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The semiotic repertoire of dairy cows

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ABSTRACT

This article moves from the familiar—the human—to the very different in sociolinguistics—the dairy cow. Based on multispecies ethnography, the aim of this article is to advocate the animal turn in sociolinguistics (Cornips 2019). The guiding question is how do non-human animals, that is, dairy cows—mutually and with humans—imbue their intraspecies and interspecies interaction with meaning that makes sense for the two species. The concept of semiotic repertoire is invoked in order to investigate how dairy cows draw on resources to make meaning, and the concept of material-semiotic assemblage is applied in order to account for the different effects generated by the resources that come together at particular moments. The assemblage perspective does not take a 'cow' or 'human' as discrete and fixed but focuses on the distributed and emergent agency as a relational effect of all elements involved: humans, non-humans, and other. (Intraspecies and interspecies interactions, the semiotic repertoire, assemblage, dairy cows, practices)*

INTRODUCTION: THE ANIMAL TURN IN SOCIOLINGUISTICS

This article moves from the familiar—the human—to the very different in sociolinguistics—the dairy cow (Cornips & van den Hengel 2021; Cornips 2022, 2024a,b; Cornips & van Koppen 2024). My intention is to show that, by placing the sociolinguistic focus on dairy cow practices, the other (i.e. the dairy cow) becomes familiar, and the familiar (i.e. the human) becomes alienated (see Myers 2011). Based on multispecies ethnography, the aim of this article is to provide proof of principle for the animal turn in sociolinguistics, that is, for an inclusive sociolinguistics that examines more than just interactions between humans or human practices (Cornips 2019, 2022). A focus on the non-human animal in (applied) (socio)linguistics is of course not new, as Kulick (2017) discusses in his historization of human-animal communication studies since the 1980s; Pepperberg (2017) considers animal language research since the 1960s (see also the many references of pragmatic interspecies studies in Szczepek Reed 2023; Peltola & Simonen 2024; Cornips 2024b). In contemporary sociolinguistic and pragmatic research, the animal is studied as more than a material and/or interactional resource used to

manage human centred interpersonal relationships (Mondémé 2011) or as experimental objects in linguistic research based on the animal (disease) model in which the genes or animal brain regions as homologous features are altered deliberately to justify a better understanding of certain human language disorders or 'genetics of language' (Benítez-Burraco 2013).

In this article, in contrast, the non-human animals are studied without superimposing human language and cognition as the norm (see Simonen & Lohi 2021 for dogs; De Malsche & Cornips 2021 for goats; Mondada & Meguerditchian 2022 for baboons; Cornips & van Koppen 2024 for dairy cows; De Rijk & Cornips 2024 for piglets), hence, they are investigated as subjects. Given this perspective, non-human animals may initiate, for example, human speaker selection by gaze (Mondémé 2022; Cornips, van Koppen, Leufkens, Melum Eide, & van Zijverden 2023), and organize their intraspecies interaction in sequential, and temporally smoothly ordered ways (Logue & Stivers 2012; Fröhlich 2017; Mondada 2018:103; Mondada & Meguerditchian 2022; De Rijk & Cornips 2024). A better understanding of the non-human animal in sociolinguistics is important since it 'can help humans to understand animals better and build new relations with them' (Meijer 2019:2). It would position sociolinguistics in the current interspecies ethics debate in the Anthropocene. The Anthropocene or Chthulucene (Haraway 2016) is a label suggested for the era we live in now: an era in which human thoughts and actions began to have a significant impact on the Earth's environment. Humans, and human actions, have become 'a major geological force' (Chakrabarty 2012) initiating changes to the earth that cannot easily be undone due to interrelated processes of climate change, decreasing biodiversity and mass extinction. In a (Eurocentric) perspective, for example, a dairy cow is considered as a production animal only, hence, as an inarticulate being whose presence is only material or defined by 'nature' and whose speaking is interpreted as 'noise' (Cornips 2022). However, dairy cows and their calves are sentient social co-beings; they display a high level of social complexity, including social learning (Marino & Allen 2017; Vaarst & Christiansen 2023), experience a range of emotions, and are 'capable of numerous self-induced activities' (Noske 1997:17). Moreover, in the ongoing breeding history of a dairy cow, specific skills enabling social cognition and interaction with humans (Hare, Brown, Williamson, & Tomasello 2002) are/were selected. These long-term breeding programmes also favour interspecies human-dairy cow understanding (Stuart, Schewe, & Gunderson 2013). Precisely in intensive dairy farming 'adequate communication' with humans (Phillips 2002) is considered of vital importance for a cow's survival. If a cow doesn't follow the (often verbal) instructions by the farmer (fast enough) she will be sent away to be killed.[1]

Tsing emphasizes that an exclusive focus on human sociality 'really hurts us. … If we want to know something about environmental change, we need to know about the social worlds other species help to build' (2013:33) and that we have to '[bring] more-than-human sociality into our understandings of the social' (2013:35). Therefore, a focus on dairy cows addresses two urgent research problems in

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sociolinguistics in the era of climate change and loss of biodiversity: (i) how to decentre the human both theoretically and methodologically, especially within the strongly asymmetrical dairy cow and human power relations in human dominated dairy production; and (ii) how to fill the gap of knowledge in sociolinguistics about the animal's sociality and interactional meaning-making (Rasenberg, Amha, Coler, van Koppen, van Miltenburg, de Rijk, Stommel, & Dingemanse 2023; Cornips & van Koppen 2024). In sociolinguistic theories, there is as yet generally no eye for the sociality of non-human animals, for what animal subjects make relevant in their intraspecies and interspecies interactions, and for power relations concerning humans and other species. To circumvent this, this article takes a multi-species interest 'in better understanding what is at stake—ethically, politically, epistemologically—for different forms of life caught up in diverse relationships of knowing and living together' (Van Dooren, Kirksey, & Münster 2016:5).

