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Overlap not gap: Understanding the relationship between animal communication and language with Prototype Theory

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Abstract

What is the relationship between language and animal communication? This has largely been discussed within research on language evolution and disciplines beyond linguistics, but impacts upon the study of language generally. There are two extant views on the nature of this relationship: either there is a stark divide, with language considered as completely unique to humans, or there is a linear continuum from animal communication to language, aligning with gradualist evolutionary principles. Yet, each view involves considerable limitations. Moreover, there is no agreed-upon definition of language, which further complicates the determination of its relationship with animal communication. Withdrawing from attempts to define language with traditional fixed criteria (as characteristic of classical categorisation), this article suggests a different approach to conceptualising language and assessing the concept's applicability to other species. Categorising phenomena through family resemblances and graded typicality of features (as in prototype-based categorisation) enables a new approach to conceptualising language, its typological diversity amongst humans, and the systematic integration of animal communication. Ultimately, with an illustrative model, this article proposes a strong overlap of animal communication with language. This approach illuminates more of the nature of language, facilitates more cohesive interdisciplinary research, and introduces potentially positive ethical implications for non-humans.
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1. LANGUAGE AND ANIMAL COMMUNICATION

How does language relate to animal communication? This question has largely been discussed within the realm of language evolution (e.g. Bickerton, 1990; Deacon, 1997; Radick, 2007), as well as disciplines beyond linguistics (e.g. Fishbein et al., 2019). Yet, the answer would impact strongly upon all areas of language study. This can include a greater understanding of ontogenetic language acquisition, by analogy with language evolution (e.g. Tomasello, 2003). It also includes the exploration of potential universal theories of grammar, which might find greater support when

factoring in other species. Already linguistic laws about communicative efficiency have been established in the communication systems of all species investigated so far (Heesen et al., 2019). Additionally, Saussure's (1966) call in the early twentieth century was to study language for its own sake, to determine its fundamental nature. This fundamental nature is still to be established and its uncertainty has been highlighted by animal communication comparisons (e.g. Hockett, 1959). Moreover, since moving beyond the famous nineteenth century Linguistics Society of Paris ban on exploring language origins (Société de Linguistique de Paris, 2021), and given the range of complex animal communication and cognition findings that are emerging in recent years, we are reaching a stage where we have little reason *not* to investigate animal communication, and its relationship with language generally. It might even be argued that it is important to actually factor in non-human communication features into a more encompassing approach to answering the question of what language is.

Therefore, while the overarching aim of this type of research is to establish the nature of language overall, which currently defies definition (Bolhuis et al., 2014), the focus of this article is on reconceptualising language using Prototype Theory and on how we might integrate animal communication evidence into this discussion. This is a new way of conceptualising language and will allow for a different and much improved way of discussing the relationship between language and animal communication. By using Prototype Theory as a basis, we can determine the similarities and differences in a systematic way, if not also integrate animal communication into an eventual concept of a prototype of language, give the known and anticipated overlapping features of both phenomena. This approach builds on Prototype Theory's graded boundaries and family resemblances. This is briefly illustrated by the model presented in Section 7.

On account of this intent to determine the nature of language and its relationship to animal communication, there will be a focus throughout on naturally-occurring animal communication and language. Therefore, neither experiments of language teaching from humans to other animals nor limited (known) instances of interspecies communication will be explored. The next sections of this paper, 1.1 to 4, provide necessary background on the topics and issues involved and are meant to serve as a broad introduction.

As this paper intends to propose a specific way in which to organise discussions about language and animal communication, there is sadly insufficient space to delve into the details and debates of each sub-topic that contributes to this overall perspective, while doing so would also create too much confusing digression from the main objective. Instead, each sub-topic will be introduced in a simplified way for efficiency's sake and to retain focus, to build towards the prototypical relationship between language and animal communication that is established here. Where possible, this is also noted locally within later sections with reference to literature that can be explored for further depth and detail beyond the paper as required by readers.

1.1. Views on language

Currently, there are two extant views on the nature of the relationship between language and animal communication. Some scholars have proposed a stark divide between the two phenomena, with language considered as uniquely human (e.g. Chomsky, 1965). Other scholars have argued for a linear continuum in line with gradualist evolutionary principles (e.g. Bickerton, 1990). Each of these views involves serious limitations in their own ways, however, as will be discussed. This especially includes the fact that almost all scholars across disciplines, and from both the divide and continuum perspectives, nevertheless consider language to be unique to humans, as detailed in Section 1.2.

To further complicate this matter, there is no agreed-upon definition of language. Bolhuis et al. (2014) make this point (c.f. also Behme, 2016), while Wacewicz et al. (2020, p. 60) state that '*language* is itself a natural language word that is fuzzy and polysemous, and as such eludes precise definitions'. Instead, numerous authors freely propose various elements or features without which they argue language could not occur, either as features of or foundations to language. A key example derives from Saussure (1966), who proposed several features of language, including 'arbitrariness': how a linguistic form like the sound of a word bears no direct relation to its associated meanings. Similarly, anthropologist Deacon (1997) proposed a 'symbolic threshold' to language. Bickerton (2007, p. 511) also stated that '[s]ymbolic units and syntax are the only real novelties in human communication'.

It is worth noting briefly for clarity that symbolic reference (c.f. Frege, 1948; Peirce, 1984) is a complex concept in linguistics and also hotly debated where animal communication is concerned. It is often deemed to be uniquely human (e.g. Byrne et al., 2017; Wheeler and Fischer, 2012), though some claim that it occurs in animal communication too (c.f. Table 1 in Townsend and Manser, 2013). This is more often the case when other conceptual confounds are stripped away, such as the requirement for reference to be semantic and context-independent, when pragmatic reference can and does occur ubiquitously (Scarantino and Clay, 2015). While it is difficult to explore these sub-topics and concepts in any depth here, it is important to note such complexities exist, especially before attempting to organise accurate comparisons between language and animal communication.

Beyond such proposed features of language, some scholars also focus on whether language is an innate capacity for humans (e.g. Chomsky, 1965). However, Dor (2015) instead sees language as a social communication technology, in the same way as books, Facebook, or computer games, and argues that language needs to be invented and constructed, and that it constantly develops as a result of usage.

Another consideration about the nature of language has been language's pre-requisites, such as its close links with understanding the minds and intentions of others (e.g. Malle, 2002), known as 'theory of mind' (Premack and Woodruff, 1978). Halliday (1975) also focused on communicative intentionality. Others argued that centre-embedded recursion, a specialised form of hierarchical syntax (sentence organisation), is core to how language operates (Hauser et al., 2002). This is exemplified in the sentence: 'The malt that the rat that the cat killed ate lay in the house that Jack built.'.

Therefore, a concept of language, its characteristic features and its pre-requisites, to some extent, comes down to who is being asked to describe the phenomenon (c.f. Lyons's introductory chapter, 1981). Or, as Botha puts it (2000, p. 152), upon examining the different approaches to the nature of language in the literature: 'How could language be at one and the same time an "aspect of human behaviour", a "process", a "meta-task", a "special human skill", an "activity", an "application of social intelligence and a theory of mind", a "species-specific capacity", "a sort of contract signed by members of a community", "hard-wired (individual) competence", a "group behaviour" and an entity "spontaneously [formed by] itself"?' Meanwhile, there seems to have been little discussion on how to reconcile these different perspectives. Therefore, there needs to be a consensus reached somehow in order to advance linguistic research in a fully collaborative way. The 'somehow' part is achieved with the conceptualisation of language through Prototype Theory, as proposed in this paper.

It is also worth pointing out early on that we need to address the definition of *animal communication* as well as language, for the sake of comprehensiveness, alignment with ethological practices, and a sense of ethical equality. Traditionally, *animal communication* is used in the humanities literature, while it is employed in the ethology literature to a lesser degree. We need to note that this phrase actually covers a wide range of communicative behaviours and cognitive mechanisms, animals of many different taxa, a wide array of signal forms and functions, and very different evolutionary histories of the communication systems. On account of the tradition of the phrase's usage and our focus on fully investigating the alleged species distinction between language and other types of natural communication, we will employ *animal communication* within this paper for the sake of comprehension as well as a convenient shorthand, but alongside *animal communication systems* to remind readers of the variety involved. Part of the purpose of this paper is to highlight such conflated notions, while the conceptualisation presented here will require us to investigate features carefully for a fair and accurate comparison across species.

1.2. Human uniqueness of language

As mentioned above, despite the lack of a definition, however, language is generally deemed to be the 'last bastion of human uniqueness' (Lawrence, 1998, p. 121). Chomsky (1965) is a major proponent of this species-centric perspective. This view has, though, persisted since ancient times (Heath, 2005).

The primate language teaching experiments of last century (c.f. Hess, 2009) supported the distinction of language capacity in terms of a species distinction because it was deemed that the chimpanzee Nim Chimpsky and contemporaries exhibited only limited vocabulary and very minimal syntax in their communications, despite years of undergoing teaching. This was regardless of the fact that some individuals like bonobo Kanzi were more capable than others (c.f. Hillix and Rumbaugh, 2004). However, these proclamations about the uniqueness of the human capacity for language came before important methodological developments. For both human children and non-humans, aspects like softening the clinical side of experimental settings and having the involvement of experienced signers can fundamentally improve the validity of findings from linguistic experiments (c.f. Ambridge and Rowland, 2013; Hillix and Rumbaugh, 2004).

Additional support for a language capacity distinction based solely on species comes from linguist Hockett's (1959; 1960; Hockett and Altmann, 1968) 'language design feature' list of sixteen features, which were created to distinguish language from communication, particularly animal communication. These features comprise the 'vocal-auditory channel', 'broadcast transmission/directional reception' so receivers can determine signal direction, 'rapid fading', 'interchangeability' of signaller and receiver, 'total feedback' for the signaller, 'specialization' for the communicative function, 'semanticity' of signals with specific and stable meanings, 'arbitrariness', 'discreteness' of sounds for a combinatorial encoding of information, 'displacement', 'openness' or productivity, 'tradition' or cultural transmission of communicative conventions, 'duality of patterning' where abstract sounds or other forms can be combined with meaning, 'prevarication', 'reflexiveness' to communicate about communicating, and 'learnability' (Hockett and Altmann, 1968).

