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Referential gestures accompanying verbal classifications in classroom interaction

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In diesem Beitrag fokussieren wir referenzielle Gesten, die die Ko-Konstruktion klassifizierender Aussagen (z.B. 'Katzen sind Säugetiere') in fachlichen Unterrichtsgesprächen unterstützen. Klassifizierende Aussagen sind im Unterricht höchst frequent und relevant für die Begriffsbildung und das Ausdrücken gedanklicher Konzepte und Ordnungsprinzipien.
Der Beitrag nutzt die angewandte Gesprächsanalyse (Antaki, 2011). Die Datenbasis bilden zwei Videokorpora: 675 Min. fachsensibler Zweitsprachunterricht und 467 Min. naturwissenschaftlicher Unterricht. Daraus wurden Beispiele ausgewählt, in denen a) klassifizierende Aussagen von Lehrkräften und Lernenden ko-konstruiert wurden und b) die Lehrkräfte dabei auf nonverbale Ressourcen zugriffen. Anhand der Analysen lässt sich zeigen:

- Die räumliche Ausdehnung und Orientierung (z.B. oben vs. unten) lehrerseitiger Gesten korrespondieren fein abgestimmt mit den jeweiligen Referenten und deren semantischen Relationen (z.B. übergeordnet vs. untergeordnet).
- Sprachlich ausgedrückte semantische Relationen oder Unterscheidungsmerkmale für eine Klassifizierung werden durch Gesten angereichert oder ersetzt.
- Gesten können dazu verwendet werden, um den inhaltlichen Fokus zu verschieben und zwischen den taxonomischen Ebenen klassifizierender Aussagen zu navigieren.

Multimodale Ressourcen können daher einen Beitrag zur Begriffsbildung leisten, indem sie rein verbale Erläuterungen von Klassifikationen mit räumlichen Erfahrungen und Objektbezügen in Beziehung setzen.

Stichwörter:
Gesprächsanalyse, Unterrichtsinteraktion, Multimodalität, Sprachliches Lernen.

Keywords:
conversation analysis, classroom interaction, multimodality, language learning.

1. Introduction

As Zima (2014) shows from a construction grammar (CxG) perspective, gestures can be components of pairs of form and function. We will show that gestures are also used to express semantic relations between the individual elements of grammatical patterns used in classifying statements (see section

1.1). Besides the grammatical functions of multimodal expressions in classroom interaction, multimodality serves many other functions in pedagogical contexts. This paper addresses a specific set of patterns that is used to express semantic classifications. The aim of our analyses is to explore how teachers use referential gestures to collaboratively produce such classifying statements with students, in science and German L2 classrooms. We regard this interactional collaboration as a form of *co-construction of knowledge and learning* (cf. Mercer 1995; Sert 2015) in classroom talk.

The paper is structured as follows: We first give a brief overview over grammatical and semantic implications of classifying statements and on the state of relevant research on multimodality in classroom interaction. After a brief presentation of the data basis and methods, the next section illustrates our results using three examples. The paper closes with a discussion of the results.

1.1 Grammatical and semantic perspectives on classifying statements

In this paper we examine how classifications are co-constructed using grammatical patterns to express semantic relations such as hyperonymy and meronymy. This section will be devoted to a overview over grammatical and semantic properties of classifications.

By classifications we mean statements that assign the individual elements of a species or entire subcategories to a superordinate category. In doing so, speakers often refer to distinguishing features that substantiate such an allocation. In this way, complex, hierarchically graded structures of meaning are expressed, which contributes significantly to the formation of concepts and the construction of knowledge. We assume that this is done by means of a set of linguistic patterns that are applied equally in all subject areas. In pedagogical contexts, work can be done on content and meaning as well as on linguistic form of these statements (Seedhouse 2004).

Lemke (1990: 87) points out that students frequently encounter thematic patterns in textbooks, tests, and classroom-talk. Understanding and applying these patterns is necessary to mentally process subject-specific content and to express this content appropriately. We regard classifying statements as "shared pattern[s] of semantic relations" (ibid.).

Statements like *zebras are mammals*, *a zebra is a mammal,* or *the zebra is a mammal* show that nominal phrases (NPs) with bare plurals, indefinite singulars as well as definite singulars can be involved in generics and classifying statements (cf. Farkas & Swart 2005; Hoffmann 2021: 140). On the other hand, all these forms, apart from bare plurals, can occur in non-generic statements as well, i.e., in those with particular referents. So, generics in classifying statements are a rather open phenomenon in terms of linguistic form of the involved NPs. Clearly, features other than the linguistic form of NPs also contribute to a generic

reading and classifications, e.g. predications (cf. Carlson 1977; Leslie & Lerner 2022) and context.

