIVE	REPETITIVE	3
COMPLETIVE	MULTIPLE OBJECT	3
COMPLETIVE	DISTRIBUTIVE OBJECT	3
CONTINUATIVE	INTENSIVE	3
CONTINUATIVE	MULTIPLE LOCATION	3
CONTINUATIVE	FREQUENTATIVE	3
DURATIVE-ITERATIVE	HABITUAL	3
DURATIVE-ITERATIVE	MULTIPLE OBJECT	3
DURATIVE-ITERATIVE	TRANSITIVE	3
DURATIVE-ITERATIVE	NO CHANGE	3
EMPHATIC	INTENSIVE	3
EMPHATIC	ITERATIVE	3
FREQUENTATIVE	INTENSIVE	3
FREQUENTATIVE	MULTIPLE OBJECT	3
FREQUENTATIVE	MULTIPLE SUBJECT	3
HABITUAL	INTENSIVE	3
HABITUAL	MULTIPLE LOCATION	3
HABITUAL	MULTIPLE SUBJECT	3
INTENSIVE	TRANSITIVE	3
INTENSIVE	REPETITIVE	3
ITERATIVE	RECIPROCAL	3
MULTIPLE LOCATION	MULTIPLE OBJECT	3
MULTIPLE LOCATION	REPETITIVE	3
MULTIPLE SUBJECT	RECIPROCAL	3
ATTENUATIVE OF EXTENT	EMPHATIC	2
ATTENUATIVE OF EXTENT	MULTIPLE LOCATION	2
ATTENUATIVE OF EXTENT	MULTIPLE SUBJECT	2
ATTENUATIVE OF EXTENT	REPETITIVE	2
ATTENUATIVE OF INTENSITY	MULTIPLE LOCATION	2
ATTENUATIVE OF INTENSITY	STATIVE	2
ATTENUATIVE OF INTENSITY	COMPLETIVE	2
ATTENUATIVE OF INTENSITY	MULTIPLE OBJECT	2
ATTENUATIVE OF INTENSITY	EMPHATIC	2
ATTENUATIVE OF INTENSITY	MULTIPLE SUBJECT	2

(*continued*)

(*continued*)

COMPLETIVE	FREQUENTATIVE	2
COMPLETIVE	HABITUAL	2
COMPLETIVE	CONTINUATIVE	2
CONTINUATIVE	MULTIPLE OBJECT	2
CONTINUATIVE	STATIVE	2
CONTINUATIVE	EMPHATIC	2
CONTINUATIVE	INTRANSITIVE	2
CONTINUATIVE	FUTURE	2
DISTRIBUTIVE OBJECT	REPETITIVE	2
DISTRIBUTIVE OBJECT	MULTIPLE SUBJECT	2
DISTRIBUTIVE SUBJECT	MULTIPLE SUBJECT	2
DISTRIBUTIVE SUBJECT	ITERATIVE	2
DURATIVE-CONTINUATIVE	TRANSITIVE	2
DURATIVE-CONTINUATIVE	NO CHANGE	2
DURATIVE-CONTINUATIVE	INTRANSITIVE	2
DURATIVE-CONTINUATIVE	EXCESS	2
DURATIVE-CONTINUATIVE	FREQUENTATIVE	2
DURATIVE-ITERATIVE	EXCESS	2
EMPHATIC	HABITUAL	2
EMPHATIC	MULTIPLE LOCATION	2
EMPHATIC	FREQUENTATIVE	2
EXHAUSTIVE OBJECT	REPETITIVE	2
EXHAUSTIVE OBJECT	MULTIPLE SUBJECT	2
FREQUENTATIVE	HABITUAL	2
FREQUENTATIVE	TRANSITIVE	2
FREQUENTATIVE	NO CHANGE	2
INTENSIVE	RECIPROCAL	2
INTENSIVE	RANDOM	2
INTENSIVE	NO CHANGE	2
IRREALIS	ITERATIVE	2
ITERATIVE	NO CHANGE	2
ITERATIVE	TRANSITIVE	2
MULTIPLE SUBJECT	REPETITIVE	2
RECIPROCAL	REPETITIVE	2
ATTENUATIVE OF EXTENT	NO CHANGE	1
ATTENUATIVE OF EXTENT	RECIPROCAL	1
ATTENUATIVE OF EXTENT	MULTIPLE OBJECT	1
ATTENUATIVE OF EXTENT	INTRANSITIVE	1
ATTENUATIVE OF EXTENT	FREQUENTATIVE	1
ATTENUATIVE OF EXTENT	DURATIVE-ITERATIVE	1
ATTENUATIVE OF EXTENT	COMPLETIVE	1
ATTENUATIVE OF INTENSITY	INCEPTIVE	1
ATTENUATIVE OF INTENSITY	NO CHANGE	1