Hockett's list of language features has been widely cited across disciplines (e.g. Anderson, 2017; Comrie, 1997; Engesser and Townsend, 2019; Gussenhoven, 2004; Reznikova, 2017; Traxler, 2012), but also strongly critiqued

(e.g. Evans, 2014; Wacewicz and Zywiczynski, 2015; Wray, 2005). For instance, not all of Hockett's language design features are requisite for recognised languages: the vocal-auditory channel is not necessary, given the widespread usage of signed languages. Moreover, the list of language design features is inequitable when used as a comparison between animal communication and language. For example, social transmission in language, or 'tradition' to use Hockett's terminology, has been argued to have more to do with conceptual content and semantic information being built up across generations of humans, whereas for animal communication use of the term 'social transmission' relates more to developing communicative modalities, like the vocal-auditory channel (e.g. Garland and McGregor, 2020). Wacewicz and Zywiczynski (2015) in particular argue that Hockett's language design features focus too much on communicative means and structure, rather than the underlying cognitive aspects of language, from theory of mind to executive function. Other scholars have presented briefer attempts than Hockett on comparing language with animal communication, for instance Haldane (1955), but these are rarely cited.

The human-only view of language may also be related to a failure to look for evidence. Even with recognised languages among humans, certain features have often gone unnoticed or ignored in favour of 'the linguistic categories prominent in classical Indo-European languages', like gender and tense (Aikhenvald, 2018, p. 2). It is a fairly recent advance of the discipline of linguistics (Song, 2013) to be seriously exploring linguistic typology in terms of the variation of languages from one another. Traditionally, linguistics has focused on language similarities and on grouping languages together instead, such as the genealogical or family tree relationships described in philology texts (c.f. Saussure, 1966). As a result of this grouping together approach, theories have been developed on potential universal characteristics shared by all languages, such as Chomsky's Universal Grammar (1968). Thus, given that study of language variation is only a recent exploration for humans, it is perhaps understandable that the literature has not considered what language-like features other species may present. This lack of consideration may derive either simply from the fact that other animals are just different species from humans and are not seen as comparable organisms. Alternatively, the lack of consideration of variation may derive from the notion that language-like features that might be exhibited by other animals are themselves not (as) familiar to those features belonging to recognised languages, especially the commonly spoken ones in the Indo-European family.

The human uniqueness perspective also subtly resides in the terminology we use, for instance, with collocations, as defined by Firth (1957) and Sinclair (1991). A key example is the collocation *animal communication*, which is used to refer to non-human communication, despite the fact that humans are animals. Given the phrase's frequent usage in the interdisciplinary literature, it is used in this article, though under advisement.

Paralleling this is the collocation *human language*. This phrase is found in linguistics textbooks (e.g. Bauer, 2017, p. 6; Radford et al., 2009, p.61; Tay, 2015, p.52), alongside other academic literature like Liebal and Oña (2018) on non-human primate communication. Is this merely a redundant phrase, for instance where Evans et al. (2007) use this collocation in their first paragraph of a linguistics work that has nothing to do with non-humans or artificial intelligence, thus with no apparent need to specify that language is human? Is this collocation an indication of an anthropocentric viewpoint to reiterate a notion that only humans possess language, as with Chomsky's works (e.g. 1965)? Yet if this were the case, why qualify *language* with the adjective *human*? Or is this a clarification to specify that languages of humans are being discussed because there may be other types of languages even amongst other species? This latter possibility seems prevalent in how the Taa people of Botswana and Namibia have named their common language, Taa-ǂaan or 'Human being language' (Andresen and Carter, 2016, pp. 284-287). Thus, whether academia wishes to maintain the stance that language is unique to humans, or whether the collocation *human language* is simply being used without thought, it is a debatable phrase and has been avoided in this paper.

1.3. Animal communication-language similarities

From another perspective, if we do not know what language is, how can we determine that only humans possess and are capable of it? Furthermore, are we content to be discussing all languages used by humans and their vast typological varieties as instances of just one single phenomenon, as implied by the unifying term *human language*? Lastly, on a more ethical note, many scholars actively avoid anthropomorphism (Kennedy, 1992), in an attempt to prevent human values and biases from encroaching on the interpretation of animal cognition and behaviour. There is a concern involved that any similarities that are drawn between other species and humans may not actually exist, and that they are only proposed because of our inherent anthropocentric perspective. However, what of the other extreme, 'anthropodenial' (de Waal, 1999)? This coinage refers to the possibility that we risk denying capabilities that other species might actually possess, due to fears that human comparisons are a disreputable fantasy. A key example might be language, or at least a capacity for language.

Beyond such philosophical lines of enquiry, scientific challenges to a human-animal language dichotomy arise. Thus, gradualist evolutionary principles requiring some degree of non-human language have been raised since Darwin's era

(e.g. Whitney, 1875; c.f. also Radick, 2007). There is also a logical validity of the expected link between social complexity and communicative complexity (Freeberg et al., 2012), which might lead complex non-human social groups to having language, or language-like communication. This could be the case for highly social species like African wild dogs, who engage in quorum voting on their group movement via their sneezes (Walker et al., 2017). Such a complex social species, with sophisticated communication, could be a candidate for investigations for language-like communication.

Evidence of animal communication systems exhibiting some language-like features is growing too. Gunnison's prairie dog alarm calls (Slobodchikoff et al., 2009) appear to encode information like colour and shape labels for their different predators, each predator in turn eliciting their own individual alarm calls. Furthermore, linguistic analysis demonstrates the semantics of putty-nosed monkey *pyow-hack* sequences as relating to non-threat-related general group movement, although the acoustic components are also used separately in the monkeys' alarm calls (Schlenker et al., 2016a). This shows an intriguing variety of meaning within the calls.

On the more structural side, chestnut-crowned babbler birds use meaningful combinations of meaningless sounds (Engesser et al., 2015), a combinatoriality on the phonological level. Meanwhile, Suzuki et al. (2019) review non-human syntactic studies to explore the character of the complexity of animal communication system structure, as Zuberbühler (2019) does in his paper, comparing more basic combinatoriality and higher-level compositionality for instance. Conversely, there are even recognised languages among humans that exhibit only minimal levels of syntax, such as Riau Indonesian (Jackendoff and Wittenberg, 2014). This language relies more on pragmatic context for effective communication.

Additionally, both animal communication and animal cognition require exploration for their links to language. Both communication and cognition have raised major debates for understanding the function and origin of language: some have argued that language evolved *for* the purpose of organising thought (e.g. Fodor, 1975) or *for* communicative purposes (e.g. Halliday, 1975), while some scholars have argued that language evolved *from* more primitive communication (e.g. Hauser, 1997), and others have preferred a more cognitive origin story (e.g. Ulbaek, 1998). In both the function and origin debates, though, both communication and cognition play important roles for understanding the nature of language.

In this light, animal *cognition*, rather than animal *communication*, has been proposed as being more useful for exploring for its evolutionary links to language (Fitch, 2019; Ulbaek, 1998).This ranges from the comprehension of symbols and their usage in primate language teaching experiments (e.g. Savage-Rumbaugh et al., 1986), to the finding that African elephants behave more defensively to adult male Maasai speakers than to humans of different genders, ages, or ethnicity (McComb et al., 2014). Meanwhile, animal cognition findings align with outcomes of cognitive science and cognitive linguistic research, for example vocal learning occurring in mice (Arriaga et al., 2012), which points to a non-innate, cognitive plasticity learning as adopted in cognitive linguistics, where linguistic structures are thought to arise from patterns of usage (Geeraerts and Cuyckens, 2010) and are thus learned, rather than being innate and needing to be 'switched on' in the brain. These links between animal communication systems and cognition with cognitive linguistics research have yet to be explored empirically beyond traditional linguistics for non-human comparisons (Amphaeris et al., 2021).

However, despite such increasing evidence of relevant complexity, and having the avenues of both animal communication and animal cognition to explore, there has been limited linguistics research on non-humans until fairly recently (c.f. Berthet et al., 2021, in the introduction of their preprint primer that offers a toolset to those researching animal communication links to language). There are multiple potential reasons for this research dearth, including discipline introversion, theoretical traditions, and potential species bias on the part of researchers. Yet, aside from these proposals, could the limited non-human linguistics research actually result more from a lack of a suitable theoretical framework about language in which to integrate other species? This article engages specifically with this latter proposal.

The next section will detail the two subsisting views of the language-animal communication relationship: the divide and the linear continuum models, as well as the problems that arise from each of them. Sections 3 and 4 explore two major categorisation options for understanding concepts, Classical Theory and Prototype Theory respectively, and their application to the whole concept of language, rather than instances of language use as has already been explored (e.g. Taylor, 1995).

This article highlights limitations of the fixed criteria definitions found in Classical Theory for our purposes of comparing animal communication systems with language(s), and proposes to categorise the concept of language with Prototype Theory instead. This involves family resemblances, which group concept features together through similarities, and graded typicality of features, which helps to differentiate concepts from one another, albeit with 'fuzzy' boundaries (Lakoff, 1973; Rosch, 1978). For example, in western cultures, a robin may be categorised as a more of a typical bird than an ostrich, though they both belong to the 'bird' concept (as opposed to, say, a rat). Moreover, multiple feature continua can be included, even for a concept like language or language capacity, all without reference to a simple blan-

ket distinction based solely on species. This categorisation approach broadens the scope of what may be considered as language in all its human diversity, while also inviting a comparative application across species.

This application of Prototype Theory to the whole of language is possible because the theory has already been explored for how it accounts for categorisation of abstract concepts like event structure (Tsohatzidis, 1990), as well as more tangible objects like fruit, while language itself is a concept like any other. Moreover, a similar approach has been taken by Watson (2019), who hypothesised that languages can be conceptualised as categories and applied Prototype Theory to the description of multilingualism in Senegal. Meanwhile, Wacewicz et al. (2020, p. 63) conclude that language can best be understood in terms of a 'family-resemblance notion derived from the patterns of use of the word *language* in everyday language(s) and reflected in the patterns of actual research practice', which is in keeping with the Prototype Theory approach to categorisation of concepts that we are adopting here. Therefore, our application of this theory to language conceptualisation and its categorisation in relation to animal communication systems is sound. Section 5 considers how we might more effectively and coherently discuss the nature of language as a general phenomenon in this way.

Section 6 then lays the groundwork for our new approach to conceptualising language and its relationship with animal communication, using Prototype Theory as a foundation. Sections 7 and 8 demonstrate how non-human communication could be incorporated into a concept of language in this way, describing the beginnings of a Prototype-Theory-based methodology with an illustrative model. The last sections touch on some positive ethical implications that such an integrative approach would have for other animals, and summarise what this new conceptualisation offers to interdisciplinary study and an understanding of the nature of language.

There is a caveat to the comparisons made throughout this paper between animal communication systems and language. Some argue that superficial similarity across species, for instance regarding the structural patterns of the communication, does not necessitate a genuine connection between the communication systems and language (Schlenker et al., 2016b). Moreover, when similarities are found, it must be considered that they may be retentions of communication generally, rather than evidence that other species appear to have (elements of) language. However, there are features undeniably shared across animal communication and language, as touched on in Section 1.1 and Section 1.3 already, as well as those to be discussed in Section 7.

Moreover, one of the key benefits of the conceptualisation we propose here is that a Prototype Theory approach enables us to work out what features are typical of language based on which features are observed and how often they occur, to what degree they are shared across animal communication systems, and whether there is a boundary line, distinct or fuzzy, past which the label *language* ceases to be appropriate. This involves a quantitative methodology, as touched on in Section 7, by which we can determine more objectively what language is than by argumentation – which tends to be guided by different perspectives and subjective views. Furthermore, direct comparisons with animal communication, such as those presented by Hockett (1959) and in subsequent publications, typically convey what distinguishes language from animal communication rather than what language is per se. In contrast, using Prototype Theory as a basis paves the way for the recognition of a prototype of language that is useful in both regards: to determine what language is, as well as how it relates to animal communication.

2. THE DIVIDE AND LINEAR CONTINUUM MODELS

Persisting from the nineteenth century (c.f. Radick's historiography on the 'animal language' debate, 2007), there has been a dichotomy of views as to how animal communication systems could relate to language. In modern terminology, scholars have proposed either a strict qualitative divide between the two phenomena (e.g. Chomsky, 1968; Dąbrowska, 2015), or a quantitative linear continuum (Evans, 2014; Gardner et al., 1989; Kershenbaum et al., 2014; Nowak et al., 2000; Westling, 2014). In Darwin's wording, these notions are known as a difference of 'kind' or 'degree' between species (Darwin, 1871/2004, p. 173), which become salient terms when exploring the application of Prototype Theory later in this article. Pinker (1995, p. 334) is one such scholar who has argued for a 'difference in kind' between the species, stating that 'Language is obviously as different from other animals' communication systems as the elephant's trunk is different from other animals' nostrils'. However, one could actually respond to this by noting that, because the trunk performs a similar function to other animals' noses, this specific example seems an instance of a particularly large 'difference in degree' masquerading as a 'difference in kind', which undermines Pinker's point.

Both of these divide and linear continuum views present problems, however. We are faced with the puzzle of explaining either how, and why, only humans acquire such a complex cognitive and social skill, if we accept the clear divide account (Bickerton, 1990); or we need to explain why we accept a continuum while simultaneously assuming other animals are not capable of (full) language. This division manifests itself regardless of whether one favours the traditional and commonly held view of evolution as a gradualist process, from Darwin onwards, or favours a more punctuated, rapid change perspective on evolution, given that gradual evolution might be deemed too slow for producing major evo-

lutionary events and ignores periods of stasis (no change) (Gould and Eldredge, 1977). Botha (2000) discusses different linguistic positions on this subject. There could even be a mixture of both types of evolution, while some believe that a gradualist approach can cover both rapid and slow changes (Wolpoff, 2018). In any case, what exact time period constitutes a gradual or punctuated evolution: a month, a millennium, a million years?

While it is important to note this contentious background, and that evolution as a whole should not necessarily be conflated with a linear continuum approach to language and animal communication systems, and while we need to stipulate that we in this paper hold a gradualist notion of evolution, in fact this debate bears little on the divide or continuum issue. A punctuated evolution still falls foul of the question about how such a vast leap to language occurs, as does the divide perspective, which is a proposal on the story of language that has not yet been explained. Meanwhile, the gradualist approach still requires explanation for why there remains an assumed speciation: that only humans developed (full) language.

Thus, to return to the divide versus continuum perspectives, those that have argued for a strict divide in species' capacity for language, have raised issues like the apparent qualitative differences between human and animal cognition that enable language learning (Dąbrowska, 2015): this includes the ability to acquire form-meaning conventions, and the understanding of communicative intention, also raised at length by Tomasello (2003). Another alleged human specific trait is centre-embedded recursion as mentioned above (Hauser et al., 2002). There are counterarguments to each individual point raised, however, particularly as we discover more about the complexity of animal communication and cognition, as well as the more we understand these features in human communication and languages. Taking centre-embedded recursion as one such refutable instance, this is actually difficult to process for humans, and in fact has a low frequency in natural discourse (Corballis, 2007; Diessel and Tomasello, 2005). Moreover, regardless of any specific language or language-related traits that could be argued as being uniquely human, we still need to account for the evolutionary history of language somehow.

With regard to the linear continuum approach, five specific problems arise there too. To explain this linear continuum notion, as well as the detail of the problems associated with this approach, Whitney (1875) is an excellent and classic source to study. In his work, he responds to critiques on his approach to language by another contemporary linguist, Müller. Whitney's (1875, p. 730) stance on the idea of comparing humans with other animals with respect to language is that there is 'no impassable barrier, but only an impracticable distance' that separates language from animal communication. This is a linear continuum with a notional break in it.

Whitney's argument struggles in five key ways. This is partly due to the limits of discoveries about animal at the time of Whitney's writing. Yet, these problems have not been fully resolved in the current literature, hence the discussion of a new approach in this article.

First of all, Whitney's focus is solely on animal communication without any consideration of animal cognition links to language, which may potentially draw other animals closer to a language capacity if not language production (c.f. Fitch, 2019). This point of view is still rare in today's literature (Amphaeris et al., 2021), but is nevertheless of serious import, given the increasing cognitive accounts of language for humans (e.g. Tenbrink, 2020).

Secondly and notably, Whitney's discussion focuses in a limited way on the vocal modality of both humans and other animals. Similarly, many of Hockett's (1959; Hockett and Altmann, 1968; and c.f. Section 1) language design features focus on the vocal-auditory channel, which have been critiqued in the same way (e.g. Wacewicz and Zywiczynski, 2015). These modalities are not necessarily reflective of all of language, given the widespread usage of signed languages for instance, but the vocal-auditory channel continues to be the main modality explored in animal communication research today as unintentionally highlighted by a Royal Society theme issue introduction (Fishbein et al., 2019).

Thirdly, Whitney refers to *all* animals rather than considering potential species variations in communication complexity. Not all animals have evolved equivalently, and so sweeping generalisations, as involved in even the modern collocation *animal communication*, need serious reconsideration. Why should an alarm signal of a highly social prairie dog and a solitary octopus be the same?

Perhaps the biggest challenge to the linear continuum approach is that Whitney (1875, p. 731) proposes a 'distance' across which 'the animals can go no further', whether that is to develop language or tools. This seems to be an antithetical point to his determination that language evolution is somehow related to the apparently rudimentary communication of other animals. He argues here that a lack of supposed cultural transmission is the cause for the limit on other animals to develop language. However, beyond any concrete argument that might be made against these particular claims and arguments that Whitney makes, this 'distance' viewpoint illustrates that, even with the intention of creating a linear continuum between humans' and other animals' capacity for language, a strong conceptual break is involved.

This is related to the fact that language is still almost entirely considered to be unique to humans. While a linear continuum with a gradual evolution does align with Darwin's (1859/1996, p. 158) recourse to the natural history canon of '*Natura non facit saltum*', 'nature takes no leaps', the setting of any limits within a continuum is paradoxical. How can we have a continuum with such a break in it – a *dis*continuity in fact? Such a conceptual continuum and yet practical

discontinuity approach towards other species and their language capacity has been subtly taken up by many modern scholars, from Evans (2014), who focuses on the differences in levels of complexity, acquisition, and range of functions of language as opposed to animal signals, to Bickerton's (1990) focus on language's status as a representational system which appears unique to humans.

A final conceptual problem for the linear continuum approach, as Deacon notes (1997) and as is clear in Whitney's account, is that many assume that language is an evolutionary inevitability, that humans have arrived at first (c.f. Hurford, 2014), or are at the pinnacle of, but this cannot be the case because it rests on 'seeing the world in terms of design' (Deacon, 1997, p.29). Technology may be cumulative, teleological, and increasingly complex, with incremental improvements made consciously to preceding breakthroughs, but biological evolution does not operate in this way. This is one of several reasons to update Hockett's 'language <u>design</u> features' (1959; Hockett and Altmann, 1968).

A last point to raise in objection to both the divide and linear continuum approaches is that whenever 'a problem is posed in a way that polarizes, the solution is often obscured before the search is under way...as we look only for points of contrast' (Tannen, 1998, pp. 23, 226). Therefore, considering a third option separate to the divide or linear continuum views would also be methodologically appealing. Indeed, rather than positing a strict divide or a linear continuum between animal communication and language, perhaps we need to seek or create a theoretical model that allows for other conceptual shapes. This point will be explored further in the following sections, as we build towards a prototypical conceptualisation that will enable a more encompassing conceptualisation of language and more effective comparison of language(s) with animal communication systems, by exploring all of the features and different possible continua of these to determine which parts (if not all) of language are core or peripheral, and which features other animals might be variously capable of.

3. CLASSICAL THEORY

From Socrates onwards, Classical Theory is the traditional and most famous way to categorise – or more technically 'define' – concepts. Therefore, it is necessary to explain this categorisation approach for context before introducing an alternative approach, Prototype Theory. However, it is important to note that this section serves as only an introductory overview of the categorisation theory, without delving into the detailed controversy and multiple interpretations it has attracted over the centuries. For instance, some would argue that the 'true' nature of the theory is 'that concepts are defined by individually necessary and jointly sufficient logical conditions...[which] was developed not by psychologists but by philosophers and linguists...not in order to explain how categories are acquired or how instances are recognized, but in order to account for the logical properties of concepts and sentences' (Sperber, 1986, p. 668). Meanwhile others would argue that Classical Theory is often presented as a 'strawman' by those favouring other approaches like Prototype Theory. However, a detailed discussion on this theory's background would prove an unnecessary tangent from our main purpose in this article: understanding the nature of language(s) and its relationship with animal communication systems with Prototype Theory.

It could be argued that we should not mention Classical Theory at all, if we are not going to present it comprehensively. Yet, we must address Classical Theory for the very reason that many debates about what language is also seem to (unintentionally) use this 'strawman' version of classical theory: involving the search for necessary and sufficient criteria for language, as with Hockett's language design feature list (1959). Thus, we are not pitting categorisation approaches against one another, as might be done in other texts despite the clearly complex nature of concepts. Rather, we are noting that when it comes to language, there is an insistence that such criteria are required, in a similar way to defining a species in biological sciences. However, in this article, the intent is to demonstrate that language is instead best understood as a prototype sort of concept, not a criteria-based one. Mention of Classical Theory in this paper, then, serves only to set the context for this proposal with a basic background of the theoretical differences and why Prototype Theory is more suitable to framing the discussion of how language relates to animal communication.

Simply put then, Classical Theory defines concepts in terms of their necessary and jointly sufficient features or 'conditions' in the theory's proper terminology. A key example from the literature is the concept or category of 'bachelor'. A necessary condition is an integral condition that must be met for something to be categorised as a certain concept; for instance, in order for someone to be categorised as a bachelor, they must be male. When someone meets all the combined necessary conditions, and only those conditions of a concept, they can be categorised as that concept, like a bachelor, and they can be said to have satisfied the jointly sufficient conditions. Moreover, 'each member is equally representative of the category' (Jacob, 2004, p. 520) without rank or grading. The situation is black or white; there is no grey area as to whether something is categorised as one concept or another, and the boundaries are rigidly fixed. According to Classical Theory, then, a bachelor is and only is an adult unmarried male. Any deviation from a concept's strict criteria, therefore, leads to redefinition, so that whatever the entity in question, it now comes under the remit of a different category and definition altogether.

Connected to this theory are the notions of essentialism and natural kinds. The basic idea here is that all phenomena have a fundamental essence and a natural way of being categorised in the world, thought to be an objective truth in nature, irrespective of human conception or categorisation of the phenomena in question (Bird and Tobin, 2017). This is like Classical Theory in terms of its necessary and jointly sufficient conditions. It also draws an important antithesis to the prototypical theory of categorisation as explored in the next section.

Despite the age and strong tradition of Classical Theory, Wittgenstein (1953/2009) famously challenged the idea that definitions are possible or could ever be reached with such fixed boundaries and conditions. Using the category 'game' for illustration, Wittgenstein noted the difficulties involved in reaching a single definition that would incorporate all games and only games, as per the requirements of Classical Theory (Armstrong et al., 1983). Instead, he conjectured a cluster concept, or a variety of features, of which only some were exemplified in each game. Other objections have followed but will not be discussed here (c.f. Earl, 2021 for more details.).

Regardless of its status as a categorisation approach generally, the necessary and sufficient criteria aspect of Classical Theory importantly has drawbacks when attempting to apply it to categorising language on a macro scale, and it is this aspect that will form the point of comparison with Prototype Theory throughout the rest of this paper. The theory could struggle to account for the wide typological variation across even recognised languages amongst humans, let alone exploring the diversity of animal communication systems. For instance language isolates like Modern Greek resist straightforward classification into language families due to their extensive differences from the other languages in that family, and even sometimes due to their unknown origin links like Basque (Pereltsvaig, 2012). Using Classical Theory to account for language could lead to creating multiple definitions of language, which would negate the purpose of seeking a single unifying definition of language. Alternatively, any definition of language that could be reached would largely ignore language variation, as if there is essentially just one language that can be reduced to a handful of (structural) rules. This latter approach is taken in Universal Grammar theory (Chomsky, 1968 onwards). However, Universal Grammar has already been called into question by another branch of linguistics, cognitive linguistics (Dąbrowska, 2015; Radden and Dirven, 2007).

More important still, on account of its fixed boundaries and strict categorisation criteria, Classical Theory supports the notion of a 'difference in kind' with regard to perspectives on language as it relates to animal communication. This 'difference in kind' view has already been disputed in Section 2. Therefore, as Classical Theory involves general philosophical challenges, does not easily accommodate language typology, and pertains to a questionable view of the co-existence of language and animal communication, it is important to seek alternative categorisation theories, which is the material point for this paper.

4. PROTOTYPE THEORY

4.1. Theory background

One of the most popular alternatives to classical definitions is Prototype Theory, which originated in cognitive science, though was preceded by Wittgenstein's (1953/2009) challenges to Classical Theory. Rosch refined Wittgenstein's philosophy (Rosch, 1978), and was an important part of the development of a coordinated theory used by multiple scholars in linguistics and beyond (e.g. Lakoff's analysis of the preposition *over*, 1987; c.f. overviews by Geeraerts, 2006; Hampton, 1995; Taylor, 2001). This theory is particularly useful as part of our conceptual basis for comparing animal communication to language(s) efficiently, and is explained in this section for those unfamiliar with it.

In Prototype Theory, a prototype arises out of typicality (frequency) and family resemblance effects, through a process of abstraction (generalisation) across instances. To use the example of the concept of 'bachelor', as raised in the previous section, within Prototype Theory a typical bachelor is an adult unmarried but eligible male, as these are features (known as 'attributes' as per the theory's terminology) that most bachelors share. A less typical bachelor, but still a bachelor, is a septuagenarian unmarried male, or a celibate adult male. So the features may not always arise, or may arise to differing degrees, unlike Classical Theory with its fixed and non-graded necessary and sufficient features or 'conditions'.

It is worth noting briefly, that though features are used to categorise in both theories. The way in which the features are grouped is very different in Classical Theory to Prototype Theory. As such, *feature* is a theory-neutral term and will be used in this article for clarity's sake, while use of the term follows on from attempts like Hockett (1959) to determine the salient features of language as opposed to animal communication.

4.2. Vertical dimension

Prototype Theory has both a vertical and a horizontal dimension, the latter of which is the most prominent dimension in the literature. However, both dimensions offer useful perspectives on the relationship between language and animal communication systems.

The vertical dimension is a hierarchical system of categorisation, as seen in biological taxonomy. Rosch's (1978) levels of categorisation are, top to bottom: 'superordinate', 'basic', and 'subordinate', with increasing levels of specificity working down the levels. For instance, one can have a very abstract and general superordinate 'mammal', a basic-level 'dog', and at the lowest level, a much more specific 'poodle' or 'dachshund' with all their various breed-specific traits. The theory does not explicitly stipulate that there can only be three levels, so it is possible to expand on this vertical hierarchical arrangement. However, for simplification here, only three main vertical levels will be discussed in this article.

Being the most abstract and general, the superordinate top layer in Prototype Theory is most inclusive in terms of membership, though – it should be stressed – there are very few features that all members share. Within the superordinate concept/category of 'mammal', for example, some similar features can be found across a dog, a dolphin, and a mole, such as giving birth to live young and possessing hair. However, there are clearly limits to such comparisons, given the wide variations in multiple other respects, including the different animals' habitats, shapes, sizes, social interactions, diets, and so forth.

A middle, basic, layer, is more specified to a particular domain of life or thought, and comprises what is experienced in daily life, including concepts like 'dog', 'house', or 'happiness'. The basic level is the most inclusive or abstract level at which the categories or concepts *simultaneously* reflect features perceived in the world: so considering the immensely diverse number of breeds at a competitive dog show, for instance, the term (and concept of) *dog* is a very generalised term that still represents an object we can easily encounter in the real world. Therefore, this basic level has primacy in our minds. The shared features between category members become more numerous and apparent too: the concepts of 'cat' and 'dog' have multiple similarities across their numerous real world examples, more so than a superordinate level 'mammal' or 'reptile'.

The basic level can then be subdivided into much more specific versions. For instance, 'dog' can be divided into the concepts of 'poodle' and 'spaniel', each with their own more detailed features, from coat type to size, creating their own central prototypes. The vertical hierarchical dimension, therefore, is best represented diagrammatically as a pyramid, in which the features of category members, rather than the category members themselves, become more numerous and specific the further down they are in the system. To put this another way: there are many more mammals that exist than dogs, yet the features shared between all dogs are far more numerous than the features shared between all mammals, hence the pyramid widening out at lower levels.

4.3. Horizontal dimension

Another key contribution of the two dimensions of Prototype Theory is the role they play in determining category members and/or their prototypical features. Within categorisation, there are two sides to the same coin: one side integrating members *into* a category, as carried out by the vertical dimension, while the flip side excludes members *from* categories, as involved in the horizontal dimension. To use an analogy within language study, the vertical dimension can be thought of in terms of language family trees. The further down the tree, the more specific the languages become, while all of these still remain part of an overall interconnected group, such as Indo-European, down to Germanic, and then to English. On the horizontal dimension, however, one can think in terms of a spectrogram. A spectrogram graphically and horizontally represents continuous flows of speech with their naturally graded forms, and yet researchers and other listeners can simultaneously separate out distinct phonemes within the flow of speech, and these phonemes are categorised in the mind as different sounds with different meanings from one another. This exemplifies the role of separation between concepts that occurs in the horizontal dimension, albeit with naturally graded rather than distinct boundaries, though boundaries may still be imposed.

Therefore, while the vertical hierarchy tends to group concepts or categories together to varying degrees, the horizontal dimension tends to differentiate concepts from each other. So 'categories tend to become defined in terms of prototypes...that contain the features most representative of items inside and least representative of items outside the category' (Rosch, 1978, p. 30). Typical features are not shared by all instances of a concept, but are shared by most of them (Earl, 2021). For example, not all dogs bark, but most do. Additionally, there are graded boundaries between concepts in the horizontal dimension. So a husky with all its traits might be seen as a more representative member of the category of 'dog', partly due to its inheriting the majority of its features from its wolf ancestors, while it is least likely to be compared to the category of 'cat' than perhaps a Chihuahua lap dog might be, though both a husky and a Chihuahua still belong to the category or concept of 'dog'.