In our examples, statements along the lines of [X is a Y], [X belongs to Y] or [X belongs to Y because Z][1] are used to

- express classifications,
- create ordering concepts,
- express hierarchical structures of order,
- designate distinctive features as criteria for classifications.

The fully developed variant of the pattern [X is a Y because Z] (e.g. 'A dog is a vertebrate because it has a vertebral column') shows similarities with a classical Aristotelian definition (cf. Deppermann & De Stefani 2019: 141–142). In this pattern, X takes the place of the *definiendum*, while Y (*genus proximum*) and Z (*differentia specifica*) together form the *definiens*. The parallels seem obvious, for classifying statements are made in definitions, which are themselves the linguistic result of concept formation. It is therefore not surprising that the phenomenon of classifying statements is an essential part of classroom discussions in all subjects.

1.2 Perspectives on aspects of multimodality in classroom interaction

In recent years, a number of studies have focussed on multimodality and its role in classroom interaction. Previous qualitative research on multimodal classroom interaction has focussed, for example, on pragmatic functions of multimodal practices (cf. Kääntä 2010), definitional work in language teaching (cf. Lazaraton 2004; Belhiah 2013), in content- and language-integrated learning (Kääntä 2021; Kupetz 2021) or in mathematics (cf. Heller 2016). In addition, Roth (2000) produced insights in the multimodality of science classes. From the broad spectrum of phenomena that multimodality encompasses, we focus on referential gestures in our analyses, as they represent a frequent and supra-individual phenomenon in our data.

Kendon (2004: 7) defines gestures broadly as "a name for visible action when it is used as an utterance or as part of an utterance." Following this definition, we focus on referential gestures which accompany the communicative task of classifying.

There have already been various attempts to categorize gestures. As Kendon (2004:159-161) claims, gestures with referential function can be realised in two ways: by "*pointing* to a physical referent or a virtual or abstract object" or by *representing* a referent of the utterance (Kendon, 2004:160). Kendon describes three formats for representational gestures:

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1 In these patterns, X stands for any individual of a species or an entire subcategory, Y stands for a superordinate category and Z denotes the distinctive features for this assignment.

- modellings in which a part of the body (e.g. a hand) functions "as a model for some object",
- enactments in which "the gesturing body parts engage in a pattern of action that has features in common with some actual pattern of action that is being referred to" and
- depictions in which the "gesturing body parts [...] engage in a pattern of movement that is recognized as 'creating' an object in the air" (ibid.).

Streeck (2008: 292–295) even differentiates between 12 individual practices of depiction. The following categories identified by Streeck are of particular interest for this study:

- "Modelling: a body part is used as a token for an object" (Streeck 2008: 292).
- "Bounding: practices involving relative positioning of fingers (index and thumb) or hands, such that the distance between them is the figurative component." (ibid.).
- "Drawing: the drawing of lines, for example by an extended index-finger." (id.: 293).
- "Marking: the elaboration of virtual surfaces or volumes by dots (points), lines, incisions, drawn figures, shaped volumes, and acts." (Streeck 2008: 294).
- "Self-marking: performed on the surface of the gesturer's body, self-markings elaborate or annotate this body by tracings, dots, and actions and postures of various degrees of complexity and specificity." (ibid.).
- "Pantomime: bodily acts made to imitate and depict the bodily acts of living beings." (id.: 295).

Besides Kendon's description and Streeck's detailed differentiation, McNeill's (a. o. 1998) categorisation garnered special attention in previous studies. McNeill (1998: 17-18) distinguishes four types of nonconventional gestures:

- Iconic gestures, which "depict concrete events or entities".
- Metaphoric gestures, which – as iconic gestures – "create pictures" but in this case of "abstract ideas, such as concepts and relations".
- Pointing as "concrete pointing" on a physical referent and "abstract pointing in the absence of any visible target".
- And furthermore beats that "clarify the role of referring forms in speech and track the occasions where things are important beyond their own immediate context of presentation".