The guiding question is 'how dairy cows relate to each other and to the human(s) in the production of a meaningful world through linguistic-material-semiotic resources' (Cornips & van den Hengel 2021; Cornips 2022). I apply the concepts of semiotic repertoire (Kusters, Spotti, Swanwick, & Tapio 2017; Kusters 2021) in order to investigate how dairy cows draw on resources to make meaning, and the concept of material-semiotic assemblage (Pennycook 2017, 2018b; Lamb 2019; Cornips & van den Hengel 2021; Cornips 2022) to account for the different effects (sounds, positioning, affect, mobility, gaze, etc.) generated by the resources in various settings that come together at particular moments (Pennycook 2018b).

The article has five sections. The first and second section discuss the semiotic repertoire and assemblage perspective, respectively; the third section informs about the methodology used, while the fourth section considers four case-studies. The final section summarizes the findings.

SEMIOTIC REPERTOIRE

Originally, Gumperz defined the verbal repertoire as 'the totality of linguistic forms regularly employed in the course of socially significant interaction' from which speakers (de)select from a 'range of expressions' during the interaction. A linguistic form in this definition refers to 'all the accepted ways of formulating messages' (1964:137–38). Gumperz situated the concept of the repertoire firmly in the social context, but the more recent theory holds that objects and environmental affordances are part of the activity of communication as well and, hence, should be part of the repertoire (Canagarajah 2021). For this reason, Kusters et al. (2017:221) argued that the focus on linguistic forms or formulating messages is too narrow for understanding meaning-making in interaction since 'speakers first and foremost use semiotic resources, rather than languages understood as coherent packages'. They therefore proposed to change the notion of verbal repertoire to semiotic repertoire, which can be understood as 'the totality of semiotic resources that people use when they communicate (such as speech, image, text, gesture, sign,

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gaze, facial expression, posture, objects and so on)' (Kusters 2021:187). The notion of semiotic repertoire is pressing in a more-than-human sociolinguistics since social semiotics features embodied potentialities and capacities of all species (Kusters et al. 2017:11). Including the semiotic repertoire of dairy cows highlights embodied multimodalities like mobility, proximity, senses, and so on (see also later). A first example (Cornips 2022) of how a dairy cow draws on resources to make meaning in interspecies interaction with 'her' farmer is that she may open the interaction by turning her head towards the human entering her barn, establishing gaze, and positioning her ears straight to the head, accompanied by producing a sound not unlike a human /u/, that is, a (semi)closed central or back vowel with a relatively low pitch (F0). The nasal character of this sound 'mmmm' remains more or less flat at about 80 Hz during production (Van Heuven 2023). It is not generated as 'noise' but as an acknowledgment of the human newcomer in the barn (Cornips 2022). Crucially, this verbal greeting depends on more resources to produce meaning, that is, the barn should have closed sidewalls and a roof, the number of different humans entering the barn should be very restricted, depending on her personality in relation to other cows and her mood at that moment, the cow must be willing to interact, and so on (Cornips 2022).

Another example to show how cows may draw resources from environmental affordances in an intensive dairy barn can be found in the quantitative applied biology study (Meen, Schellekens, Slegers, Leenders, van Erp-van der Kooij, & Noldus 2015) based on audio and video-recorded vocalizations in specific time intervals by two groups of Holstein Friesian cows in the Netherlands in 2014. The two groups consist of young cows who have not yet had a calf and, hence, did not produce (mother)milk yet (so-called heifers), and older ones, having had a calf at least once, that are producing milk. These had been located in different physical places in the same building for three consecutive weeks ten hours per day (7:00am–5:00pm). The authors analysed 847 calls (twenty percent of all detected calls) which, in their opinion, could be attributed to distinctive activity (in their terms behavioural) conditions: for example, lying and ruminating and feeding-related (eating, drinking, standing and chewing food, looking for food in the trough while no food is present, reacting to food-providing tractor).

Their findings reveal that heifers produce significantly more feeding related sounds with a maximum frequency between 200 and 400 Hz than dairy cows. These heifers vocalize when they stand partly inside a cubicle, or stand still while looking around, which is analysed as stress-related behaviour (171 times by heifers (n = 46) versus fifty-one times by dairy cattle (n = 95)). In contrast, the dairy cows produced significantly more murmuring or low humming sounds than the heifers, expressing that they are comfortable during lying and ruminating. The pitch maximum of this sound is significantly lower (below 100 Hz) than during the other activity conditions.

Although the authors do not analyse it as such, the meaning-making of the sound of the heifers and adult cows in this study is dependent on other semiotic resources.

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In this specific barn, the dairy cows find a good compost bedding, that is, organic rest material in their cubicles, hence they will lie down, whereas heifers do not and keep standing. The comfortable compost bedding generates a murmuring sound by the dairy cows, while the lack of compost bedding could explain why heifers stand idly in their cubicles and produce significantly more stress-related sounds instead.

These two cases show that the meaning production by dairy cows has to be conceptualized as a DISTRIBUTED phenomenon, an emergent property deriving from the interactions and interrelations between human, dairy cows, heifers, spatial resources, and things usually seen as inanimate (Pennycook 2018a). Semiotic resources can thus not only be understood in individual terms (an individual cow who initiates the greeting sequence or who produces a specific sound), or in more social terms (the group of heifers versus the adult cows), but also in material terms (comfortable compost bedding or not, open versus closed walls).

From this perspective, the material context is not merely 'passive' or inert, and semiosis cannot be analysed separately from it. Following Pennycook (2017:273), the semiotic resources of the cows matter, that is, their co-speech should be understood as embodied (Bucholtz & Hall 2016; Mondada 2018), multimodal (Goodwin 2017), and multisensory phenomena (Zhua, Otsuji, & Pennycook 2017). Importantly, the notion of the semiotic repertoire focuses on both the affordances and constraints which are crucial in the case of production animals in a (trans)national industrial dairy and meat context in which profit has to be made. The notion of the semiotic repertoire, thus, offers not only a lens on the conditions of 'sharedness' of potentialities, 'on "thing" getting done' (Zhua et al. 2017:390) but also on restrictions, on 'things' getting NOT done (Busch 2012). The fact that heifers are held captive indoors makes them extremely dependent on the care practices by the farmer. Thus, both affordances and constraints, that is, whether cows are able to move around or not, or whether heifers encounter comfortable compost bedding or not provide an insight into how to understand the daily realities of dairy cows and the concrete effects of power and inequities. Therefore, a focus on the materiality that heifers and cows are made to live alongside as commodified products is important (Thurlow 2020:355). Acknowledging the influence of material artefacts on cows' routines, practices, and capacities for sociality in human-dominated organizations (D'Adderio 2021) opens us up to studying how these resources shape how cows engage with and make meaning through them (Cavanaugh & Shankar 2014; Cornips & van den Hengel 2021; Cornips 2022).

The concept of assemblage (see the next section) accounts for how semiotic resources relate dynamically in the activities at particular moments and intersect with each other to build locally relevant action (Caronia & Mortari 2015; Goodwin 2017). Sometimes semiotic resources like sounds, gaze, affect, movements, proximity, and objects like compost bedding matter, sometimes they don't (Pennycook 2018b; Canagarajah 2021; Kusters 2021), and the question is 'how they matter and for whom' (Caronia & Mortari 2015:407).

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THE ASSEMBLAGE PERSPECTIVE

In assemblages, heterogenous semiotic resources come together as networked elements in a particular place at a particular time (Pennycook 2017). An assemblage perspective does not take a 'dairy barn' or a 'cow' or 'sound' as a discrete and fixed unit but views each entity as an emergent and distributed formation. Such an entity is produced as a relational effect of all networked elements involved (Pennycook 2018b). An assemblage approach necessarily focuses on the question of 'what is happening' (Law & Mol 2008:58) by the perceptible difference made by networked elements such as actions, instruments like fences, tools, norms, values, bodies, affect, compost bedding, food, and so on (D'Adderio 2021) in their physical and social environment (Fox 2015:305) without postulating any element as intrinsic (Gurney & Demuro 2022:315). A set of relations in an assemblage such as a cows' bodily activity—gaze, sound, ear positioning, mobility, and so on—are inseparable from each other and when the elements change, the set of relations between them change as well. An entity such as compost bedding or sound production can make a difference when it is 'relatively more likely to exert influence on practices or routines than one that isn't' (D'Adderio 2021:92). In such a relational perspective, [m]ateriality is not mere passive 'stuff'; by semiosis it becomes a 'vibrant, dynamic and active partner in human action' (Lamb & Higgins 2020:353). To put it differently, '[t]hings and objects are connected in a recursive relationship: not only do people [and non-humans] make things, but things also make or have their (socio-culturally mediated) capacity to act and influence other human and non-human actors' (Gibas, Pauknerová, & Stella 2011:24).

Materiality is crucial for bringing power dynamics to the fore, especially in industrial dairy-farming assemblages since 'inequities often manifest themselves in very material ways' (Ennser-Kananen & Saarinen 2023:12): for example, captivity of the dairy cows, restricted access, uncomfortable cubicle, shortage of food, body mutilations, (mother) milk, short life, death, immediate mother-calf separation, and so on. These kinds of elements are enmeshed in a web of countless relations in the industrial dairy-production assemblage that involves at least: agricultural food industry, agriculture multinationals, land, consumers, landscape, land/water management, financial markets, soil, public human health, animal health and welfare, European and national agriculture politics, nature-culture binary thinking, dairy cow breeding programmes, nitrogen, affect, sociality of the cow, and so on. In Meen et al. (2015) (discussed above), the industrial dairy assemblage of which dairy cows are part and the industrial dairy assemblage of which heifers are part differ in at least two networked elements. Since dairy cows, unlike heifers, produce milk and hence are more valuable in consumer neo-liberal markets, they 'deserve' their comfortable costly compost bedding in their cubicle compared to the heifers who are not yet productive. In these distinct assemblages, where compost bedding is present or absent, the productive cows and not yet productive heifers can be viewed as networked elements that link up with the elements of

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compost bedding and economic values, each of which makes a difference to the other with respect to the effects on the different whole-body activities by dairy cows and heifers, including sound production. The two examples illustrate how the semiotic repertoire is engaged with and used as a ground for expression formation, and how thinking in terms of assemblages cuts across humans, cows, and objects, shifting the focus to what these elements in a relationship with each other can do (Fox 2015:305). So, it is not 'who is what', that is, cow or human or compost bedding, that has an ability to act but 'how they are involved' (Conway, Osterweil, & Thorburn 2018:6) in the relational 'what is happening' event.

Since all elements of an assemblage are interconnected, Canagarajah & Minakova (2022:187) emphasize that they all are potentially indexical, that is, they all carry a socially relevant meaning. In the dairy industrial context, cow-human practices like milking/being milked and feeding/being fed or cows grooming each other are displayed daily and habitually, and interwoven into the interspecies and intraspecies interactions that this article seeks to draw attention to. Full-body practices that are co-constructed by human and cow bodies gain indexicality through becoming 'sedimented' (Kusters 2021:188) as crucial vectors within the dairy farms' semiotic assemblage. Moreover, an assemblage perspective not only puts the focus on 'capacities for action, interaction, affect, and flows' but also 'on the production of knowledge' within the assemblage (Gurney & Demuro 2022:316). Dairy cows, heifers, and calves in interspecies and intraspecies practices display knowledge in using artifacts designed by humans like bars, fences, milking machines, feeding, sand, compost bedding, and cleaning robots, brushing machines, and so on (Cornips & van den Hengel 2021) through their whole-body activities (including vocalizing) (Caronia & Mortari 2015).

MULTI-SPECIES ETHNOGRAPHY

In order to become attentive to effects generated by semiotic resources coming together in ongoing practices, I have been conducting multispecies ethnographic fieldwork (Hamilton & Taylor 2017; Abrell & Gruen 2020) since mid-2018.[2] Conducting ethnography is a reflexive process, with full awareness of one's own positionality, actions, and values in the practice of doing fieldwork as part of relating to cows, farmers, and other humans (Cornips 2022; 2024a). On this approach, data are considered as co-produced by humans and dairy cows since the cows and I always relate during fieldwork. In this reflexive process cows are examined and experienced as subjects in respectful ways, which requires the assumption of agency and perception in a situation of life shared between humans and cows (Despret 2008; Lestel, Bussolini, & Chrulew 2014:127). Therefore, when doing ethnography, I put the dairy cow's activities in the centre, with the meaning-making activities by which cows construct their worlds.

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The focus during fieldwork is on observable activities, more specifically, on how whole-body intraspecies and interspecies interaction—that is, co-speech of sounds, gaze, movements, facial expressions (kinesics), space (proxemics), and sensorial practices of meaning-making through tasting, touching, seeing, listening, hearing, and smelling—are enabled by the conditions of possibility. These conditions are material artefacts, the spatial layout, the cows, humans (and other species like dogs, cats, horses), and (feeding, cleaning, milking) robots moving about, and so on (Pennycook 2018b).

In particular, a multispecies ethnography lends itself to experiencing how cows interact with other cows, the farmer(s), caretakers, and me while relating to each other and their (routinized or not) practices and know-how. Significantly, I had to acquire a familiarity and sensitivity and be responsive to the reciprocal nature of the relation, to effect 'becoming with' (Haraway 2007). Throughout the years, I have been learning with and through the cows via bodily experiences like brushing, touching, milking, feeding, walking, and just being with them (Haraway 2007; Lestel et al. 2014; Cornips 2024a,b), while a cow may engage with me through being together, gazing, approaching, licking, lying down in my proximity, sniffing, and touching. In particular, cows are met in immediate, embodied encounters, leading to new relations, which affect cows but also me in our developing relationship (Cornips 2024a,b).

I experienced and related to dairy cows (see Table 1 below) in three different situations: (i) in farming conditions in which the cows need to produce milk and calves, hence meat, and in which humans define themselves as farmers (Farm-Maastricht & Farm-Utrecht in Table 1 below); (ii) in the cow sanctuary where (older) females and males live together without having to produce anything, and the human defines himself as a caretaker (cow sanctuary in Table 1) and (iii) in a more 'natural' small herd, in which females, males, and calves live together outside and the dairy cows produce milk for their calves (but not for human consumption) and the humans define themselves as caretakers (small herd in Table 1). Most video-recordings were made on my mobile phone, in order not to become too intrusive and in this way be allowed to follow a dairy cow wherever she was going, thus, to be flexible as much as possible.

The question then is how to identify the networked elements in the assemblage as co-constructed resources in a semiotic repertoire that become enregistered with meanings for the two species (Canagarajah & Minakova 2022:187). To that end, I select recurrent practices within the routinization of dairy production (Cornips & van den Hengel 2021; Cornips 2022) like feeding and eating (see above), milking, ruminating, entering the barn by the farmer, delivering a calf, and boredom (tongue rolling, biting on fences; see Phillips 2002). A second focus homes in on the individual cow experiencing troublesome interruptions in these routines, like mother-calf separation, separation from the herd due to advanced pregnancy, being hungry, delivering a calf, illness, or transport to the slaughterhouse. Further, selection of resources is also based on unexpected and surprising

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TABLE 1. *The four fieldwork sites.*

	Location	Breed	N	Barn type	Milking	Field work (d/m,y)
1	Intensive Maastricht	Holstein-Friesian	150	loose housing	robot milking	5 (1 month), 27/7, 17/8, 18/8, **2018**
2	Intensive Utrecht	Holstein-Friesian	120	loose housing	milking parlor	*since **1996**
3	Cow sanctuary	Various; older individuals	50	tie-stall loose housing	none	15/12, **2020**, 24/3, 16/12, **2021**
4	Small herd	Various: adult female cows, (fe)male calves	7	pasture	none	08/05, 28/05, 18/06, 4/09, 16/10, 27/11, **2021**, 30/01, 13/03, 20/04, 07/05, 03/06, 27/08, 10/09, 02/10, 20/11, **2022**

*As holidaymaker present many weekends in summer

activities (Lestel et al. 2014:126–27), as for example the individual cow's acknowledgement of an unknown human entering the barn (see above).

In order to trace the meaning-making activities by the individual dairy cow in shared situations, a focus on 'anecdotal and other evidentiary forms' (Lestel et al. 2014:127) is crucial. Lestel et al. (2014) provide anecdotes of a New York cat that actively seeks out and happily and repeatedly eats spicy chillies since he shares a household with humans who like to eat spicy chillies, and of Wattana, an orangutan raised in the menagerie of the *Jardin des Plantes* in Paris who became an 'eager, assiduous and skilled knot-maker' (2014:126). The dancing ox Yoshua (see Figure 3 below) is another example. These activities bring about the embodied potentialities, capacities, and the production of knowledge of which the (dairy) cow is a part, and they entail 'interpretation and emplacement' according to Lestel et al. (2014:129).

CASE STUDIES OF VARIOUS PRACTICES IN VARIOUS ASSEMBLAGES

In this section, four case studies of different practices are presented which reveal how dairy cows draw on resources to make meaning (semiotic repertoire) and how these resources like sounds, positioning, mobility, gaze, knowledge, dancing, affect, fences, sand, and so on work together in various settings to generate a relational effect from an assemblage perspective (Pennycook 2018b). In this article, I do not discuss different types of assemblages but rather how assemblages differ in their networked elements, with different effects as a consequence. Two case studies stem from an intensive dairy farm under actual farming conditions such as the ones discussed by Meen et al. (2015): one case study situated in the cow sanctuary where (older) females and males live together and have been given names, and one case study of a more 'natural' small herd where females and calves, also with individual names, live together, and wander outside all year (see Table 1).

While moving to the analysis of the data, I adopt a narrative approach instead of conversation analysis (CA), for example, to emphasize the wider societal context, examine how the dairy cows relate to others and material artefacts, to keep an eye on sensorial meaning-making, and to explore less-anthropocentric approaches to representation in sociolinguistics. The narrative approach enables a focus on the semiotic repertoire, including what material artefacts do, how they influence whole-body practices by dairy cows, and their social meaning-making, and on the assemblage to account for the different effects generated by the resources in these settings that come together at certain moments (Pennycook 2018b).

The intensive dairy farm assemblage

The intensive dairy farm with its '[i]ntensive management and manipulation of the reproductive and productive capacities of their body' (Gillespie 2018:17) is the

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commonest dairy farm assemblage in the Netherlands (Meijer 2023). It is closely connected with larger political structures of repeated violence, like forced frequent pregnancies, mother-calf separation, dehorning, premature killing, breeding programmes for higher yields of (mother) milk, meat, calf production, health problems, and the assignment of cows to encaged places (Cornips & van den Hengel 2021; see also Figure 1 below). An intensive dairy farm prevents calves, heifers, and cows from forming a natural herd, which includes a matrilineal social structure with strongly clustered networks and various non-random attachment and avoidance relationships regarding age and gender (Marino & Allen 2017:488). Mother cows cannot transmit their know-how, which prevents the younger ones from engaging

FIGURE 1. A cow in an intensive dairy farm (photo taken by author during fieldwork).

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in processes of cognitive and social learning and deprives them from being comforted by older cows (Marino & Allen 2017). An intensive dairy farm is also marked by high mobility: newcomers, like newborn calves, arrive frequently, while oldcomers, like adult cows, male calves, and other infertile, lame, sick, or no longer productive individuals, have to leave in order to be killed.

Case study 1: Routinized feeding/to be fed practices

Farm-Utrecht is a high-productive barn (see Table 2).

TABLE 2. *Fieldwork with the cows in the high-productive barn (Utrecht) (taken from Table 1 above).*

	Location	Breed	N	Barn type	Milking	Field work (d/m,y)
2	Intensive Utrecht	Holstein-Friesian	120	loose housing	milking parlor	*since **1996**

When I conducted my fieldwork in Farm-Utrecht, the heifers and 'dry' cows[3] had to stay inside in summer, in contrast to the dairy cows producing milk that grazed outside. During their stay inside, the barn often appeared to contain no food (roughage or concentrate) that the heifers and dry cows could get to, so they frequently articulated their wish to be fed. In the high-yield intensive dairy-farming assemblage, considerable genetic selection is applied to improve milk production by Holstein Friesians (see Figure 1) based on a high-input diet in the extremely standardised intensive dairy system. As all farmers in my fieldwork say, 'Friesian Holstein cows excel at sports at the Olympic level'; they have to eat continuously high-quality food and supplements to fulfil their 'genetic potential'. Without enough food, they 'are at risk of suffering metabolic disorders in early lactation', that is, they have problems with producing milk shortly after giving birth to a calf (Rodríguez-Bermúdez, Miranda, Baudracco, Fouz, Pereira, & López-Alonso 2019:6).

The Holstein Friesians in this barn waited impatiently at the feed fence, articulating a specific sound, most often in concert with each other. I sometimes entered the very smelly barn—since these cows stand or walk on discrete beams where faeces and urine pass—when I heard them calling for the grass silage to be swept in reach of their mouths. When sweeping the grass silage to them, many cows touched and tried to lick me. They could start eating, and as a result they became silent. However, this was soon followed by jointly producing the same sound again, while standing agitated at the feed fence because the grass silage was out of reach once more. Eating and being fed is a routinized practice (Phillips 2002) that minimally happens more than once per day in the barn, and the intensive dairy assemblage is activated through ongoing feeding/eating practices.

The relational effect of the networked elements working together—food shortage, stress, no mobility due to the feed fence, genetically disposed to produce high

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yield milk and eat without interruption (if not ruminating or sleeping), neo-liberal markets, agricultural food policy, and so on—the resulting activities of the cows together is to push restlessly to the feeding fence, while with their mouths open, they produce, individually or jointly, a strong rising pattern starting below 100 Hz and rising to over 200 Hz.