Category members are grouped or separated according to their family resemblances and level of typicality with respect to the central concept or category prototype. An office building, for example, can be similar to an apartment block in terms of its architecture, but their respective functions differ. So it may be that an office building is more suited to the category of industrial rather than residential buildings.

Ultimately, the key characteristics of Prototype Theory in the horizontal dimension are its ability to categorise concepts and their features in a flexible, graded way, with a central prototype or member being most representative of a category, and least like other categories. The theory does not involve the distinct, exclusive conditions and boundaries of Classical Theory. Nor does Prototype Theory involve or relate to essentialism as discussed before. It is quite possible for at least some prototypes to vary from culture to culture, or from time period to time period. For instance, a prototypical tree in England might be an oak but in Hawaii it might be a banyan tree. Alternatively, if a sailor in the sixteenth century were asked to give an example of a prototypical ship, which ship would probably differ in multiple ways to a prototypical ship in today's world given technological advancements and a wider range of construction materials. Therefore, the theory allows for flexibility not just in terms of determining the prototypical category member and the graded boundaries between categories, but also in terms of how prototypical category members might change with new information or circumstances. There is no objective static eternal reality to the categorisation, as there is with essentialism, which is linked to Classical Theory.

Prototype Theory's effects are also psychologically real (Fodor, 1998, p. 105), and are exhibited empirically throughout numerous studies of human cognition (e.g. Rosch et al., 1976), as well as across features of recognised languages. This includes establishing a central colour category member 'red' amongst the various other colour terms that are marked in the world's languages, despite the universality of biological colour perception amongst humans (Berlin and Kay, 1969) (barring the occasional genetic abnormality of course). Taylor (1995) reviewed a wide range of other linguistic examples of Prototype Theory in action at a language usage level.

Prototype Theory's gradience aspect also explains how grammatical categories are not always discrete, such as adjectives, which 'draw some of their properties from nouns and some from verbs' (Cohen and Lefebvre, 2017, p. 11). This can include the way in which both adjectives and verbs can refer to states like *buried* or the way in which, like nouns, adjectives can be modified, in this case by adverbs, as in the phrase <u>*very*</u> *beautiful*. Meanwhile, there are plenty of naturally continuous or graded categories such as the colour spectrum. Thus gradience is ubiquitous, despite Hockett (1960) and others arguing for discreteness as a core feature of language (e.g. Berwick et al., 2013; Bickerton, 2007; Nowak et al., 2000).

4.4. Challenges to Prototype Theory

As a theory of categorisation, there are several challenges to Prototype Theory. For instance, Prototype Theory may not be needed at all, as Wierzbicka (1990) argues when intuitions are used to judge typicality of birds, and a bat is not included, this seems to show that certain features are actually thought of as necessary not just prototypical. Moreover, Wierzbicka argues (1990, p. 362) that though 'Concepts encoded in natural language are, in a sense, vague...this does not mean that their semantic description should be vague, too' (p. 365).

Another potential serious drawback of Prototype Theory is its very flexibility that makes it appealing as a theoretical foundation for understanding the nature of the language-animal communication relationship. For instance, Rosch (1978) touches upon the theory being context-based, while Jacob (2004, p. 538) notes that categorisation flexibility could 'prohibit the establishment of meaningful relationships because categories are created by the individual...and are thus fleeting and ephemeral'. Yet, there are limiting factors to any categorisation. Even Prototype Theory has category boundaries, though gradient ones. A chair can never be considered a type of cat, despite both having four legs for example.

Thus, in applying Prototype Theory to a categorisation of language and its relationship with animal communication, feature constraints as well as feature typicality must be carefully considered, but at the same time the theory's flexibility can be highly beneficial to this categorisation in ways that are explored in the next section. Additionally, whether Prototype Theory can account for how language works in the mind is a separate issue to using the theory to model discussions *about* language (c.f. van der Auwera and Gast, 2013).

5. WHAT COUNTS AS LANGUAGE?

Despite the problems of Classical Theory for our purpose of comparing language with animal communication systems, its notions of definitions of concepts and terminology still have their value, especially in academic contexts. In this light, it is rather striking that there is, so far, no agreed-upon definition of language – despite the fact that language not only hosts an entire subject area (linguistics) but also features prominently in many other disciplines. The concept itself

appears to be exceptionally elusive, and this creates a notional gap in the literature that hinders consistent treatment of language across different fields.

However, is it that we have not yet reached a definition, or is it that a definition of language – in the strict Classical Theory categorisation sense – is simply not possible? Instead of a definition or fixed criteria list, à la Hockett (1959, 1960), should we use a more neutral term like *conceptualisation*, to refer to how we conceive of and discuss language? Even Hockett and Altmann (1968) already began to move away from a language design feature list towards more flexible feature frameworks and open-ended questions to be answered with empirical research.

Prototype Theory provides a useful categorisation tool that we can use in place of attempting to reach a clear-cut and rigid definition of language. It still incorporates features, but not on the strict basis of Classical Theory, while it offers more than just a list. It also reframes the much bigger question from 'What is language?' to 'What counts as language?' and lays the foundation for a more encompassing and flexible conceptualisation of language.

Most importantly perhaps, Prototype Theory categories can evolve as features and members, even contexts, change, so that as we discover more about non-human communication – perhaps non-human language – in all its variety, the conceptual model of language can grow naturally with this information. Conversely with classical definitions, criteria are predetermined and members are categorised accordingly, so there is no such room for growth within a conceptualisation of language.

6. UNDERSTANDING THE RELATIONSHIP BETWEEN ANIMAL COMMUNICATION AND LANGUAGE WITH PROTOTYPE THEORY

6.1. Difference in Type: The horizontal dimension

Prototype Theory, then, is an appealing alternative basis for conceptualising language. The theory also presents a useful alternative to the Darwinian terms of a 'difference in kind' or 'difference in degree' in how animal communication might relate to language: a 'difference in type'. Not only does this third proposal move beyond the two subsisting but problematic conceptualisations of this relationship, but it also specifies the terminology associated. The term 'kind' is very specific, linking to the theory of natural kinds and definitions in Classical Theory, as described above, whereas the term 'type' moves away from this debatable, strictly categorical approach and instead links to Prototype Theory, along with its notion of graded boundaries.

A Prototype Theory approach also mediates the other two views of the language-animal communication relationship, especially within its horizontal dimension. It answers the 'difference in kind' notion, entailed by Classical Theory, in that the application of Prototype Theory would still encapsulate key differences between concepts: a 'dog' will always be different in various ways to a 'cat'. Therefore, the disparate typological variety of recognised world languages, from their differences in word order to the variation of whichever numerals are expressed, as well as any notable differences between language and animal communication systems, will be recognised within the theory's application.

However, unlike Classical Theory, one prototypical conceptualisation can encompass a vast degree of the variety to an extent because of its graded boundary approach, rather than the distinct and discrete classical analyses. So, in Prototype Theory, the concept of 'dog' would stretch from an ideal husky with all its highly typical features, out to a canid hybrid, such as the offspring of a coyote and a dog, with the blend of features from a typical 'dog' concept and a typical 'coyote' concept. Therefore, Prototype Theory also contributes to a conceptual continuum between language and animal communication, in that it describes a range of graded typicality effects across instances, and so speaks to the 'difference in degree' notion.

Importantly, though, in contrast to the apparently linear notion of a 'difference in degree', with a one-dimensional animal communication to language continuum, the typicality effect in Prototype Theory will manifest itself in terms of multiple comparisons of individualised features existing within animal communication systems and language. This is because the theory is based on a complex combination of multiple simultaneously compared and equivalent feature frequencies and gradience with equivalent-level categories. Thus, regardless of which species exhibits the communicative features to be discussed, like displacement or morphological inflection (word endings), these features will be weighted in terms of their frequency and will reveal themselves as either more or less typical of a central 'language' prototype. In this way, the communication of each particular species could simultaneously be more central and peripheral to a prototype of the concept 'language' – depending on which feature is focused on and to what degree that species' communication makes use of the particular feature.

There will be species distinctions with respect to language and communication systems, of course. For instance, other animals' physical and environmental experiences of the world are not identical to those of humans, nor to other species. According to the theory of embodied cognition (Evans, 2007; Johnson, 1990), human experience of the world and physiology helps to shape our cognitive processes, which can then be expressed through language, for instance in

terms of conceptual metaphors. So Lakoff and Johnson (2003) noticed patterns of expressions within language that relate to this embodied experience. One example is the notion of containment. Given that humans are prevented from moving through solid walls or that we perceive how water can be captured in a vase, this informs our view of the world and we use words like *in*. Such a word does not just describe the physical placement of an object, like in the phrase *the water <u>in</u> the vase* but can describe more abstract ideas, as with the phrase *falling <u>in</u> love*.

Other animals of different sizes will not experience containment in quite the same way. Different ecological niches and physiologies will impact on the cognition and communication of a species in different ways, leading to variation in any of their language(-like) features. This adds to, and interacts with, the differences in communicative modalities that differ fundamentally from human speech, writing, or signed languages. While other species tend to lack a vocal apparatus or opposable thumbs, they can communicate in other ways such as vibration (Endo et al., 2010). Therefore, given the expected variety across species in communication forms and possibly functions too, as well as the necessary evolutionary relationship between animal communication and language in some respect, could the languages that humans use serve as reference points, almost like the process of triangulation to determine the location of a point in mapmaking, rather than as the templates against which other animal communication systems should be compared, when we are determining the ultimate nature of the phenomenon of language and its central prototype?

6.2. Vertical dimension clarifications

The vertical dimension of Prototype Theory clarifies the levels at which we discuss aspects about language, and also the way in which we discuss animal communication in relation to language. Discussion about the cognitive foundations of language, its evolutionary past, and so on (e.g. Tomasello, 2003; Bickerton, 1990), concern questions about what could be superordinate to the concept of language, rather than to discussions of what counts as language itself, as these discussions are highly abstract and removed from language as it is experienced and used on a daily basis.