Such attempts at differentiation do not represent sharply defined categories and often lead to overlaps between different category systems. However, they can be used to capture, describe, and classify functions that can be realised to varying degrees by referential gestures. We will use Kendon's (2004) three

formats for representational gestures as an overarching framework, although we will draw in part on the more nuanced work of Streeck in our analyses[2].

Studies that address multimodal practices of definitional work in language learning came to significantly similar findings on the relation of referential gestures and linguistic expression: They enrich, reinforce, or specify, linguistic expressions (Belhiah 2013; Smotrova & Lantolf 2013; Majlesi 2015). Thus, referential gestures serve as a means of establishing intersubjectivity (Majlesi 2015) or cohesion and are reciprocally revisited in interactions, sometimes over long periods of time (Eskildsen & Wagner 2013).

Science classes are far less extensively researched from a multimodal perspective compared to language learning settings. The findings so far on the role of referential gestures show some similarities with language teaching: As in language learning scenarios, referential gestures in science classes are used to enrich, reinforce, or specify verbal expressions, and they are reciprocally revisited in interactions (Pozzer-Ardenghi & Roth 2008). This revisiting occurs both in the course of elaborations to gain new insights and in the course of repetitions of already established concepts (id.: 390). A main difference to language classrooms is caused by the learning environment: In science classrooms the learning environment often contains further visual resources in the form of pictures, diagrams, graphs, etc., which can be made relevant in interaction. This is why gestures can provide a double referential function, on the one hand by highlighting what is being referred to, and on the other hand by enriching the content (Roth 2000).

Even though there has been intensive research into the definitional work in particular, there have been no studies to date on the question of how the related classifying statements, which are highly relevant in classroom discussions, are co-constructed multimodally by means of referential gestures. The following analyses will shed light on this.

2. Data and methods

Basis for analyses are two data sets of the co-authors:

- The first is 467 minutes of videotaped science lessons with teachers and teacher trainees in German secondary schools. Each lesson was filmed with two, respectively three, cameras. The collection is extracted from teacher-fronted classroom talk in 9 classes. The students are between 10 and 16 years old. 6 teachers of the data set are teaching trainees at the end of a six-month internship and five teachers are experienced teachers with at least 5 years of experience. The examples chosen for this paper are from two experienced teachers.

2 Although McNeill's classification is also widely used, in our opinion it does not fit our research interest as well as the other classifications discussed.

- The second is 675 minutes of videotaped German L2 lessons. Each lesson was filmed in two perspectives. The collection is extracted from teacher-fronted classroom talk in three classes of content-based language teaching. The students are between 11 and 14 years old, have been for a maximum of one year in Germany and have different first languages. The two teachers are experienced teachers in L2 teaching.

We decided to use both datasets because of the omnipresence of classifying statements in any educational setting and wanted to get a more nuanced insight into their use and functions in classroom interactions across disciplines.

The analyses follow an approach of institutional applied conversation analysis (Antaki 2011: 6-8). Conversation analysis makes accessible "micro-understandings of human interaction" (Waring & Creider 2021: 6). If learning is understood as a social and co-constructive process, then conversation analysis, with its perspective on interactions that unfold from moment to moment, is a particularly appropriate tool to analyse it. All data are transcribed according to Jefferson (2004), the multimodal annotations follow the conventions of Mondada (2013)[3]. Multimodal annotations have to be selective. For this study we focussed and annotated especially referential gestures. All screenshots are anonymised and all names in transcripts are pseudonyms.

3. Results

In our data, a few elements were easily recognisable: Teachers attempt to elicit specific elements of the respective grammatical pattern when co-constructing classifying statements depending on the pedagogical focus. The teachers use their interactional resources to get their students to complete the focussed component of the classifying statement. In the following, we call this part to be completed the *elicitation goal*.

Table 1 provides an overview of the grammatical patterns and the respective elicitation goals in the examples discussed:

Example	Elicitation goal	Pattern
(1) (2)	Hyperonym (Y)	[The X belongs to the Y] [The three X are Y, if Z]
(3)	Distinctive features (Z) of a class	[X is called Y, because Z]

Table 1: Overview Examples

The examples were chosen because they illustrate three different and frequently used patterns as well as two different elicitation goals in the multimodal co-

3 Readers can find the description of the multimodal transcription conventions used for this study in the appendix.

construction of classifying statements that are relevant for concept formation and language learning, respectively.

3.1 Elicitation of a hyperonym

(1) Invertebrates

The first example is taken from a science class (5. Grade) about the western honey bee. