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Saying “goodbye” to the conundrum of leave-taking: a cross-disciplinary review

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Leave-taking behaviours habitually occur before separation from social interaction in most human societies. It is thought to be a human universal, providing ritual brackets around interaction. Despite Knapp’s claim that leave-taking can tell us a good deal about human interaction, the topic remains critically overlooked from an evolutionary perspective. Cross-species data on leave-taking would be key to unveiling its evolutionary history and its role in sociality, but studies focusing on non-human species are rare. Here, leave-taking is reviewed using an evolutionary approach, pitting it against its symmetrical counterpart, greeting, and emphasising the lacunae in research on leave-taking. It is argued that leave-taking is overdue for serious, empirical attention regarding the ways in which leave-taking could contribute to understanding social evolution. Finally, methods are outlined to operationalise the study of leave-taking and propose the use of “levels of separation” to allow comparison of human and non-human species and to expand research efforts.

Greeting and leave-taking: bookends of interaction?

As widely recurrent features of the human ritual repertoire (Adato, 1975), greeting and leave-taking have been considered “bookends of human interaction” (Eibl-Eibesfeldt, 1971). Despite the scientific literature considering these phenomena in parallel, greeting is well-studied across human and non-human species, while studies of leave-taking are rarely empirical and almost non-existent for non-human species.

Greeting occurs when individuals are about to have increased access to other individuals and is claimed to be a universal across all human societies (Duranti, 1997; Goffman, 1971), as well as being present in many animal species including primates (Okamoto et al., 2001), cetaceans (Rendell and Whitehead, 2001), birds (Danchin, 1987) and fish (Sogabe and Yanagisawa, 2007). Although cross-cultural studies are limited, both greeting and leave-taking appear to show variation in form, e.g., how much the positive or emotional aspect of greeting is emphasised, and the relative importance of verbal and non-verbal greetings (Firth, 1972).

Despite the assumption that greeting and leave-taking should be considered in unison (Eibl-Eibesfeldt, 1971; Goffman, 1971), there seems little theoretical reason that this should be the case. Besides the positioning on either side of interaction, the two are likely to require different cognitive abilities (McGrew and Baehren, 2016). Factors such as age, sex, status and context may influence greeting behaviour (Rababah and Malkawi, 2012) and leave-taking (Goffman, 1971; Knapp et al., 1973; Akindele, 2007) but they are likely “socially charged” in different ways; serving different social functions (McGrew and Baehren, 2016). For instance, greeting by

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definition occurs at the beginning of an interaction, and thus the behaviours and associated functions set the stage for the anticipated interaction, e.g., mediating aggression (Okamoto et al., 2001), increasing group cohesion (Aureli and Schaffner, 2007) and encouraging social bonding (Nishida et al., 1999). On the other hand, leave-taking occurs at the end of the interaction and may have evolved to meet distinct functions such as dismissal, concluding the interaction, or maintaining the relationship throughout separation.

Evidently, there is discrepancy in the research efforts of these two supposedly parallel behaviours when considering non-human primates. Interest in the greeting behaviours of non-human primates is long-standing, presumably because of some striking parallels with human greeting (van Lawick-Goodall, 1968). Some of these behaviours seem to have similar functions, e.g., extending the hand as a gesture of reassurance, or a deep bow and nodding of the head as an act of submission (Simpson, 2009). Greeting is thought to have deep evolutionary roots because it is widespread across human cultures and its occurrence across non-human species includes baboons (Smuts and Watanabe, 1990), spider monkeys (Schaffner and Aureli, 2004), hyenas (Smith et al., 2010), chimpanzees (Laporte and Zuberbühler, 2010), howler monkeys (Dias et al., 2008) and macaques (De Marco et al., 2011). It is unclear whether leave-taking is similarly widespread given the lack of literature (Goffman, 1971); its absence in non-human primates would suggest leave-taking is a more recently derived behaviour in hominins, not paralleling the evolution of greeting (Eibl-Eibesfeldt, 1970). The use of primates as models for human evolutionary processes is powerful; they share genetic, physical and social traits with humans (Muller, 2017), including aspects of communication (Seyfarth and Cheney, 2018) and as such can be used to quantitatively test *a priori* predictions of evolutionary hypotheses. As such, our extant primate relatives may offer crucial insights into processes and timescales on which leave-taking may have evolved. Even if behaviours differ across species, there may be components showing continuity and reflecting evolutionary precursors to leave-taking in humans.

Currently, such cross-cultural and cross-species empirical studies on leave-taking are lacking. Descriptive reports exist (e.g., Rababah and Malkawi, 2012; DuFon, 2010; Akindele, 2007), but

there are almost no systematic or quantitative data on how people or non-human species end interactions (Albert and Kessler, 1978; Knapp et al., 1973). This contrast in the richness of scientific literature between greeting and leave-taking is striking (Fig. 1). The apparent recent increase in greeting publications may reflect a general growth in publication rates. However, the contrast of 618 publications concerning greeting, compared to 61 for leave-taking, shows an approximately ten-fold greater relative publishing frequency.

The lack of research on leave-taking is further highlighted when the types of publication are considered. Many of these publications have only brief mentions of leave-taking or short anecdotes, making the number of studies actually concerning leave-taking even fewer (Fig. 2). This distinction between greeting and leave-taking remains stark when disaggregated by discipline (Fig. 3). Disciplines taking an ethological approach have largely ignored leave-taking, despite taking a strong interest in greeting behaviour. Contrastingly, linguistic and ethnographic areas of research have shown more interest in leave-taking, though still minimal compared to studies on greeting behaviour. Part of this discrepancy between fields can be explained by the conclusion that leave-taking does not exist in non-humans, e.g., researchers at ten wild chimpanzee sites reported that each of their sites showed greeting, but none showed leave-taking (McGrew and Baehren, 2016). In addition, we are told that “although many animals have greetings similar to ours in both form and function, an animal version of goodbye is much harder to establish” (Goffman, 1971: p. 79).

For humans and non-human primates, at least part of this discrepancy can be attributed to ritualised greeting behaviours. These contrast with the less elaborate, subtle and in the case of non-humans possibly non-existent, leave-taking behaviours. One example is illustrated by descriptions of greeting and leave-taking in Andaman Islanders (Radcliffe-Brown, 1922), in which reunion of friends or relatives after some period of separation results in a ritualised form of wailing and weeping. In contrast, the behaviour before separation involves one person lifting the hand of the other towards their mouth and gently blowing on it: which is less elaborate than the greeting behaviour. As such, the rationale for conceptualising leave-taking within the bracketing framework no

Fig. 1 Trends in publications of greeting and leave-taking. Data extracted from Web of Science using “greet*”, and “leave-take*” in selected fields of Anthropology, Behavioural Sciences, Communication, Ecology, Linguistics, Psychology, Biology, Zoology. Text-mining limited to disciplines relating to behaviour and communication ensures including only publications in which these terms are used with the same meaning as defined in this review.

Fig. 2 Frequency of publications concerning leave-taking (N = 60).

"Mentions" are publications that had one or two sentences about leave-taking. "Discussions" are lengthier texts that focussed heavily on leave-taking. "Anecdotes" briefly mentioned examples of leave-taking, while "studies" contained data, either measuring leave-taking empirically or a qualitative description.

Fig. 3 Frequency of studies by discipline n = 38, as a subset of Fig. 2.

Some studies (n = 5) referenced both humans and non-humans, thus the data points n = 33. Studies were classified as ethnographic if they had detailed description of the behaviour, linguistic if they included empirical conversational analysis and language structure, and ethological if they measured behaviour.

longer seems self-evident and it is worthwhile to consider leave-taking in its own right.

Leave-taking may not occur beyond humans: research on other primates, social animals, both wild and captive, yields few and vague reports of leave-taking. Firth (1972: p. 3) suggested that in both human greeting and parting, formal conventions of use of body (posture) and limbs (gesture) play such a major role that "animal parallels easily come to mind", although he gave no examples of such parallels. Similarly, Lockard (1980) suggested that the ethological method used in her earlier study could be extended for cross-species comparisons, where leave-taking could act as a way to signal intention to depart in social animals. However, neither study elaborates on these ideas. Social anthropologists have also attempted to establish an understanding of rituals (Radcliffe-Brown, 1922) and rites (Van Gennep, 2019) that involve separation, although work specifically on leave-taking behaviours is lacking. Although the (purported) absence of leave-taking in non-humans might explain the discrepancy in leave-taking studies between disciplines (e.g., lacking in primatology compared to linguistics) this fails to explain why other human-oriented fields (e.g., anthropology) have paid so little attention to leave-taking.

Several scholars have contributed to the topic of leave-taking, particularly Goffman (1952; 1955; 1967; 1971; 1974), and Kessler (Albert and Kessler, 1976; Albert and Kessler, 1978) but the topic

failed to "take off" with other researchers and in other fields. Albert and Kessler (1978) suggested that this paucity of research may be due to the difficulties in studying properties of interpersonal endings, which are often brief and occur at high speed, making them hard to record or experimentally induce. They argued that to study leave-taking researchers need to: (a) be sensitised to fleeting nuances of behaviour; and (b) use technology to create a permanent record, which can be retrospectively examined. We now have such powerful and low-cost technology, but perhaps the short popularity of leave-taking seen in the '70s and '80s faded before these practical solutions became available.

From the literature

Definitions of leave-taking. Research on human leave-taking has received greater attention than it has in its non-human counterparts. Nevertheless, the available research spans several disciplines without attempting to integrate knowledge on the topic and often seems to be considered as an afterthought to greeting, receiving subsidiary attention. Operational definitions of leave-taking vary markedly by field and by variable studied. Linguistic studies use measures such as the final words in spoken exchange, whereas ethological studies include broader non-linguistic definitions, such as the end of a dyadic exchange, or the finishing of an interaction. Additionally, many papers that discuss leave-taking do not include a precise and workable definition, but subjectively refer to endings, partings, leaving, closings, etc. This vagueness has more serious consequences for research as it has led to incongruity in what is considered leave-taking, and a disparate and disjointed literature. Table 1 summarises a selection of definitions extracted from the scientific literature to: (a) illustrate their variety and discrepancies, and (b) aggregate the key values to suggest a universal definition. The definitions are not intended to be exhaustive but give a sense of the variation present.

I used the following key words for the search in *Google Scholar*, *Search Oxford Libraries Online* and *Web of Science*: "leave-taking", "leaving behaviour", "greeting and parting", "parting behaviour", "farewell(s)". I included publications from different academic disciplines such as anthropology, psychology, animal behaviour, linguistics, but excluded papers relating to other kinds of "taking leave" e.g., parental leave, medical leave, leaving abusive relationships etc. Articles were included only if they presented a clear, novel definition. Although it seems at first that leave-taking is a simple behaviour that should be intuitively understood, the variation in definitions across the literature highlights the challenge in identifying what this behaviour involves.

These definitions differ in crucial ways: (1) several are broad and theoretical, particularly those featuring a general discussion of leave-taking, e.g., Adato (1975), Albert and Kessler (1978), Goffman (1971), but failing to give examples of how to measure behaviour. Contrastingly, (2) other studies use narrow definitions, suitable only in a specific context, such as child-parent separation (e.g., Jones, 1972; Field et al., 1984), "mother-infant parking" (Scheumann et al., 2017), or mourning customs (Van der Hart and Goossens, 1987). While this specificity may help an empirical test in these contexts, the measurable variables (see far-right column of Table 1) vary greatly. I argue for the need to adopt a definition that is both broad enough to allow cross-species comparisons and includes specific variables to be measured to allow for empirical and comparative investigations (e.g., Knapp et al., 1973).

Additionally (3) associating leave-taking with departure, using terms such as "separation", "breaking contact" and "state of decreased access" seems valid, but a crucial distinction (4) is whether or not there is also reference to "routine", "ritual",

Table 1 Original definitions of leave-taking with reference to species and empirical measure used when available ($n = 30$).

Reference	Species	Definition of leave-taking	Empirical Measure
Adato, 1975	Human	"Ritually" required way of departing	Absent
Akindele, 2007	Human	Closing sequence of a conversation	Absent
Albert and Kessler, 1978	Human	Cessation of all verbal and non-verbal communication between two previously interacting individuals	Absent
Ameka, 1999	Human	Events that occur in terminating social encounters	Absent
Berne, 1968	Human	Stereotyped series of simple complementary transactions	Absent
Betholia, 2009	Human	Break in social contact	Absent
Jones and Leach, 1972	Human (children)	Maternal and child patterns of behaviour at separation	Absent
Clark, 1985	Human	Summarise the content of the contact they have just had; justify ending their contact at this time; express pleasure about each other; indicate continuity in their relationship by planning, specifically or vaguely, for future contact; and wish each other well	Absent
Clark and French, 1981	Human	Reaffirm their acquaintance before breaking contact	Absent
Corsaro, 1979	Human (children)	Withdrawal strategy-ending of an interactive episode	Absent
de Waal and Waal, 2007	Chimpanzee	"Before separated"	Absent
DuFon, 2010	Human	"Occurs at the end of an interaction"	"Words that ask for permission to leave"
Firth, 1972	Human	"Patterned routine which is highly conventionalised" suggestion of parting after an encounter	Absent
Fitch, 1990	Human	Conversational exchange at the end of social gathering	Absent
Gleason and Weintraub, 1976	Human (children)	Last nuclear utterance in a routine	Absent
Goffman, 1971	Human-mentions animal	State of decreased access	Absent
Gräfenhain et al., 2009	Human (children)	Acknowledge their leaving	When child left the main game to play competing game, did they acknowledge their leaving (a) verbally or non-verbally, (b) acknowledged they were now playing a different game only after they had left, (c) whether they instead left without acknowledging
Hassall, 2006	Human	Act intended by the speaker to convey to the hearer that the speaker regards the encounter as at an end	Absent
Heesen et al., 2021	Chimpanzee and bonobo	The exit phase comprises all the coordinative actions necessary to get out of a social encounter once the main business of the encounter has been completed.	The moment all body movements typical of the activity ceased (e.g., movements of the hands on the body of the partner typical for grooming, and wrestling with, tickling or chasing each other for social play) until the moment that at least one partner gazed at the other before or while leaving (and at most after each partner gazed at each other once before or while separating), and if the interaction was not followed by a renewed interaction or attempt to re-engage partner within 2 min.
Hong, 1985	Human	Personal expression of parting	Absent
Knapp et al., 1973	Human	How interpersonal transactions are terminated closing of interaction	"Concluding remarks" "Analysis of non-verbal cues began 45 s prior to the subject's rising from a seated position and continued until the subject had left the interviewing room"
Lockard et al., 1978	Human (discussed in context of other species)	End of a dyadic exchange	45 s to 5 min before departure
McGrew and Baehren, 2016	Human and chimpanzee	Show leave-taking/farewell behaviour when they part after being together	(Purposefully not given)
Rababah and Malkawi, 2012	Human	"Greetings are the general rituals of beginning and finishing an encounter"	Absent

Table 1 (continued)

Reference	Species	Definition of leave-taking	Empirical Measure
Schegloff and Sacks, 1973	Human	Proximate solution to life utterance completion—a terminal exchange composed of conventional parts	Absent
Scheumann and Zimmermann, 2017	Grey mouse lemur	Mother and infant were together at sleep site before mother left the nest	Vocal behaviour 60 sec before a mother leaves the infant in nest
Sukwiat and Fieg, 1987	Human	Closing of a conversation	Absent
Van der Hart and Goossens, 1987	Human	Ceremony used as a strategy in mourning therapy	Absent
Wang, 2005	Human	Art of saying “goodbye”, extracting oneself from a communication event	Point that one of the parties signals his intention to leave to the final termination exchange
Whittaker et al., 1994	Human	Interaction closings	Formal farewells (bye”, “see you”). verbal or visual orienting signs (e.g., turning away) given to indicate conversations were about to close: these only occurred on 21 % of occasions.

Fig. 4 Proportions of leave-taking definitions that contain each identified component (n = 30). Components are not mutually exclusive, e.g., some contain both separation and social interaction components. *Separation* includes the terms departure, ending, or parting; *ritual* includes the terms stereotyped behaviour, pattern or routine; *conversation* includes the terms verbal interaction and spoken word; *social interaction* includes the terms social encounter, exchange, contact; *functionality* includes reference to leave-taking as a strategy or solution to achieve a goal/solve a problem.

“stereotyped” or “conventionalised” nature of leave-taking; which some see as critical (e.g., Adato, 1975; Firth, 1972; Berne, 1968). Some regard leave-taking as being specific to the end of conversational spoken word (5), which is applicable only in linguistic studies. Other studies (6) refer more generally to termination: “social contact”, “dyadic exchange”, “ending of an interaction”, “encounter”, “transaction”, “episode”. A broader definition beyond spoken language is useful when looking for behavioural comparisons with non-human species, such as Albert and Kessler (1978: p. 541): “By ending, we mean the cessation of all verbal and non-verbal communication between two previously interacting individuals”. Finally (7), some definitions refer to functionality in leave-taking: “act intended by the speaker”, “regard the encounter at an end”, “withdrawal strategy”, “proximate solution to utterance completion”. Should behaviour be defined in terms of its functionality? What if the cause for leave-taking is opaque, is behaviour at the end of interaction necessarily leave-taking? In studies of animal behaviour (e.g., Horner et al., 2010), it is argued that definitions seek to reduce disagreements about interpretation, and not exclude other interesting, potentially relevant behaviours. One must distinguish the necessary properties of leave-taking from contingent causal properties. Accordingly, I have not included function in my definition of leave-taking as this remains unknown, even for humans where leave-taking occurs. Similarly in greeting studies,

Fig. 5 Levels of separation across different durations of absence. Levels include recurrent separation, extended separation, and permanent separation.

the behaviours are identified without necessarily investigating function (e.g., focusing just on the behaviour occurring at the start of a sequence, Kummer, 1968), and from this initiation, function is then investigated (Aureli and Schaffner, 2007).

Of the thirty definitions, only seven included an empirical measure. Twenty-five included a theoretical component. Proportionally, half of the definitions assume that leave-taking is a social behaviour, referring to final behaviours before individuals spatially separate (Fig. 4). I argue that using the aforementioned issues of definition, we should aim to be: (1) broad enough to encompass different behaviours and contexts, but also (2) provide specific empirical measures relevant to the study, (3) should pertain to the separation, (4) have an element of routine or behavioural sequence that is recognised at the group level (5) should not be limited to linguistic studies but include non-vocal, non-linguistic behaviours, and (6) be studied in social encounters. Finally (7), I argue that we should avoid using definitions that assume function until they have been specifically tested. To this end, I define leave-taking as *behaviours occurring before intended cessation and separation from a social interaction of two or more individuals*. The concept of separation is discussed in greater detail in Fig. 5, but involves as a minimum a breaking of contact e.g., turning away, but is situated along a scale of proximity and duration. Ideally, empirical measures should be specified, relevant to the study type and context allowing function, intention,

Table 2 Solutions to address current problems with the study of leave-taking.		
	Problem	Solution
Theoretical	Lack of consistent definition	Define generally as “behaviours habitually occurring before intended separation from social interaction”, from which to determine specific relevant measures within each study
	Lack of focus on level	Introduce levels of separation (Fig. 5)
Methodological	Lack of empirical study	Apply the definition and framework across populations, including non-human species
	Data collection doesn’t capture leave-taking	Take advantage of video technology to record behaviour and use video data coding software
	Appropriate candidate behaviours	Pilot study leave-taking data collection across populations and species, with a focus on non-verbal behaviours and including behaviours suggested in the literature, e.g., scratching, weight shift, eye gaze and body orientation
	Lack of control variables	Use non-social condition to test leave-taking as a social behaviour, and control other influential variables such as length of interaction, context, individual difference

development, causes and consequences to be investigated subsequently.

Cross-cultural insights. Studies of human leave-taking span anthropology, psychology, linguistics and ethology. This breadth testifies to the wide-ranging nature of the topic but making it challenging to critically review the literature. Initial studies of leave-taking were pioneered by Goffman, who conceptualised the topic from multiple angles including “loss” requiring defence, strategies, and consolations (1952); as access rituals (1971), and as brackets relating to frame analysis (1974). Since Goffman’s work, there has been some attention paid to leave-taking, though few replicated data, and Knapp et al. (1973) acknowledged this neglect by behavioural researchers, saying that scholarly investigations are few and far between.

Leave-taking appears in popular science literature, such as Lundmark’s (2009) book “Tales of Hi and Bye”. By the author’s admission, his book is not a scientific work and focusses more on the greeting than the leave-taking. Nonetheless it draws on a number of disciplines to illustrate the variety and complexity of leave-taking. It also addresses the idea of temporal changes in leave-taking; noting that handshakes are a more recent expression of leave-taking compared to greeting, using historical and literary evidence to trace early presence of this behaviour in artwork (Herrenberg Altar, 1540) and in literature (Shakespeare, 1596; *Merchant of Venice*, Act 2, Scene 8).

Discussions of leave-taking make substantial claims about the universality (Eibl-Eibesfeldt, 1971), cultural variation (Firth, 1972) and function (Lockard, 1980) of leave-taking, but without providing evidence to support the claims. However, beyond “common knowledge” about different leave-taking styles, there is little empirical evidence as to how or why cultures vary in these behaviours. Among attempts at comparison, Firth (1972) stated that some goodbyes stress positive messages of well-wishing for the future, and others, sadness at parting. Ameka (1999) claimed that universalities exist in conversation closing, pre-closing, leave-taking and final departure, with varying degrees of elaboration across cultures in leave-taking.

Critical cultural variation does exist, however. Hong’s (1985) comparison of leave-taking in eastern and western human cultures found that Mandarin Chinese has a greater focus on the setting of the verbal exchange and has less formulaic, religiously derived language than in English “well-wishing” (Ferguson, 1976). He found avoidance of personal pronouns that make leave-takings more personal than in English (Hong, 1985). Wang (2005) investigated this using a video coding method on leave-taking from clips of Chinese TV series, concluding that contextual, personal variables are more important than in English. In another example, Atika (2020) compares leave-taking in Sasak to English, finding that the Sasak form is more

personal and demonstrates greater empathy and solidarity. Atika argues that this reflects the differences in culture, in particular reflecting Muslim values, for example using specific forms of address in leave-taking to those who have completed the *hajj*, the pilgrimage to Mecca.

Second language acquisition studies also highlight ways in which leave-taking differs linguistically and culturally. Study-abroad paradigms provide opportunities to understand the use of linguistic strategies in non-native speakers. Critically, these studies focus on language development, giving insight into stages of proficiency throughout acquisition. Understanding leave-taking conventions in one culture does not guarantee understanding in another: Conventions are highly variable, in manner and context, causing issues for language learners and leading to inappropriate address, formulas, and timing (e.g., Hassall, 2006; Cook, 1985; Sukwiat and Fieg, 1987; Scarcella and Brunak, 1981). In French for example, leave-takings tend to be longer than greetings (Béal, 1994) and are generally more context dependent than English, e.g., the French tend to converse only with the waiter in a café, where interaction with customers is seen as inappropriate, in contrast to English culture (Carroll, 1987). Acquisition of French by native English-speaking students supports this contrast: Native speakers reported that they would not engage with other customers in a café, whereas non-native speakers were likely to, in a light-hearted and “chatty” way (Hoffman-Hicks, 1999). Such studies highlight significant differences in leave-taking and demonstrate specific contextual, linguistic cultural variation in the behaviour. Similar studies should be replicated across other cultures, to get a broader sense of the range of variation.

Comparative insights. Mentions of leave-taking are almost non-existent in the non-human literature, with few acknowledgements of its absence. Goffman (1971: p. 79) stated that “an animal version of goodbye is much more difficult to establish”, compared to greeting and Firth (1972) suggested that parallels to human leave-takings were apparent in other species. Lockard et al. (1978) presented some non-verbal correlates of leave-taking in humans, such as eye gaze, body orientation and weight shifts, and unlike most leave-taking literature, hers was framed in an evolutionary context: It was based on the premise that social vertebrates rely on coordinating activities and suggested that postural movements may serve an analogous function in humans to signal imminent departure. Lockard (1980) mentioned that her ethological human study could serve as a comparison across species to signal intention to depart in social animals. However, these were passing comments that have not been investigated (Table 2).

The first example of non-human leave-taking was ad lib, as Gardner reported that chimpanzees in a sign language experiment began to use the “bye bye” signal to one another

(cited in de Waal and Waal, 2007). de Waal and Waal (2007) also reported that a gorilla in Arnhem Zoo would pat the keepers or blow kisses to them before she went indoors, apparently foreseeing the separation. Both of these reports are anecdotal, but perhaps more importantly, involve captive (likely) enculturated apes seemingly mimicking human behaviour. If so, this gives little insight into naturally occurring separation behaviours present in their wild counterparts. One paper that does feature wild chimpanzees is Harrod's (2014) review of chimpanzee responses to death. Drawing on secondary data from five sites, he finds that chimpanzees responded with "farewell behaviours" e.g., turning away and glancing back, lingering for a final touch and returning to look as they leave the deceased. Although intriguing, this report seems somewhat anthropomorphic; "farewell" behaviours are described only as assumed parallels to human partings. Furthermore, it raises the question of whether leave-taking applies to situations involving a deceased individual. Although understanding of mortality may be important in driving leave-taking (McGrew and Baehren, 2016), there could be other explanations of these behaviours, such as checking to see if the other individual is really dead. Regardless, these reports remain singular and so provide little evidence for systematic expression of leave-taking, e.g., if or how behaviours occur and vary as external factors affect them. Nevertheless, anecdotes remain important in behavioural science (Martin et al., 2021), in which a single observation may call attention and lead to further observations and form the basis for experimental, systematic study.

To investigate this lack of leave-taking in the primate literature, McGrew and Baehren (2016) sought responses to a questionnaire from fieldworkers at ten wild chimpanzee field sites. The results were unanimous: greeting was universally present in chimpanzees, whereas leave-taking was universally absent. The authors did not give respondents a definition beyond "show leave-taking/farewell behaviour when they part after being together", so as not to constrain their responses, but it may be that such behaviour is not easily recognisable.

There seem to be only two empirical studies of non-human leave-taking published. The first, by Scheumann et al. (2017) report that grey mouse-lemurs (*Microcebus murinus*) reciprocally greet upon reunion of mother-infant dyads, but do not show leave-taking when separating. As a less derived primate species, the absence of leave-taking suggests a more recent origin within the primate order. Contrastingly, the presence of greeting in this prosimian indicates that it has a deeper evolutionary history in mammalian phylogeny. In this study, greeting and leave-taking were recorded in the context of mother-infant reunion and separation through "infant parking", whereby the mother forages solitarily after leaving the infant in a tree-hole. Owing to their nocturnality and constraints in the gestural and facial displays of the species, this study limited data to vocalisations. As such, it could not test non-verbal elements of leave-taking that seem important in humans and could have parallels in non-human species (Firth, 1972; Lockard, 1980). Empirically, Scheumann et al. (2017) conclude that there are vocal greetings, and no parallel vocal leave-takings, in at least one primate species.

A similar study in group-living primates that uses gestural communication (Fröhlich and Hobaiter, 2018) could give greater insight as to whether leave-taking has comparable elements across species. Using a mother-infant dyad paradigm provides opportunity to investigate parental care as a driving force to reconvene after separation that seems to be important in primate greetings (e.g., in marmosets, Takahashi et al., 2017). Leave-taking could link to attachment theory, representing an evolutionary survival instinct for offspring to stay close to the mother. However, in species such as *Microcebus murinus*, who have evolved the "infant

parking" system enabling mothers to forage, an infant vocal signal could be maladaptive and increase predation risk (Zeifman, 2001).

The second, a more recent study by Heesen et al. (2021), finds evidence that captive chimpanzees and bonobos mark the entries and exits of joint activities with gesture and mutual eye gaze. These findings are important in our understanding of leave-taking as it provides the first published empirical evidence of non-human behaviour at the end of social interactions, where the research concluded that the apes demonstrated mutual gaze and communicative signals prior to and after engaging in joint activities with conspecifics. However, to consider this behaviour leave-taking a number of factors need to be addressed. The length of the interaction (so called "joint commitment") is argued by Lockard et al. (1978) to be a driving factor in the production of some behaviours towards the end of social interaction, but Heesen et al. (2021) used no such controls in this study. We cannot conclude that these exit behaviours are truly leave-taking unless they are found to occur in greater propensity in social separation, compared to solo or proximity separation. For example, we may exhibit behaviours when getting up and leaving alone, possibly gazing where we are planning to move to, e.g., making preparations such as zipping up a jacket, checking the seat to make sure we have not left anything; these behaviours occur because humans exit the scene and not because of social separation, thus should not be considered "leave-taking". The gestures and eye gaze should be shown to occur in these joint commitments compared to, for example, close proximity (see study by Gräfenhain et al., 2009). This paradigm should be further applied in free-ranging, natural settings to establish the ecological validity of the results.

Proximate drivers. Proximate drivers are mechanisms that directly underly the production of behaviour. Specifically, they refer to events immediately responsible for causing behaviour, and can help us understand what behavioural patterns encourage leave-taking. In humans, certain classes of verbal behaviour have been shown to increase in the terminal phase of conversation, broadly categorised into content summary statements; affective summary statements; continuity, justification, well-wishing statements; and statements of positive affect (Albert and Kessler, 1978). There is also evidence that these statements are sequentially arranged and influenced by various factors including how structured the conversation is. However, these findings are from English-speaking student subjects and so the results may not be generalisable. "Normative structures" rely on conventionalised contexts well understood by members of the society (Wang, 2005) and cross-cultural interpretation of these contexts may influence leave-taking perceptions.

One of the most extensive contributions to our understanding of the structure of leave-takings is Kessler's (1974) Ph.D thesis. Some of the most important findings include differences in summary statements and justification of leave-taking between structured and unstructured conversation, greater positive and well-wishing statements between strangers than friends and greater continuity between friends than strangers. This is probably the most extensive attempt to date to understand the linguistic and structural nature of verbal leave-taking seen.

Schegloff and Sacks (1973) also look at the structural organisation of ending conversations, concerned with how individuals navigate turn-taking in leave-taking. They report a pre-closing section to the conversation, including verbal markers e.g., "Well...", "Ok...", plus clearer statements that prohibit further talk, known as "adjacency pairs", where an utterance from one speaker directs the successive utterance from the other,

completing the exchange. Experimentally, when one individual is instructed to give no termination cues, the other attempts to adopt leave-taking structures, e.g., buffering, to terminate the interaction (Knapp et al., 1973).

Laver (1984) provided another structural framework, focussing on mitigatory and consolidatory comments, providing well-wishes for the future. These were often used together with some formulaic leave-taking such as “goodbye”. In contrast, Kinnison (2002) classified speech acts into 13 categories with categories varying across populations, e.g., announcing, excuses and consolidating were more frequent in Chinese speakers and appreciation and compliments more common for Americans. Broadly, there seems to be significant structure to the verbal element of leave-taking, although classification itself varies.

Furthermore, several authors have described leave-taking as a multiactivity, in which behaviours are co-ordinated to bring interactions to a close. In an example from Haddington (2019) leave-taking at car drop-offs is outlined as a process with two simultaneous “action streams”, leading to the closing of the encounter and bringing the car to a stop. In a medical consultation context, Heath (1985) shows how verbal leave-taking is co-ordinated with embodied action of preparing to leave the room. Similarly, in a study of guided walking tours, Broth and Mondada (2013) describe the role of orientation during sequence closings. Haddington (2019) argues that these examples demonstrate how physical action is reflexively co-ordinated with the leave-taking itself, and that movement can help achieve the closing of a sequence. Thus, the expression of leave-taking seems to be multimodal across different contexts.

Ethnographic studies of leave-taking point to influential factors in its expression in different populations. Akindele’s (2007) study of discourse in the South African language Sesotho found that age, sex, context and time of day are all important in leave-taking, usually expressed as reason to leave and well-wishes. Similarly, DuFon (2010) highlights importance of status and hierarchy in leave-taking in Indonesian. Rababah and Malkawi (2012) report similar patterns in partings in Jordanian Arabic: age, sex, context and time of day are important, although their main focus is greeting with little explanation of leave-taking. How precisely these factors influence behaviour given their descriptive nature is difficult to determine, though Laver (1981) consolidated this as “politeness-oriented linguistic routines”, in which the formulaic phrases should be consistent with social status, degree of acquaintance and nature of the situation.

The importance of contextual variables and in-person cues is also highlighted in linguistic literature on telephone and computer mediated communication, where speech is the only medium for communication. For example, Tang’s (2007) study focused on the lack of non-verbal cues in phone conversations, and the subsequent lack of information about status and interpretability of the other individual. He reported that phone conversations have extra verbal cues compared to in-person interactions, to compensate for this lack of information. More acquainted individuals are more likely to say “goodbye”, but this is optional for those less acquainted (Clark and French, 1981). The percentage of “goodbyes” in the terminal exchange also increases if some useful information was exchanged, or when operators revealed more about themselves. This suggests that verbal leave-takings are mediated by social relationship and contextual information about the interaction. Major drawbacks of these language-only approaches involve the omitting of non-verbal behaviours and focussing only on a few developed populations, limiting generalisability of the results to the evolution of species-typical leave-taking.

Adaptive value and function. The functions of leave-taking may not be mutually exclusive. One possible recurrent function is social bonding, to signal the continuance of social ties (Lockard, 1980). For instance, Goffman (1967) stated that a farewell is needed to sum up the effect of the encounter on the relationship and outline expectations for the next meeting. Many definitions stress social interaction as a necessary pre-condition for leave-taking, then maintaining the relationship throughout separation and reassuring that contact will commence at some point (Betholia, 2009). A positive and successful leave-taking could send a relational message regarding feelings and attitudes that bolsters the relationship for the time apart (DuFon, 2010) and could even be adaptive in facilitating social relationships (Firth, 1972). These hypotheses remain to be tested.

Studies on emotional attachment have demonstrated that separation from the caregiver results in anxiety and distress in children, contrasting pleasure and security when in physical presence. Bowlby’s (1969) attachment theory states that attachment to a primary caregiver aids survival and acts to provide a continuing emotional tie and ensure the relationship continues, inspired by earlier studies of imprinting across species (Lorenz and Fischer, 1963). Attachment behaviours are activated when proximity is threatened, for example, by separation. As infant survival depends on proximity to the caregiver, and human infants are altricial and unable to follow, the act of crying has evolved as a signal to alert the caregiver, whereas smiling acts as a way to reinforce bonding (Newson and Newson, 1963). This pattern is found across primate species, where Bowlby argues that chimpanzees and baboons can be seen as the template for how infant care evolved in humans, and that the dread of separation is the motivating factor in the lives of all young primates (1969). Furthermore, more responsive mothers increase offspring survival (Hrdy, 2011). Once young children progress beyond the phase of specific attachment around 3 years of age, separation no longer risks survival (Bowlby, 1969), but attachment mechanisms could remain at separation to maintain social bonds in close relationships. Parallels in infant distress at separation and expression of leave-taking (for example, crying, holding out arms, following) could suggest that a function to increase social bonding is a result of attachment innately present to increase survival chance. Hrdy (2011) argues that there is no universal pattern of infant care across primates and suggests that babies for whom care is shared between adults could develop behaviours to manage this, such as seeking eye contact and looking at their surroundings earlier. This connection between infant attachment and separation and ritualised leave-taking in adults also remains to be studied.

Further insight into the social importance of leave-taking comes from Gräfenhain et al.’s (2009) study of joint commitments in children. By two years of age, children join in group games and co-ordinate roles, with results suggesting that children are more likely to demonstrate leave-taking in joint games, as opposed to when playing solo games alongside another individual. This demonstrates an emerging understanding of joint commitments, but also provides evidence that leave-taking manages shared commitments and is intrinsically social: Joint activity relates to leave-taking in children, and this could be a useful paradigm to investigate leave-taking across species.

Several mentions of leave-taking describe it as norm-bound (Knapp et al., 1973), for example its definition as a “ritual of a stereotyped series of complementary transactions programmed by external social forces” (Berne, 1968: p. 34), or Betholia’s (2009) description of leave-taking as a ritualistic event. This stereotyped sequence provides evidence that leaving without proper leave-taking violates social expectation (Adato, 1975), e.g., leave-taking

that is too abrupt or too prolonged can leave participants ill at ease with one another (Dufon, 2010), and casual leave-taking from subordinates to high-ranking officials is problematic (Goffman, 1971). Goffman's "failed departure" examples further illustrate this: when two individuals part but then reconnect, e.g., say goodbye but walk in the same direction, the behaviour seems improperly profuse. Similarly, when children wave as they leave a public place, it is amusing because it fails to qualify as proper leave-taking (Adato, 1975). These examples exemplify the "social expectations" (Adato, 1975) and "norm bound" (Knapp et al., 1973) nature of leave-taking rituals. Dulaney and Fiske (1994) provide an overview of the similarities between features of rituals and behaviours of obsessive compulsive disorder (OCD) patients. One of these features, "attention to threshold", refers to thresholds of interactions, i.e., entrances and exits. They argue that this feature, along with others, is significantly represented in rituals such as birthing and initiation ceremonies, and is also a symptom of OCD. Rather than arguing that rituals are in any way pathologic, this suggests a shared psychological mechanism, distorted or hyperactive in pathological individual ritual, and could help to explain the widespread human concern with parting and thresholds.

Corsaro (1979) found that two-thirds of child-child interactions have no withdrawal and concludes that children do not need to mark the cessation of activity ritualistically, compared to adults. Simultaneously, children focus more on the access ritual (greeting) than the withdrawal (leave-taking). Gleason and Weintraub (1976: p. 134) offered insight into this, suggesting that for "termination routines", there is importance of training by adults, following performance, "only later, long after he has learned to say bye-bye or thank-you—might the child come to know what, if anything, it all means". They also stated that "bye-bye" is one of the earliest routines in development, non-verbal in its first performances, altogether suggesting that elaborate leave-taking may not be important for children, but that the non-verbal ritual develops even before verbalising referential language. This gives an important insight into the development of leave-taking, possibly relevant also for non-vocal behaviour in non-humans, and the role of adults in shaping early social rituals.

Leave-taking requires not only social interaction, but also the expected separation afterwards, or "decreased access" under Goffman's (1971) framework, and thus another possible function could be to inform conspecifics of imminent departure. He predicted that the lengthier and more absolute the separation, the more expansive the ritual, an idea reiterated by DuFon (2010). Longer separations have higher investment leave-taking; farewell parties only precede extended time apart. For example, Wang (2005) shows that in television interactions, concise and efficient farewells occur when the separation is very brief, as opposed to longer term separations. This idea is evident in "real life contexts", where temporary leave-takings during the comings and goings of the workday are fewer, briefer and less formal (Whittaker et al., 1994). Lockard et al. (1978) presented a short study of human postural changes preceding departure, reporting that increased frequency of unequal weight stances and weight shifts signal imminent departure, especially when combined. These behaviours were apparent when individuals left a place together but were more exaggerated when the pair actually separated, suggesting a social signal driven by impending separation. This is one of the few ethological studies focused on non-verbal behaviour that also controlled for other factors, e.g., length of interaction. Although small in sample size, this provides the start of an ethological framework from which to further investigate how these behaviours contribute to leave-taking (Table 2).

Comparing differing separation lengths with associated behaviour also gives an insight into the effects of separation. Betholia (2009) gives an example of temporal change in the Meitei of Bangladesh, a previously close-knit society in highly cohesive groups, where continuing relations were expected, and leave-taking was not an elaborate behaviour. The longitudinal study showed that as the society's complexity and separations increased over time, leave-taking became more elaborate. This gives particularly powerful support to the idea that leave-taking is driven by the separation experienced in most social groups.

Despite such studies on the importance of separation to leave-taking, it remains unclear why separation should drive such behaviour. Studies on leave-taking at death are relevant, as final leave-takings take place at death and mourning (Van der Hart and Goossens, 1987). This is compatible with the theory that leave-taking in its human form is possible due to our conceptualisation of time and the future (Firth, 1972), understanding of separation, and the permanent separation of mortality (McGrew and Baehren, 2016). However, such possibility does not necessitate selective pressure. Field et al. (1984) described leave-taking behaviours of children and parents, highlighting distressed behaviours, especially in younger children, supported by a similar study (Jones, 1972), where behaviours included crying, holding out arms and gesturing to be picked up. They suggest that the leave-taking behaviours function as a survival instinct: to stay close to the caregiver, not to become separated, and to protect young children by favouring proximity, while allowing independence in older children through more positive separation. Furthermore, developmental psychology literature suggests that adult and peer training is critical in children's acquisition of leave-taking (Corsaro, 1979). As with the grey mouse lemurs, this parent-offspring interaction might only be adaptive when leave-takings do not alert predators to the presence of solitary infants. Studying parent-infant dyads limits the potential to understand more general leave-taking and how it becomes established ontogenetically. These suggestions could explain the negative results of the grey mouse-lemur study. Interesting questions arise from these results: What species should we investigate with regards to leave-taking? What contexts are appropriate to investigate? What behavioural measures might give most insight? Does this behaviour occur intentionally to transfer information? These questions have not, as far as I am aware, been investigated in any human or non-human species and thus the adaptive value remains unknown.

A third possible function of leave-taking could be to reduce aggression. This idea comes primarily from the literature relating to the Violence Inhibition Mechanism (VIM) (Blair, 1993). Previous work across many species suggests that there are universal appeasement behaviours that reduce the risk of aggression or even end aggressive attacks from other individuals (Lorenz and Fischer, 1963). These behaviours are mediated by the VIM in which conspecifics use distress signals to inhibit violent or threatening behaviour (Blair, 1995). A similar pattern has also been found in human infants (Murray, 1980) and young children (Camras, 1977) where sad facial expressions in 4–7-year-olds result in the termination of aggression. Some of these behaviours e.g., turning of the head, bowing, are submissive as they expose vulnerable parts of the body to the conspecific (Lorenz and Fischer, 1963). However, others have been argued to reflect a threat of breaking off contact (Eibl-Eibesfeldt, 1989) as aggression blocking behaviours can include turning away and breaking eye contact. This threat of breaking contact, as well as demonstrating submissive behaviours, could provide an alternative theory for the function of leave-taking as a way to minimise aggression.

Evolutionary perspectives

Knapp et al. (1973) shows that although leave-taking may seem mundane and ordinary, it could tell us a good deal about human interaction “since unique and terribly human interpersonal forces are unleashed when people say goodbye to one another” (1973: p. 182). This point highlights both the importance and presumed uniqueness of human leave-taking. The need for studying leave-taking is not just warranted from the absence of literature; plenty of phenomena remain unstudied purely because they are mundane or self-evident. However, the plausible universality of human leave-taking, which is likely integral to most social interactions, merits investigation.

Investigating the behaviours that occur at the end of interactions could have implications for the evolution of sociality, in understanding why departing intention is important. As argued by Albert and Kessler (1976), studying interpersonal endings is important to theories of social psychology, such as consistency models and exchange theories. Such research would complement theories of human behaviour that describe motivational intention for ending a social encounter, e.g., dissonance (Festinger, 1957) or imbalance (Heider, 1958), but not the mechanism for doing so. Furthermore, understanding leave-taking variation across human societies should provide new insights into the similarities and differences in the expression in this behaviour: Are there similar patterns that suggest leave-taking as a primitive trait ancestral to *Homo sapiens*? Or has leave-taking converged across species to solve common challenges that entail separation, such as fission-fusion societies? By contrast, evidence of leave-taking in more distantly related non-human species would suggest deeper evolutionary roots for this social behaviour.

The desire to understand how species have evolved to manage social separation is not new. However, that leave-taking could be a way to synchronise movement or to signal intention to depart in social animals (Lockard, 1980) challenges an important point: that leave-taking is inherently *different* from synchronised, collective cohesion. The former refers to a separation of individuals and an ending of social contact, whereas the latter relates to co-ordination that aims to keep the group together. The latter is also well-studied across the animal kingdom, in birds, social insects and fish (King and Cowlshaw, 2009). For primates, Schamberg et al. (2017) described bonobo branch-dragging before long group travel, and Rowe (2017) examined factors influencing collective decision-making on group movement in Tibetan macaques. This is inherently *different* to leave-taking because there is no separation and is usually referred to as group movement (Schamberg et al., 2017), group travel (Rowe, 2017), or group co-ordination (King and Cowlshaw, 2009). This highlights the need to distinguish leave-taking (i.e., notification of social separation) from intention to depart, where other individuals notify of a joint cohesive departure, moving away together.

Many species have fission-fusion group structures of varying degrees (Aureli et al., 2008), evolved to balance the benefits of group-living in environments in which resources are clumped and dispersed (Lehmann et al., 2007). The costs and benefits of group-living vary between individuals and across species (Kappeler and van Schaik, 2002), which leads to variation in group size and cohesiveness. Specific ecological factors also influence the extent and patterns of fission-fusion, such as variable availability of key resources (Ramos-Fernández and Morales, 2014). Consequently, the extent of group cohesion affects the evolution of communication patterns. For example, in highly cohesive species, communication is expected to be advantageous for high information acquisition and to reduce competition resulting from the constant presence of conspecifics (Aureli et al., 2008) and to maintain cohesion through co-ordinated movement (e.g., Boinski, 1996; Rowe, 2017; Cords and Killen, 1998). On the other hand,

fission-fusion species are expected to have developed signals that re-establish relationships and resolve uncertainty, as well as cognitive skills that help interpret indirect information about conspecifics when not in view (Aureli et al., 2008). Aureli et al.’s predictive framework generates a series of testable hypotheses about communication, which could, but currently do not, include leave-taking. For example, this framework hypothesises that chimpanzees might have evolved signals to resolve the uncertainties associated with low cohesion, whereas more cohesive primate species, such as baboons, would be expected to have signals that maintain cohesion. In this sense, we can think about fission-fusion in terms of a gradient that varies within and between taxa, and subsequently could predict the differing need to use signals to manage separation. Research efforts into leave-taking across the radiation of baboon species could provide a particularly fruitful avenue of enquiry; allowing us to compare the effects of their varied social systems in phylogenetically close species.

We might predict that leave-taking is more likely to exist in those species that exhibit classic “fission-fusion” (e.g., chimpanzees, spider monkeys, hyenas, Aureli et al., 2008), driven by their regular extended periods of separation. However, even within cohesive societies, such as the genus *Papio*, distancing between individuals exists (Patzelt et al., 2011). Although there is no definitive fissioning of subgroups, individuals socialise with multiple conspecifics, break into smaller distinct groups, and are most cohesive at night and early mornings, as they aggregate to sleep in trees (Anderson and McGrew, 1984). By recognising that fission-fusion exists to some extent in all social groups and abandoning the fluid versus cohesive dichotomy (Aureli et al., 2008), I reveal a potentially important factor to study leave-taking: the level of study. How we collect data is a crucial decision when studying behaviour, as it impacts what questions we are able to answer, and which patterns are revealed (Martin et al., 2021). For example, behaviour at occasional short-term “fission events”, e.g., in chimpanzees (Aureli et al., 2008) would set the stage for studying subgroup leave-taking (Fig. 5). However, these events do not seem comparable to most studies of human leave-taking that focus on frequent, daily interaction endings between individuals (Albert and Kessler, 1978; Schegloff and Sacks 1973; Lockard et al., 1978). Instead, they seem more similar to extended periods of separation (Goffman, 1971; Firth, 1972). There could be much potential in studying the recurrent daily separations that happen often in other species, when brief interactions between individuals come to an end. Comparatively, these interaction endings seem more similar to ethological studies of interaction analysis in humans (Gräfenhain et al., 2009; Knapp et al., 1973; Lockard et al., 1978). Conversely, examples of permanent departure in other species are perhaps more akin to human separations before emigrating, leaving to enter risky circumstances such as war, or even before death (Van der Hart and Goossens, 1987; Radcliffe-Brown, 1922). Similar to the gradient of cohesion seen across species and contexts, we might expect to see a gradient of leave-taking, in which different forms of impending absence drive different patterns of behaviour, although defined in distinct levels for the purpose of this framework. I propose that levels of separation should reflect the social entity that is being departed from, where low-level reflections separation from individual interactions, medium-level reflects subgrouping of small social groups, and high level reflects departure from an entire social group. This may often parallel duration and distance, e.g., separation from an entire social group is more likely to be extended than separation from a social interaction where one stays within the main group and likely encounters the same individuals repeatedly. However, the relationship between separation of social unit, duration and distance remains poorly

understood; such levels should be used as guidance to establish what level of social unit is separating, and on what scale.

At present, our understanding of leave-taking is limited by lack of data across species (Table 2). Despite the apparent similarities between humans and other species in factors that cause leave-taking, such as status recognition (Chiao, 2010), strengthening of social bonds (Lehmann et al., 2007) and understanding of separation (De Marco et al., 2011), Firth (1972) argues that humans have greater flexibility, length of time, conceptualisation of the future, formality and correctness. Some non-human species show propensity for mental-time travel (Cheke and Clayton, 2010) and anticipatory behaviours (Mulcahy and Call, 2006; Osvath and Karvonen, 2012), but McGrew and Baehren (2016) argue that we lack evidence that this extends to the social domain. They also suggest there could also be differences in the costs and benefits of leave-taking across species: in cohesive groups in which the separation is never longer than a number of hours versus species that exhibit more definite fission events (e.g., chimpanzees) this could affect any information that is exchanged about how long they will be apart. This constrained temporal factor could result in less frequent and conspicuous leave-taking behaviour compared to greeting.

It seems likely that non-human species have no elaborate leave-taking, unlike humans who engage in leave-taking “ceremonies” (Van der Hart and Goossens, 1987), sometimes involving elaborate behavioural sequences. However, “evolutionary components” may exist in the non-human animal repertoire, which reflect the ancestral state of the behaviour, or its possible function(s). Furthermore, when considering the proposed levels of leave-taking (Fig. 5), subtle changes in frequency or timing of behaviours during the day-to-day separations, could easily be missed unless they are the focus of specific study. Commentaries on this so far (McGrew and Baehren, 2016; Scheumann et al., 2017) take into account only obvious medium-level partings at fission-fusion. Focusing on interaction level separations and subtle changes that may indicate leave-taking may be more fruitful in non-human species. Investigation of these subtle but frequent leave-takings in daily partings of non-human species need to be undertaken (Table 2).

A new framework for leave-taking

Future efforts to address limitations in the study of leave-taking should fall broadly into two categories: its framework and empirical predictions. A dual focus on these areas will help to simultaneously strengthen the methods used to collect data and advance the evolutionary nature of hypotheses tested.

The lack of a robust framework links to the lack of empirical studies on leave-taking. Here, I have proposed an operational definition of leave-taking summarised as: behaviours occurring before intended cessation and separation from a social interaction of two or more individuals. I have advocated using levels of separation (Fig. 5) as a way to navigate the gradient of leave-taking seen across different types of separation and reveal potentially interesting behaviours across species. Taking advantage of technological advances, video recording and behavioural coding software (Cristani et al., 2013; Friard and Gamba, 2016) can help address methodological issues and allow more effective study.

A comparative method should be part of this framework, in order to place leave-taking in an evolutionary perspective and identify candidate behaviours comparable across species. Variation across species could suggest different selection pressures of social system, environment, and context, and provide further opportunity of empirically testing. The apparent universality of this behaviour in humans suggests a deep evolutionary history in the hominin clade, but it remains unclear whether elements of

leave-taking behaviour were present in our Last Common Ancestor with the genus *Pan*, or even with the Order Primates as a whole.

In most, if not all, human populations leave-taking is seen prominent and important, and as such deserves careful attention from those interested in behaviour. The discrepancy between the literatures in greeting and leave-taking is stark. In part, this contrast is due to difficulties in studying leave-taking, but also due to a fragmented and underdeveloped theoretical framework. I argue that our understanding of leave-taking would benefit from greater consideration in the disciplines concerned with behavioural evolution, and that cross-species methods should now take advantage of technological advances to do so. Confirming some of our proposed predictions on leave-taking could inform us on critical aspects of its evolutionary origin, variation and function.

Data availability

No primary data is generated in the paper. The literature data that support the findings of this study are available from online sources associated with the references cited in the paper.

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Competing interests

The author declares no competing interests.

Ethical approval

As a review article, this manuscript did not require ethical approval.

Informed consent

As a review article, this manuscript does not contain any studies with human participants performed by the author.

Additional information

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