While communication may be the most prominent superordinate category of language, there are also aspects of general cognition to consider, which is also arguably on a higher conceptual level than the more specific concept of 'language'. For instance, there are very strong arguments for the cognitive basis (Fodor, 1975; Kolodny and Edelman, 2018) and yet communicative function (Hauser, 1997; Hurford, 2007; Scott-Phillips, 2015) of language, illustrating that both superordinate phenomena need to be considered for the support they offer to language, and possibly also to animal communication systems. There are also discussions of a metareflection feature of language (Hockett and Altmann, 1968), helping us to realise our consciousness, by being able to think about and discuss thought and language, as well as merely thinking and using language. It relates to discussions about consciousness in philosophy and cognitive science (Frankish, 2005), while consciousness does play a role in language and linguistics (Itkonen, 2008). Therefore, it could be that consciousness forms a third superordinate category for language, if it is not coalesced into general cognition.

The hierarchical placement of language below general cognition and communication proposed here is motivated by the fact that language seems to be a specialised derivative, though a blended derivative, of these other cognitive and social phenomena. Moreover, Prototype Theory only allows for a concept or category to exist at one hierarchical level at a time. It is not possible, therefore, to discuss language as a superordinate abstract general category at the same time as language at a basic usage level. It is, of course, possible to discuss the cognitive or communicative foundations of language, as separate to language itself, but Prototype Theory's arrangement clearly shows that the concept or category of language must remain unified and intact.

Therefore, following the theory, and highlighting one of its key benefits for distinguishing what features we ultimately do and do not include in a conceptual description of language, we need to acknowledge that language as a concept sits on the basic level, given that it is a unified concept and given that there is a basic level primacy also proposed with respect to Prototype Theory. Language is a phenomenon we perceive in the world in the form of recognised languages from French to Maori and their features, just as much as we perceive the category of 'dog' or the emotion 'happiness'. So any features that we explore must not be pre-requisites for language like memory (Corballis, 2019), but must be naturally occurring and evident features in language and communication usage, as those we mention in the next section, including repetition and identifiers. Any increasingly specific instances of languages, including idiolects, would then be discussed at a more specific subordinate level.

A specific example of a pre-requisite for, but not feature of, language that may be found in animal communication too is communicative intentionality. Like other scientific concepts, comprehensive treatment of its nature, especially intentionality per se, cannot be presented fully here. However, for a simplistic and intuitive approach, communicative intentionality combines to a degree the communicative and cognitive aspects of language and potentially animal communication systems, and refers to the way in which certainly humans actively and clearly communicate with the goal of their signal/message being recognised and understood in the given context (Zlatev et al., 2018). One example would

be waving over someone in a room to talk to them (c.f. Cohen et al., 1990 for more detail). Communicative intentionality is an important (Townsend et al., 2017) if sometimes contested (Fischer and Price, 2017; Moore, 2018; Rendall et al., 2009; Zuberbühler 2018) area of animal research. It is also key for language, as Tomasello (2003) noted that pre-linguistic infants have to learn not just what others are saying but also the fact that they are trying to say something at all (c.f. Halliday, 1975). Grice's (1957) classic theory of non-natural meaning also involves intentionality: communicating as well as communicating about the fact that we are communicating, alongside recognition of that intentionality, which requires a theory of mind (Bar-On and Moore 2017).

Communicative intentionality amongst non-humans can arguably be found in call volume modulation amongst non-humans. For instance, some non-humans 'whisper' to evade predators (Harrington and Asa, 2003; Videsen et al., 2017). Moreover, all mammals and birds that have been tested for it have been shown to voluntarily increase the volume of their signals in noisy environments (Farina, 2014; Zollinger and Brumm, 2011), known as the Lombard effect when attributed to languages (Lombard, 1911). Such volitional active signal volume modulation indicates communicative intention (Lane and Tranel, 1971; Lau 2008). Therefore, communicative intentionality is a strong superordinate feature to be considered for how it supports language and animal communication, but one that must not be plotted on the basic level. However, more specific and observed features that exhibit communicative intentionality, such as call volume modulation or ostensive gestures, could be compared across languages and animal communication systems at the basic level.

When exploring the nature of the relationship between language and animal communication systems, rather than comparing them in some more general way, as on a superordinate level, we also need to consider animal communication evidence on the basic level, because it is what we currently observe and experience, just like features of French. This is further supported by the fact that animal communication, and animal cognition too, are as much basic level derivatives of superordinate categories like general cognition and communication as is language. Thus comparing language and animal communication, as well as potentially animal cognition, should be an equivalent level exercise rather than approaching the latter two non-human phenomena from a solely evolutionary origin perspective, as though animal communication and cognition are merely a simpler and older version of language (c.f. approaches like Bickerton, 1990; Fitch, 2010; Hauser, 1997). Instead, animal communication should be compared equally to language on the basic level, in terms of its features alongside the features of language(s), to determine what the prototype(s) is (are). This is a major way in which Prototype Theory differs to the linear continuum approach and contributes to more efficiently understanding the relationship between language and animal communication. There is still an anticipated continuum between the phenomena, but on an equivalent-level basis (the horizontal dimension), rather than in terms of evolutionary derivation (the vertical dimension).

The value of Prototype Theory's vertical dimension continues down the hierarchical levels. Unlike the Classical Theory approach, where category members that appear at lower hierarchical levels necessarily encompass features of each of the higher level members, and just add to those, Prototype Theory suggests that lower category levels could also drop and/or change features from its higher category levels, and so actually end up as less or just different from its higher more abstract category. For instance, a basic-level 'dog' might be described, among other things, as having four legs, but a more specific, subordinate type of dog might be a poor <u>three</u>-legged greyhound. Thus, the concept or category of 'language' is more specialised than the general category or categories that lie above on the superordinate level. Plus, as the vertical dimension continues to specialise further down the levels, recognised languages like French or Maori are, in some ways, additive and more specific than their higher level categories. However, importantly the superordinate phenomena of cognition, communication, and perhaps consciousness, potentially also incorporate features that could have been exploited by recognised languages at the basic level, but were not. These other features might be found if other species have their own languages or language-like communication systems or cognition.

For all we know, for instance, unlike the necessarily cooperative conventionality that is involved in establishing and maintaining symbolic means of communicating, as commonly occurs in language (Deacon, 1997), the language or language-like communication of other animals might be used to intentionally *mis*inform others. This would be in line with the Machiavellian readings of animal behaviour (Knight, 1998), such as the fork-tailed drongo birds uttering false alarm calls to scare other animals from their food source to steal it (Flower et al., 2014). Alternatively, while recognised languages amongst humans contain sequential and hierarchical sentence structure, as touched on by Hauser et al. (2002), perhaps there is another structural option that certain other species utilise.

In summary, then, Prototype Theory answers the challenges set by the 'difference in kind' and 'difference in degree' views of the relationship between language and animal communication systems, as were outlined in Section 2. A model based on Prototype Theory easily allows us to factor in animal cognition features as well as animal communication features. The features do not have to be modality specific, and the features that can be assessed can vary widely and across an array of species. Moreover, rather than a linear continuum from all of animal communication to language, which groups all non-humans together, the focus on communicative/linguistic features rather than species, as per

the theory's approach, allows multiple feature continua to be considered simultaneously and equivalently. All of these features can then be quantified for their level of frequency and so typicality across all the communication/language that is recorded for analysis, without a resultant species or single feature apex. Yet, this third conceptualisation option nonetheless allows for difference between features, if not also species, as well as any other variables that might be involved in a language-animal communication comparison. However, these differences can be accounted for in related continuous terms that align with evolution, given the theory's categorisation through family resemblances and graded boundaries.

Before moving on to a brief look at how to use the prototype model comparatively, we need to be clear that this paper contributes the new conceptualisation of language as well as its relationship with animal communication on a prototypical basis. We do show the beginnings of developing a methodology for this also, but are not presenting a full theoretical explanatory model of language as it relates to animal communication systems as yet. What we are presenting and advocating is a way forward in which to compare language to animal communication more fruitfully: quantitatively, without subjectivity, and with feature overlaps rather than a simple species distinction, by using Prototype Theory. Moreover, we anticipate that there will be a strong overlap between the two phenomena, language and multiple animal communication systems, as demonstrated by discussing some potential features in the next section, along with the fundamentals of Prototype Theory per se.

7. INCORPORATING ANIMAL COMMUNICATION INTO A PROTOTYPE MODEL

Now that a prototypical basis for understanding the relationship between language and animal communication has been established, how might the animal communication evidence relate to the concept of language using this approach? Fig. 1, shows a rudimentary layout of the following discussion, illustrating both the conceptualisation presented in this paper, and the basis for how a methodology can be developed for future empirical usage.

First, picture the basic level as a horizontal line, the centre of which will be the eventual prototype of languages that we experience and use. Features that are found naturally occurring amongst languages and animal communication systems must be determined first practically, via familiarity from amongst recognised languages, like inflectional morphology (grammatical word changes). Then, features can be found by observing patterns in communication systems we are not so familiar with. This is along with those features gleaned from a systems approach to animal communication, as advocated by Hebets et al. (2016), which would seek to quantify and assess structure and function relationships, or form-meaning pairings in more linguistic vernacular, both within and across conditions, as a whole system. This leads to the proposal of features like 'flexibility' and 'evolvability' in Hebets et al. (2016), which are broad and inclusive for greater comparative application. So we have adopted a similar approach to Hebets et al. (2016) with our broad terms for encompassing features like 'repetition' that we have used as token examples to show the methodological procedure for using the prototypical approach to conceptualising language and animal communication, unless evidence is already widely acknowledged for established terms for features like 'displacement'.
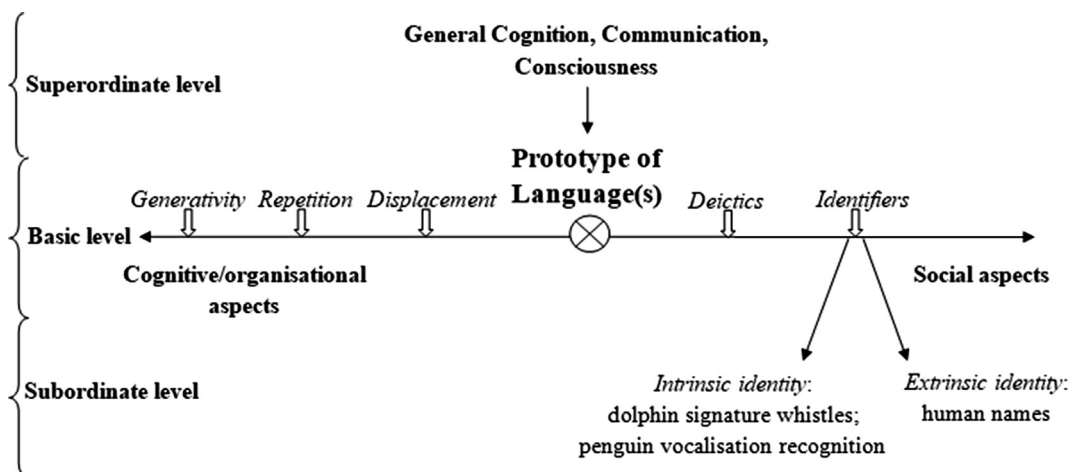

Fig. 1. Incorporating Animal Communication into a Prototypical Model of Language(s).

All these features can then be plotted to the right and left of the centre of the line once they have been quantified. Thus, the more frequent and typical that the features are across non-human communication and recognised languages, the closer they are situated to a central (abstract) prototype of language(s). As we need to build in the cognitive under-pinnings of language, as discussed above, we also include observable features from across human and animal cogni-tion. The features we select and plot into the model must not be very general, superordinate, fundamentals or pre-requisites for language, such as pattern-finding ability (Tomasello, 2003), on which language is based. Instead, they must be features that occur within language usage that could be argued to be a feature of what counts as language. They can then be quantified to see how characteristic they really are of language, and also animal communication sys-tems, through a predetermined sampling process of languages and communication, so that a prototype (or prototypes) emerges naturally and without further subjective claims.

For instance, a feature like repetition may seem quite peripheral to recognised languages at first glance, especially given the numerous academic comments on the vast productive power of language as opposed to animal communica-tion (e.g. Anderson, 2017; Chomsky, 2017; Malmkjaer, 1991). This is the human ability to discuss anything, with its small sound/writing/sign systems combining to produce infinite sentences. However, such statements on languages among humans rarely come with quantitative justification, rather than persuasive hyperbole. There is, conversely, a rich variety in certain non-human communication systems, like the bowhead whale repertoire (Johnson et al., 2015), or the male tropical mockingbird having 133 distinct song types (Price and Yuan, 2011), which needs further exploration and consideration.

Furthermore, repetition in language is, in fact, quite common, and is a useful point of comparison across language and animal communication systems (Pleyer and Hartmann, 2020). Ancient literature like Homer's great works contains a multitude of repeated passages and character epithets, largely because of the need to memorise and orally deliver the narrative. Today's songs are also fairly repetitive in this way, and so it might make us wonder if the meaningful content of bird song is actually more similar to the repeated choruses within human songs than spontaneous and roving human chatter. Reduplication is a morphological instance of repetition in recognised languages, such as within Classical Greek, in which some verbs accrue a prefix consisting of the verb's first letter and an epsilon vowel to help mark the perfect, pluperfect, and future perfect tenses. An example using the Latin alphabet is _dedōka_ 'I have given'. Other uses of this feature across other languages include creating plurals and diminutives, and intensifying words.

The theory of entrenchment, which explains how linguistic units are established as patterns in the mind, offers further support for repetition as a feature of languages. This theory explains that the greater the usage of a form and meaning pairing the more embedded the pattern or routine becomes (Evans, 2007). This theory also bridges the cognitive and communicative aspects of language. Additional to these aforementioned examples, consider how corpus linguistic methods study collocations and other concordances (word groupings). Based on the fact that this analysis method works on the principle of counting all the repeated words and phrases in languages to determine patterns, can we not propose repetition, including re-use of words and phrases, as a linguistic feature, and a fairly typical one across species?

In Rosch's (1978) account of Prototype Theory, the varied frequency of category members and/or their features cor-responds to their relative proximity to or distance from the prototype: the more frequent a feature is of a given category, the more prototypical the feature is, and so the more prototypical the members exhibiting that feature are too. So, given that we can easily assess the frequency of repetition through corpus linguistics methodologies, this feature of language and animal communication systems will be straightforward to quantify in terms of its feature weighting to be added into the prototypical model of language. It is worth noting, that assessment of the important features of language may need to be based on more than frequency of occurrence alone. However, this will require future consideration when expand-ing on the methodology for supporting a prototypical conceptualisation of language presented here.

A second feature to consider plotting into the prototypical model of language would be displacement, or as Evans (2014, p. 56) puts it, 'out of sight is _not_ out of mind'. This is the way in which we refer to events and objects that are not present in the here and now. Displacement is often brought up as a key feature of language usage (Hockett and Altmann, 1968) and symbolic communication more generally (Planer, 2021). It can also be found within animal commu-nication, such as the waggle dances of honeybees, as Evans notes (2014). This dance is used to signal to other bees about where and at what distance from the hive food resources can be found (von Frisch, 1967), where clearly the food referred to is not currently present. Another example can be found in an updated experiment about ape communication (Lyn et al., 2014), where apes were found to communicate with displacement, gesturing to empty containers both when desired objects were visibly displaced or absent altogether. Language-trained bonobos were more likely to engage in this communication than language-naive chimpanzees in the study. Yet Lyn et al. (2014) noted the importance of taking care over methodology and interpretation for such comparative studies. Bottlenose dolphins can also copy the signature whistles (vocal identifiers) of absent dolphins, with a function similar to humans addressing and referring to one another with names, which is another instance of communicative displacement (King et al., 2013).

Displacement can even be found elsewhere in animal behaviour and cognition, such as studies that demonstrate mental time travel in non-humans, which is the capacity to engage in episodic memory – the ability to remember the 'what,' 'where,' and 'when' of an event (Tulving, 2002), and future projection. Past recollection occurs amongst wild great tits, as they choose spring breeding sites to stay close to their winter flockmates (Firth and Sheldon, 2016), and sheep can remember fifty conspecific faces after a period of two years (Kendrick et al, 2001). Meanwhile, western scrub jays anticipate future events by preferentially caching food in places where they have learned they will be hungry the next day, as well as storing particular types of food that will not be available later on (Raby et al., 2007). Great apes can even prepare themselves for future actions with tools (Osvath and Osvath, 2008). Thus, displacement can be plotted somewhere along the basic level of the language prototype, once we have quantified how often it occurs within all the sampled language utterances and instances of animal communication systems.

As a third feature example, generativity is often claimed to be a compelling and distinguishing feature of language. Known as 'productivity' to Hockett (1960), or 'discrete infinity' by Chomsky (2005), this describes the way in which humans at least are able to combine a relatively small number of (symbolic) signs to generate infinitely new meanings (Evans, 2014) and is alleged to be one of the key distinguishing features of language as opposed to animal communication. Yet, generativity might possibly be found in animal communication. For example, male humpback whale song changes over time, mostly with small transitions, and spreads across populations from west to east (Garland et al. 2011). Could these form changes in the song lead to different meanings too, and therefore represent generativity?

Moreover, generativity in cognition should also be considered here. This is because of the earlier mentioned proposals for comparing language with animal cognition as well as animal communication (e.g. Fitch, 2019), alongside the Cognitive Linguistics approach, which involves the 'Cognitive Commitment' (Lakoff 1990) to use information from other cognitive sciences to understand the general principles of language. However, rather than strict generativity, we could adopt a new overarching term perhaps, to incorporate the links between linguistic generativity and imagination or creativity. Thus, we can consider how it may be that generative-type thought and imagination, as involved in mental time travel, both support and shape language and are shared widely across species, but perhaps it is the expression of such thoughts that are specific to humans (Corballis, 2019). The whale song example above may counter this, but it is early days as yet to come to conclusions about this feature amongst non-humans. Thus, until we find evidence of a non-human recounting a personal experience, telling a story, or expressing a future wish, we cannot know if generative imagination is a possibility amongst animal communication systems, but it does seem to have a distinct role in animal cognition, supported by the application of a creativity framework to animal cognition (Kaufman and Kaufman, 2004).

Ultimately, beyond subjective controversial analysis, as just one example of many, we can also use the prototypical conceptualisation and methodology we are presenting here to determine the status of this feature of generativity within language and any non-human communication system. Generativity could well end up as a feature that is more prototypical to a language prototype and much less to an animal communication prototype, perhaps with a fuzzy boundary as per Prototype Theory. Thus, it might be that generativity is ultimately a feature of language alone, and then we either do not see this feature amongst non-human communication, or where we do, we have to start to label it as *language*. However, it is our proposal that we cannot know this about this feature or any other, and can only surmise such conclusions, until we quantitatively sample language and animal communication systems, plot all the evident features in relation to one another, and then compare all features across the communication systems to see what the objective outcomes are. In this way, our prototypal model builds on the benefits of quantitative methodologies, such as corpus linguistics, which notably bypasses intuition for quantitative objective data (Reppen, 2010; Sinclair, 1991). But, crucially, the Prototype Theory approach we present in this paper furnishes scholars with an effective theoretical solution for the conceptual problem of understanding language and comparative analysis, as well as the basis for a methodological tool for comparing quantitative data already – and yet to be – collected across species, which has been largely missing in linguistics thus far.

Less organisational, cognitive, and more social features of languages might include deictics (referring to something in a specific context, c.f. Byrne et al., 2017), such as human pointing gestures or words like *tomorrow* or *that*. These can be found among other species too, like the honeybees' elaborate references to food locations through their waggle dances (von Frisch, 1967), or grouper fish and coral trout regularly pointing out prey hiding in crevices to other local predators, moray eels and wrasse, with vertical headshakes, and even a horizontal 'shimmy' to recruit these other predators to hunt (Vail et al., 2013).

Identity markers could be included as a feature as well, though perhaps less frequently, or typically, than deictics. Where humans use names for each other, as an extrinsic source of identity, because the name is given to us by someone else, other species seem to recognise each other more through intrinsic identity markers. This includes the signature whistle of bottlenose dolphins (Janik et al., 2006), or the special bi-frequency, or double voice, calls of emperor penguins (Aubin et al., 2000), a bit like Mongolian throat singing. These examples both emanate from the individual themselves, more like how we recognise someone by their walk, as opposed to the way in which we label a person with

a name from their job title like (black)*Smith* or *Pressman*. This illustrates how a feature can vary according to family resemblances and show very specific sub-variations but, at the same time, can be grouped together on the basic level.

There are, of course, multiple other language-related features that can and should be plotted into this model, such as symbolic reference or turn-taking, the latter of which involves an exchange of signals between communicative participants that has been witnessed across primate orders, from marmosets to gibbons to humans (Levinson and Holler, 2014). However, this section serves to demonstrate how the prototypical model can work rather than the comprehensive end product of its implementation.

It is also worth noting that there are a few caveats to this procedure in terms of the feature analysis. For a start, some features will be gradable and would seem difficult to quantify comparatively, but in fact these would fit exactly within the conceptualisation of language we are proposing, as Prototype Theory involves graded typicality. Other features appear heavily linguistic, like morphology, yet we can look to similar comparisons like Gunnison's prairie dog alarm calls (Slobodchikoff et al., 2009), where signals are adapted with 'affixes' for different functions and contexts. Equally, there may be features that arise in animal communication that seem to have little analogy to languages. However, we can plot these on the same basic level as any of the other features, and it is actually important that we do because this gives us a quantitative objective indication of whether animal communication systems are actually different to languages, and to what degree.

Once all comparative features have been quantified and their weighting has been established across the samples of languages and animal communication systems, they are plotted on the basic level relative to one another, along with annotation for which communication system or language they belong to, some being plotted more centrally and prototypically than other features. This will then demonstrate any between-category contrasts as well as the central prototype's characteristics. We can then discuss, as an interdisciplinary community, if there should be a distinct or fuzzy line drawn between species, or rather particular languages/communication systems, and what the final language prototype's characteristics are on the basic level. This can then be coupled with discussions from the other vertical levels of Prototype Theory, the superordinate and subordinate levels, to move towards a fully comprehensive description of the nature of language, and how animal communication relates to this. It is our view that there will be a strong overlap between animal communication systems and language, and both can be included into one language prototype category.

8. MULTIPLE PROTOTYPES

It is unclear, as yet, what the result of such analysis of language and animal communication systems may yield. As proposed above, one common prototype might emerge that can incorporate the communication of all species, including language(s). Alternatively, in line with the notion that the relationship between animal communication and language may be a 'difference in type', we may discover one prototype for language and another for other animal communication, or even multiple animal communication systems prototypes, to bear in mind the expected variety we will find across the communication of other species. Otherwise, prototypes may emerge to account for all the typological variants across recognised world languages and communication systems, which would not be species-centric but would be distinguished instead from one another based on their typical features.

However, all of these prototypes and the categories they represent would be separated by graded rather than absolute boundaries, and similar features may be found within the scope of each. Thus, some species' communication and features thereof, including that of humans, could be incorporated into one language or otherwise titled prototype, while others fit more comfortably within (a) separate animal communication or otherwise titled prototype(s).

As one hypothetical example of these various outcomes, there could be one prototype that includes Indo-European languages as well as features of vervet monkey or Gunnison's prairie dog alarm calls, with an emphasis on inflectional morphology conveying meaning. Alongside this, another prototype might exist for languages and communication that convey meaning with a greater emphasis on context-based pragmatics, like Riau Indonesian (Jackendoff and Wittenberg, 2014) and primate gestures (Hobaiter and Byrne, 2014).

Furthermore, if there were multiple evolutions of language, this too could yield multiple prototypes. However, which characteristic features the actual prototype(s) will ultimately comprise across languages and animal communication systems, as well as cognition, remains to be seen once the conceptualisation of language presented here is put to empirical use.

9. ETHICAL IMPLICATIONS

As a final consideration, we note that there are also potentially positive ethical implications to this prototypical conceptualisation of language. The ethical corollary of an alleged species-only distinction concerning language and other

communication is that non-humans have generally been regarded as not just different and 'other', but as inferior, from the social climate that created Roman '*venationes*', the hunting of exotic animals for amusement and power displays (Epplett, 2001); Descartes' (1641/1996) proposal of animal automata, which led to Thorndike's (1898) behaviourist and non-cognitive approach to other animals; to the vast amounts of vivisection justified for humanity's sake in today's world. Thus, given such a deeply entrenched conceptual correlation between language and human uniqueness, it follows that any challenges to this viewpoint or evidence that non-humans may have the capacity for language may lead humans to review their largely pejorative sentiments regarding other species.

Not only have there been more language-like findings amongst animal communication in recent years, but applying Prototype Theory to determine the relationship between animal communication systems and language yields potentially positive ethical implications for non-humans, whichever of the three ethical approaches is taken (Calarco, 2015). An 'identity' approach, where similarity to humans leads to respect and equality of treatment can be catered for through Prototype Theory's family resemblances. A 'difference' approach, which focuses on the differences of other species and respecting them for that very point, can benefit from how a prototypical model allows for greater variation and flexibility than classical definitions. Finally, an 'indistinction' approach, de-emphasising the uniqueness of humans and seeking continuities in the direction from other species towards humans, is supported by the more inductive nature of Prototype Theory: start from observed rather than predetermined features and assess their relative typicality.

Prototype Theory invites us to open-mindedly explore the features across communicative systems, and then count the feature weightings, making the pursuit of the nature of language more scientific than speculative. Then if other species have language, or the capacity for it, this can finally be recognised systematically. We may also start to move away from the species-specific term *animal communication*, adopting new more inclusive terminology, such as 'languoid', which has been proposed to account for the vast variety of language-like entities among even humans (Cysouw and Good, 2013).

10. SUMMARY

This article has explored the conceptual links between animal communication systems and language, and innovatively suggests Prototype Theory as the basis for an effective approach to conceptualise language, as well as understand the relationship between language and animal communication, and as a way to organise discussions about this matter. The paper first established that there are two traditional views on the nature of the relationship: a strict divide or a linear continuum of animal communication to language. However, each of these views comes with challenges, predominantly the problem of explaining the origin of language if we adhere to the strict divide view, or the problem of explaining why there remains a strong stance that language is unique to humans if we adopt the linear continuum approach. Moreover, the two views cannot adequately integrate the increasingly complex animal communication and cognition findings being discovered in animal behaviour and cognitive science research. Against this background, we explored the implications of understanding the concept of 'language' from a Prototype Theory perspective, as opposed to a Classical Theory strict definition. Prototype Theory involves comparing features and their relative typicality, in terms of family resemblances and with graded boundaries between concepts.

We suggest that the Prototype Theory approach is particularly well suited for understanding the relationship between animal communication systems and language, as it allows for multiple equivalent-level feature continua, obviating the problematic separation of animal communication from language with a starkly species-only based distinction. As the theory also allows for graded boundaries between concepts, there can be a graded continuum without stipulating that animals remain only at one end of a linear spectrum from non-humans to humans. Rather, various features of animal communication systems may be simultaneously more central or more peripheral to an abstract prototype of language. This allows for a coherent and systematic integration of animal communication findings into a concept of language, thus mediating between the notions of the divide and continuum, and presenting an effective conceptualisation of the relationship between language and animal communication.

Prototype Theory is also an effective way to conceptualise language. In lieu of a classical definition, with a predetermined fixed set of criteria, the notion of a prototype of language allows for naturally-occurring typological variation across recognised languages, diachronic variation, as well as the different theories of language proposed by a variety of scholars. Additionally, the vertical dimension of the theory also separates out discussion of what the features of language are from what aspects support the foundation for language.

The prototypical conceptualisation of language presented here also provides the foundation for further work, currently in development. This involves a comprehensive working methodology that can be tested empirically, as touched on in Section 7. This methodology based on Prototype Theory will include a language/communication sampling procedure, process for feature identification and selection, quantification and weightings processes, and procedures for feature plotting, relative comparison and analysis of features, as well as determining the prototype's central scope and

subsequent transitional ranges. The methodology will also need to account for situational factors, like context and function, as well as features arising from comprehension as well as production, which could lead to an expansion of the Prototype Theory approach adopted here to add a third dimension. A fourth dimension might be incorporated to account for the temporal aspect as well: the fact that languages themselves evolve in terms of their features and their typicality.

Another consideration for future expansion of the prototypical conceptualisation and methodology concerns the level of detail – the granularity or 'cognitive zoom' (Tenbrink, 2020, p. 118) – involved when using the prototypical model in applied research. For instance, comparing word endings for different tenses is a lot more detailed than looking at the use of tense more generally. Therefore, each feature and its instances across languages and species may need to be analysed separately, where multiple feature-specific prototypes could be developed on a subordinate level. These feature prototypes would then feed into a more generalised prototype analysis across languages and other (animal) communication systems on the basic level.

Crucially, however, as presented in this paper, Prototype Theory provides a novel and different but important shape and effective basis to our thought about language categorisation, and it shows that neither the distinct divide nor the linear continuum need be invoked in discussions about how to determine language's relationship with animal communication systems. This is important for paving the way to more cohesive interdisciplinary research in this area, for the way in which we understand the nature of language, for how we integrate animal communication evidence into such a conceptualisation of language, and even for the way in which we treat other species as a result of appreciating their communicative and cognitive similarities and differences more.

Therefore, once we begin using all available tools on animal communication, including a wider array of linguistic theories and methods than are currently adopted, together with this more integrative prototypical conceptualisation of language, we will be prepared to fully discover how animal communication relates to language, as well as ultimately determining what the core prototype of language really is. With a 'difference in type', graded, prototypical model, however, we need to become more open to the possibility that, in the end, there may not be so great a language gap between species after all, but instead a seriously strong overlap.

11. AUTHOR NOTE

CRediT authorship contribution statement

Jenny Amphaeris: Writing – original draft, Writing – review & editing. **Graeme Shannon:** Writing – review & editing. **Thora Tenbrink:** Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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