(*continued*)

(*continued*)

ATTENUATIVE OF INTENSITY	OCILLATING	1
ATTENUATIVE OF INTENSITY	PRETENCE	1
ATTENUATIVE OF INTENSITY	RANDOM	1
ATTENUATIVE OF INTENSITY	DISTRIBUTIVE SUBJECT	1
ATTENUATIVE OF INTENSITY	REPETITIVE	1
ATTENUATIVE OF INTENSITY	TRANSITIVE	1
ATTENUATIVE OF TONE	COMPLETIVE	1
ATTENUATIVE OF TONE	INTENSIVE	1
ATTENUATIVE OF TONE	ITERATIVE	1
ATTENUATIVE OF TONE	CONTINUATIVE	1
ATTENUATIVE OF TONE	EMPHATIC	1
ATTENUATIVE OF TONE	REPETITIVE	1
ATTENUATIVE OF TONE	MULTIPLE LOCATION	1
CAUSATIVE	DISTRIBUTIVE OBJECT	1
CAUSATIVE	EXHAUSTIVE OBJECT	1
CAUSATIVE	HABITUAL	1
CAUSATIVE	MULTIPLE SUBJECT	1
CAUSATIVE	ITERATIVE	1
CAUSATIVE	REPETITIVE	1
CAUSATIVE	RECIPROCAL	1
CAUSATIVE	COMPLETIVE	1
COMPLETIVE	EXHAUSTIVE OBJECT	1
COMPLETIVE	RECIPROCAL	1
COMPLETIVE	IRREALIS	1
COMPLETIVE	NO CHANGE	1
COMPLETIVE	NONCONTROL	1
COMPLETIVE	PERFECT	1
COMPLETIVE	EMPHATIC	1
COMPLETIVE	RANDOM	1
COMPLETIVE	GRADUAL	1
COMPLETIVE	FUTURE	1
COMPLEX PROCEDURE	MULTIPLE SUBJECT	1
COMPLEX PROCEDURE	INTENSIVE	1
COMPLEX PROCEDURE	NEGATIVE	1
CONSECUTIVE	TRANSITIVE	1
CONSECUTIVE	EXCESS	1
CONSECUTIVE	GRADUAL	1
CONSECUTIVE	NO CHANGE	1
CONSECUTIVE	INTENSIVE	1
CONSECUTIVE	DURATIVE-ITERATIVE	1
CONSECUTIVE	DURATIVE-CONTINUATIVE	1
CONTINUATIVE	HABITUAL	1
CONTINUATIVE	GRADUAL	1

(*continued*)

(*continued*)

CONTINUATIVE	REPETITIVE	1
CONTINUATIVE	NO CHANGE	1
CONTINUATIVE	PERFECT	1
CONTINUATIVE	PRETENCE	1
CONTINUATIVE	PURPOSIVE	1
CONTINUATIVE	RECIPROCAL	1
CONTINUATIVE	DISTRIBUTIVE OBJECT	1
CONTINUATIVE	EXHAUSTIVE OBJECT	1
CONTINUATIVE	NONCONTROL	1
DISTRIBUTIVE OBJECT	FREQUENTATIVE	1
DISTRIBUTIVE OBJECT	HABITUAL	1
DISTRIBUTIVE OBJECT	RECIPROCAL	1
DISTRIBUTIVE OBJECT	MULTIPLE LOCATION	1
DISTRIBUTIVE OBJECT	MULTIPLE OBJECT	1
DISTRIBUTIVE OBJECT	INTENSIVE	1
DISTRIBUTIVE SUBJECT	GRADUAL	1
DISTRIBUTIVE SUBJECT	INTENSIVE	1
DISTRIBUTIVE SUBJECT	EXHAUSTIVE SUBJECT	1
DISTRIBUTIVE SUBJECT	TRANSITIVE	1
DISTRIBUTIVE SUBJECT	DURATIVE-CONTINUATIVE	1
DISTRIBUTIVE SUBJECT	EMPHATIC	1
DISTRIBUTIVE SUBJECT	STATIVE	1
DISTRIBUTIVE SUBJECT	FREQUENTATIVE	1
DISTRIBUTIVE SUBJECT	RECIPROCAL	1
DISTRIBUTIVE SUBJECT	PRETENCE	1
DISTRIBUTIVE SUBJECT	IRREALIS	1
DUAL LOCATION	PAST	1
DURATIVE-CONTINUATIVE	OCILLATING	1
DURATIVE-CONTINUATIVE	PRETENCE	1
DURATIVE-CONTINUATIVE	MULTIPLE OBJECT	1
DURATIVE-CONTINUATIVE	RECIPROCAL	1
DURATIVE-CONTINUATIVE	REFLEXIVE	1
DURATIVE-CONTINUATIVE	REPETITIVE	1
DURATIVE-CONTINUATIVE	SCENE SETTING	1
DURATIVE-CONTINUATIVE	STATIVE	1
DURATIVE-CONTINUATIVE	RANDOM	1
DURATIVE-CONTINUATIVE	IRREALIS	1
DURATIVE-CONTINUATIVE	EMPHATIC	1
DURATIVE-CONTINUATIVE	GRADUAL	1
DURATIVE-ITERATIVE	REPETITIVE	1
DURATIVE-ITERATIVE	REFLEXIVE	1
DURATIVE-ITERATIVE	EXHAUSTIVE OBJECT	1
DURATIVE-ITERATIVE	RANDOM	1