Of course, I do not claim that these sounds can be directly translated into invariant and stable English 'hunger' and/or 'I am hungry'.[4] There is no one-to-one equivalence of the sound the cow makes and English or any other human language, since the cow's sound cannot be separated from its meaning-making: moreover, each and every semiotic activity has a translational aspect (Zheng, Tyulenev, & Marais 2023).

Due to me establishing a relation with the cows in the course of my fieldwork and by attuning to the calling heifers and dry cows, I became part of their multimodal and multisensory routinized feeding/eating practices, simply by entering their barn to sweep the silage to the feeding fence, and by touching those who approached me sniffing and licking. All of this is an effect of the coming together of semiotic resources in a particular place at a particular time.

Case study 2: Routinized mother-calf separation practices and its interruption

TABLE 3. *Fieldwork with the cows in the high-productive barn (Maastricht) (taken from Table 1 above).*

	Location	Breed	N	Barn type	Milking	Field work (d/m,y)
1	Intensive Maastricht	Holstein-Friesian	150	loose housing	robot milking	5 (1 month), 27/7, 17/8, 18/8, **2018**

From May through mid-August 2018, I conducted fieldwork at Farm-Maastricht, where I spent several weeks during my holidays (see Table 3). Farm-Maastricht subsequently became the site for three days of further ethnographic observation, including two days of gathering audio and video-recordings (Cornips & van den Hengel 2021). The dairy farm houses about 150 adult cows, heifers, and calves. In Dutch intensive dairy farms, farmers usually assign a space of her own to a cow about to deliver a calf, in the so-called *afkalfstal* 'calving area' containing straw. Practices of separating new-born calves immediately from their mothers after birth are routinized in the intensive dairy farm, hence, are sedimented in this assemblage. However, during my observation on 22 July 2018, 8:30 pm a delivery took place in the calving area with the aid of a farmer, although he shortly after had to go to a wedding, leaving the mother-calf separation to be executed by a hired man. This man discovered that the calf was still with her mother seventeen minutes after birth and carried her away. In these seventeen minutes, the mother cow could stand up after the delivery and lick her calf thoroughly while

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producing a brief 'mm' sound with mouth closed (see Figure 2). The sound lasted about 400 ms, with a minimum and maximum pitch of 62 and 69 Hz respectively, and a flat gradient of 24 (Hz = s) (Van Heuven 2023). The calf was given time to stand up as well and, directed by suckling motivation, search the mother's udder and teat to drink. The whole-body activity including licking, sniffing, positioning, and moving the bodies, ear and tail positionings, and vocalizing of the mother cow directed at her newborn is a clear example of how cows draw on resources to make meaning. The seventeen minutes of being together, which is exceptional in high production farm assemblages, made a difference (Law & Mol 2008:58), that is, it generated: a specific whole-body activity, care practices by the mother, the presence of straw as affordance enabling the newborn to stand up quickly, the search for the teat to drink, and so on. On this view, whole-body actions, affect, and cognition are viewed relationally, that is, distributed across cows, calves, and humans, place, and artefacts generating 'something to happen', which constitutes an interruption of routinized mother-calf separation practices in high productive barns.

FIGURE 2. The standing mother cow licks her lying calf intensively in the delivery space while producing a brief, low frequent 'mm' sound (photo taken by author during fieldwork).

After the calf had been carried away after seventeen minutes, the exhausted mother cow suddenly notices that her calf is no longer with her. She starts to inspect the calving area, sniffs at the door through which the calf was carried away, and at the place where she gave birth. Soon after, she sees me standing at the fence while I'm video-recording her. She quickly walks over to me, taking the initiative to establish firm eye contact. In that brief and powerful moment in which we looked at each other intensely, after having been with the cow in her long and painful delivery (her tongue

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turned blue and the farmer pulled the calf out with a stick), I empathized, connected, and felt with the mother cow. Her actions—inspecting, sniffing, walking with agitation, looking at and sniffing the door, producing sound, and so on showed that she was in stress. Personally, I experienced her complicated delivery and the separation from her calf as painful, and her quickly moving to me while initiating gaze as extremely upsetting. It reveals that the intensive dairy farming assemblage we were part of includes affect and affective evaluations as well (Cornips 2024a,b). The emotions displayed by the mother cow 'did things' and the intimacy between us established by her gaze aligned her to me (Ahmed 2000). I was moved by the mother cow, my body was connected to hers by her increasing proximity and gaze, and made the calving area a social or 'lived' place. Hence, affect was shaped intensively in the relational effects between our bodies (Ahmed 2004:9).

Case study 3: Cow sanctuary practices and dancing Yoshua

TABLE 4. *Fieldwork in the cow sanctuary (taken from Table 1 above).*

	Location	Breed	N	Barn type	Milking	Field work (d/m/y)
3	Cow sanctuary	Various; older individuals	50	tie-stall, loose housing, & sand barn	none	15/12, **2020**, 24/3, 16/12, **2021**

In the cow sanctuary, females and males of all types of dairy and beef cows like Lakenfelder, Fleckvieh, Holsteiner, Dexter, Wagyu, and Belgian Blue live together (see Table 4). They do not have to produce milk or meat. Most of the cows still possess their horns. Many cows are old from a 'production' perspective; during my fieldwork in 2022, the oldest one called Wakamoe was twenty-three years old. The cow sanctuary has two barns: the largest indoor barn houses the cows who can stand up quite easily from a lying position, while the sand barn—located outside, with open sides but with a roof—houses the cows who experience difficulties in getting up and moving around, such as the oldest cows or young overweight beef cows. In a manner of speaking, I could hear the joints of some cows creak when I observed them. In contrast to intensive dairy farms, the sanctuary houses a herd that is quite stable through time, since no living cow will leave the sanctuary; over the years some cows arrive when space in the barns becomes available due to the passing of herd members. As a result, the cows develop longstanding relationships with each other.[5] For example, Bert Hollander, the caretaker of the sanctuary, told me that Wakamoe (Dexter, an Irish breed of small cows), born 11 July 1999 and standing on the right in the large group barn, was brought in together with her mother Vita. Mother and daughter were always together and Vita was still feeding Wakamoe when Wakamoe was fifteen years old. Since Vita passed away, Wakamoe did not tolerate any other individual at her mother's place on her right

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side, so she succeeded in keeping the place in the barn next to her empty (Dumon Tak 2017:38–39). In this sanctuary assemblage, whole-body activities related to stress and/or feeding as in the industrial dairy ones (see above) were not detected during my fieldwork visits. Instead, I noticed how the cows in the sand barn often acknowledged the caretaker Bert Hollander with a low-pitched sound when he came by. Further, no cow is interested in me—a human fieldworker—as in the intensive dairy barn. They neither approach to touch or lick me nor establish gaze during my fieldwork.

In fact, the whole-body activities of the cows expressing sociality in the sanctuary like Wakamoe showed that the cows used different semiotic resources than can be detected in transient intensive farms. In these farms, the cows have to produce milk and calves and consequently need to spend most of their time eating. In the sanctuary, where there is no need to produce calves, milk, or meat, the cows (most of them are not (productive) Holstein Friesians) can determine how to spend their days (together). I witnessed how the cows spend lots of time licking each other, especially the head and neck regions, to reinforce either family or affiliative bonds between each other (Phillips 2002:95). Also, their movements may be different. There was a Belgian Blue beef ox, called Yoshua, who entered the sanctuary in May 2011 and passed away in December 2021.[6] Because he was

FIGURE 3. Dancing Yoshua in the sand (photo taken by caretaker Bert Hollander).

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overweight, he lived in the sand barn. Every time fresh sand was poured into the sand barn, Yoshua started to jump up and down, within the limits of what his body was able to do (see Figure 3). This is what made Yoshua famous as 'the dancing ox' (Dumon Tak 2017:10–13).

At the start of the video-recording, Yoshua can be heard to utter a very brief fricative-like /x/ sound, probably while blowing some sand from his nose when he was dancing.[7] The focus on sand as a networked element made it possible to recognize how one affordance of sand, that is, as material that enables overweight meat cows to move and position their bodies, 'delineates A POSSIBLE BUT AVAILABLE course of action', that is, 'dancing' (Caronia & Mortari 2015:415). Sand also made it possible for Yoshua to sit down (see n. 6), which could never have happened in an intensive dairy farm, given the slatted floors covered in urine and faeces. The freshly poured sand was perceived and used as an affordance (Gibson 1997/2014) revealing the relatedness of a cognitive activity: Yoshua knows that sand is matter for dancing and sitting on despite his heavy weight, resulting in the actual event of sitting and dancing. Neither the sand, nor the dancing, nor the sitting, nor the sound /x/, nor the ability of Yoshua to perceive and 'know the properties of sand' and his motivation to sit and jump up and down, 'is specifiable in the absence of specifying the other' (Greeno 1994:338). The dancing Yoshua is clearly an example of a surprising activity (Lestel et al. 2014:126–27).

Case study 4: Small herd wandering outside assemblage: Cato calls to her 'adopted' calf Piet

TABLE 5. *Fieldwork with the small herd (taken from Table 1 above).*

	Location	Breed	N	Barn type	Milking	Field work (d/m,y)
4	Small herd	Various: adult female cows, (fe)male calves	7	pasture	none	08/05, 28/05, 18/06, 4/09, 16/10, 27/11, **2021**, 30/01, 13/03, 20/04, 07/05, 03/06, 27/08, 10/09, 02/10, 20/11, **2022**

In the spring of 2019, I was looking for a shelter and a meadow for a calf called Piet, which I had adopted during my fieldwork in the intensive dairy farm, since otherwise Piet would be killed at the age of three weeks. Eventually, the calf was welcomed to stay with a small herd in the south of the Netherlands. The herd consists of three adult females, two of whom—Janneke and Noortje—had just delivered a calf, while the third one—Cato—had none. The small herd remains outside day and night, summer and winter, but they can take shelter in a small

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shed with a roof and closed sidewalls (see Table 5). Probably because Cato was without calf, she was the first to contact Piet on his arrival by touching nose to nose. She eventually turned out to be the one to care for Piet, to tolerate him very near to her and in due course to lick him frequently and attend to him. Since Piet could not drink milk from his mother as the other two calves did, a bucket of milk and concentrates were provided for him by his caretakers and by me when I visited him. The caretakers always prepared the milk in an outbuilding next to their living quarters, where the presence of the herd was made impossible by an iron fence. Piet, however, was allowed to pass the fence and walk down the human corridor so that he could be fed and eat without competition from the other herd members. At about eight months old, Piet entered the human space out of curiosity as usual; Cato, who was standing close by in the meadow on the other side of the fence, called him. In doing so, she looked at him (his back was turned towards her), stretched and moved her head upward to produce a call with her mouth open for 1.5 seconds, with an intensity rising from 30 to 90 decibels (see Figure 4). The pitch of the sound started in the low 100 Hz at 400 ms but then rose to (well) above 500 Hz (more than two octaves) in a very short time, about 300 ms. The level last part had a pitch of 560 Hz. This time, maybe also because of the barking dog gated in the garden belonging to the household of the caretakers, Piet reacted very quickly. He walked back to Cato and the herd behind the fence six seconds after Cato uttered her call, whereas in other field work situations it would take Piet much longer to respond to Cato's call.

Cato's call is a clear example of intraspecies interaction during a troublesome interruption in the daily practices of this small herd. It manifests the sociality between an adult cow caring for a newly arrived calf ageing into adulthood. This kind of interaction is not found in the intensive dairy barns since cows are separated in age-cohorts during their short lifespan; hence, this calling sound between an adult and 'older calf' is not part of the semiotic repertoire.

A focus on the sociality of cows shows that some observable whole-body activities are clearly affective, that is, mother-calf interaction that includes licking while producing short sounds, the fricative uttered by Yoshua while moving his body up and down enabled by the sand, the greeting of the caretaker of the sanctuary positioning the head towards him and producing a sound (see also Cornips 2022), the gaze by the mother cow while walking towards me immediately after her calf was carried away, Cato calling her 'adopted' older calf Piet to come back from the human area while stretching her head and neck, and orienting to him, and Wakamoe in the barn keeping the position to the right of her—her mother's place—empty. The whole-body activities shown at the moment of shortage of food and lack of compost bedding involve stress and urgency, revealing high rising frequency sounds uttered with open mouth while standing and pushing agitated at the feed fence as networked elements most often heard in the intensive dairy assemblage.

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FIGURE 4. Cato, behind the fence, is urging Piet in the human space to come back (photo taken by author during fieldwork).

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DISCUSSION AND CONCLUSION

This article has moved from the familiar—the human—to the very different in sociolinguistics—the dairy cow. Ongoing ethnographic fieldwork since mid-2018 strongly indicates the significance of the cow as a subject relating to other cows and humans (including the fieldworker). The focus of the fieldwork is on how various practices of dairy cows reveal which resources they have at their disposal in interspecies and intraspecies interaction like sounds, gaze, movements, facial expressions (kinesics), space (proxemics), and sensorial practices of meaning-making via vocalizing, tasting, touching, seeing, listening, hearing, and smelling. The notion of the semiotic repertoire enables a perspective on the conditions of embodied potentialities and capacities of resources enabled by material artefacts, architecture of the barn, cows and humans moving about, and so on. The notion of assemblage is added to allow an account of how heterogenous semiotic resources as sand, separation, sounds, compost bedding, neo-liberal market, affect, allogrooming, sniffing, bars and fences, licking and so on work together to produce an emergent effect through their relationship. In smelly intensive dairy-farm assemblages, a mother-calf whole-body activity emerged only accidentally, due to seventeen minutes of negligence of the newborn calf by the farmer(s); whole-body activities in routinized feeding practices of heifers and dry cows reveal stress, agitated activities, pushing to feed fences, and a specific sound (high rising with open mouth) in the case of regular food shortage and an extreme dependency on the care practices by the farmer. Many of these cows also like to touch, lick, and sniff me when sweeping the grass silage in reach of their mouths. These whole-body activities are not seen in the cow sanctuary and the small herd assemblages. In the cow sanctuary assemblage, cows do not have to produce anything; instead, they have 'leisure' time to display long-term affiliative relationships reinforced by routinized grooming practices, while the presence of freshly poured sand as a networked element enables an overweight cow to dance. The small herd assemblage manages to produce sociality between different generations that wander outside day and night, thereby showing themselves to be a herd in which an adult cow calls her 'adopted' older calf to come back to her. In this way, various semiotic resources come together in various assemblages as an emergent effect in time and place.

In sum, the notions of the semiotic repertoire and assemblage enable the researcher to include non-human animals in sociolinguistics; these make the researcher attentive to potential worlds that come into being or not and would otherwise be unobserved. For the observation of these potential worlds, the focus also includes what material artefacts do, and acknowledges their influence on the routines of dairy cows' practices and their capacities for sociality in human-dominated organizations. Hence, semiosis cannot be dissociated from it.

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NOTES

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[1]The age of a high-productive dairy cow in Dutch intensive farms is five to seven years before she is slaughtered; the natural lifespan of a cow is around twenty years.

[2]The method of observing cows has been declared exempt from ethics approval by the 'Animal Experimental Ethics Committee' *Dierexperimentele Ethische Commissie* (DEC) of the Veterinary Medicine Faculty, Utrecht University, and received approval by the Ethics Review Committee of the Royal Netherlands Academy (KNAW).

[3]Milking a cow about to deliver a calf is stopped temporarily, roughly two months before her delivery; she is then called a 'dry' cow.

[4]Jahns (2012; see also Jahns, Kowalczyk, & Walter 1997) developed a dairy cow call-recognizer, a device that automatically transcribes dairy cow sounds (in order) to identify her state and condition in what is called animal health, welfare, and farm efficiency. An experimental elicitation methodology was used that put the individual cow deliberately in a state of hunger, clawing, milking, and so on. This research was conducted before ethical guidelines were (rightly) accentuated. Only the (concerted) sound made by the Holstein Friesians during fieldwork in this barn could be compared with Jahns call-recognizer. Their corpus entitled 'Interspecies Communication: hoe spreekt de melkkoe 1996–2001 (2019)' is archived (#1125) at the Meertens Instituut (KNAW).

[5]Bert Hollander frequently posts video-recordings revealing long-standing sociality between the herd members; see https://www.facebook.com/rundveeopvang; accessed November 28, 2022.

[6]See https://koeienrusthuis.nl/13-1-2022-yoshua-danst-nu-op-de-eeuwige-weilanden; accessed November 22, 2022.

[7]See https://www.youtube.com/watch?v=LnbcZWHPfTo&list=PLitY0pT32OomLpZj6qKyDnv0kX1aMZRQl&index=14; accessed November 22, 2022.

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