(*continued*)

(*continued*)

DURATIVE-ITERATIVE	EMPHATIC	1
DURATIVE-ITERATIVE	GRADUAL	1
DURATIVE-ITERATIVE	PRETENCE	1
EMPHATIC	MULTIPLE SUBJECT	1
EMPHATIC	IRREALIS	1
EMPHATIC	REPETITIVE	1
EMPHATIC	RECIPROCAL	1
EXCESS	GRADUAL	1
EXCESS	NO CHANGE	1
EXCESS	TRANSITIVE	1
EXCESS	INTENSIVE	1
EXHAUSTIVE OBJECT	RECIPROCAL	1
EXHAUSTIVE OBJECT	MULTIPLE OBJECT	1
EXHAUSTIVE OBJECT	MULTIPLE LOCATION	1
EXHAUSTIVE OBJECT	INTENSIVE	1
EXHAUSTIVE OBJECT	HABITUAL	1
EXHAUSTIVE OBJECT	FREQUENTATIVE	1
EXHAUSTIVE SUBJECT	ITERATIVE	1
EXHAUSTIVE SUBJECT	GRADUAL	1
FREQUENTATIVE	PRETENCE	1
FREQUENTATIVE	STATIVE	1
FREQUENTATIVE	PERFECT	1
FREQUENTATIVE	NONCONTROL	1
FREQUENTATIVE	MULTIPLE LOCATION	1
FREQUENTATIVE	FUTURE	1
FUTURE	NONCONTROL	1
FUTURE	NO CHANGE	1
FUTURE	PERFECT	1
GRADUAL	TRANSITIVE	1
GRADUAL	NO CHANGE	1
GRADUAL	MULTIPLE SUBJECT	1
GRADUAL	MULTIPLE LOCATION	1
GRADUAL	ITERATIVE	1
GRADUAL	INTENSIVE	1
HABITUAL	NO CHANGE	1
HABITUAL	MULTIPLE OBJECT	1
HABITUAL	REPETITIVE	1
HABITUAL	TRANSITIVE	1
HABITUAL	RECIPROCAL	1
INCEPTIVE	INTENSIVE	1
INCEPTIVE	ITERATIVE	1
INTENSIVE	IRREALIS	1
INTENSIVE	STATIVE	1

(*continued*)

(*continued*)

INTENSIVE	REFLEXIVE	1
INTRANSITIVE	MULTIPLE SUBJECT	1
INTRANSITIVE	NO CHANGE	1
INTRANSITIVE	RECIPROCAL	1
INTRANSITIVE	REFLEXIVE	1
IRREALIS	MULTIPLE SUBJECT	1
IRREALIS	RECIPROCAL	1
IRREALIS	MULTIPLE OBJECT	1
ITERATIVE	STATIVE	1
ITERATIVE	REFLEXIVE	1
MULTIPLE LOCATION	REFLEXIVE	1
MULTIPLE LOCATION	RANDOM	1
MULTIPLE LOCATION	TRANSITIVE	1
MULTIPLE OBJECT	REPETITIVE	1
MULTIPLE OBJECT	STATIVE	1
MULTIPLE OBJECT	TRANSITIVE	1
MULTIPLE SUBJECT	NO CHANGE	1
MULTIPLE SUBJECT	STATIVE	1
MULTIPLE SUBJECT	PURPOSIVE	1
MULTIPLE SUBJECT	NEGATIVE	1
NO CHANGE	NONCONTROL	1
NO CHANGE	PERFECT	1
NO CHANGE	RECIPROCAL	1
NO CHANGE	TRANSITIVE	1
NONCONTROL	PERFECT	1
OCILLATING	RANDOM	1
PRETENCE	STATIVE	1
PRETENCE	TRANSITIVE	1
PURPOSIVE	RECIPROCAL	1
STATIVE	TRANSITIVE	1

Appendix D: Languages attested for each co-pattering pair in Figure 8

INTENSIVE	ITERATIVE	Araki; Cree, Plains; Fijian; Huasteca Nahuatl; Indonesian; Jamaican Creole English; Karok; Koasati; Kwazá; Mokilese; Oromo, Eastern; Plateau Malagasy; Rapanui; Réunion Creole French; Tok Pisin; Vietnamese; Yukulta; Zialo
DURATIVE-ITERATIVE	ITERATIVE	Acoma; Afrikaans; Classical Nahuatl; Daga; Indonesian; Jamaican Creole English; Karok; Koasati; Kwazá; Maori; Niuean; Réunion Creole French; Senoufo, Supyire; Tok Pisin; Yukulta; Zialo; Zuni
DURATIVE-ITERATIVE	INTENSIVE	Ainu; Indonesian; Jamaican Creole English; Karok; Koasati; Kwazá; Marquesan; Maybrat; Réunion Creole French; Squamish; Tamil; Tok Pisin; Yukulta; Zialo
ITERATIVE	MULTIPLE LOCATION	Arapesh; Berber, Middle Atlas; Cree, Plains; Gayo; Gooniyandi; Koasati; Kyuquot Nootka; Oromo, Eastern; Rapanui; Réunion Creole French; Tok Pisin; Washo; Zialo
CONTINUATIVE	ITERATIVE	Acoma; Afrikaans; Cree, Plains; Daga; Diyari; Gayo; Kwazá; Mandarin Chinese; Mokilese; Yaqui; Zuni
DURATIVE-CONTINUATIVE	DURATIVE-ITERATIVE	Afrikaans; Dyirbal; Koasati; Mangarrayi; Maung; Shi; Squamish; Tok Pisin; Yukulta
INTENSIVE	MULTIPLE LOCATION	Cree, Plains; Koasati; Oromo, Eastern; Rapanui; Réunion Creole French; Squamish; Tagalog; Tok Pisin; Zialo
ITERATIVE	MULTIPLE SUBJECT	Acoma; Araki; Classical Nahuatl; Koasati; Kwazá; Niuean; Rapanui; Sumerian
ATTENUATIVE OF INTENSITY	ITERATIVE	Afrikaans; Fijian; Indonesian;Kwazá; Mandarin Chinese; Maori; Niuean; Réunion Creole French
DURATIVE-ITERATIVE	FREQUENTATIVE	Afrikaans; Classical Nahuatl; Hawaiian; Karok; Maori; Meyah; Niuean; Swahili
DURATIVE-ITERATIVE	MULTIPLE SUBJECT	Acoma; Classical Nahuatl; Hawaiian; Koasati; Niuean; Squamish; Takelma
DISTRIBUTIVE OBJECT	ITERATIVE	Classical Nahuatl; Cree, Plains; Georgian; Papago; Senoufo, Supyire; Sumerian; Tetelcingo Nahuatl
COMPLETIVE	DURATIVE-ITERATIVE	Daga; Karok; Koasati; Marquesan; Maung; Squamish; Zialo

(*continued*)

(*continued*)

COMPLETIVE	MULTIPLE LOCATION	Angkamuthi dialect of Uradhi; Arapesh; Koasati; Rapanui; Squamish; Tagalog; Zialo
COMPLETIVE	ITERATIVE	Arapesh; Karok; Koasati; Rapanui; Sumerian; Tetelcingo Nahuatl; Zialo
COMPLETIVE	INTENSIVE	Karok; Koasati; Marquesan; Rapanui; Squamish; Tagalog; Zialo;
DURATIVE-CONTINUATIVE	INTENSIVE	Koasati; Rapanui; Squamish; Tok Pisin; Tukang Besi; Yukulta
COMPLETIVE	DURATIVE-CONTINUATIVE	Koasati; Maung; Rapanui; Senoufo, Supyire; Squamish
ATTENUATIVE OF EXTENT	ATTENUATIVE OF INTENSITY	Afrikaans; Mandarin Chinese; Ngiyambaa; Niuean; Tagalog
DURATIVE-ITERATIVE	MULTIPLE LOCATION	Koasati; Réunion Creole French; Squamish; Tok Pisin; Zialo

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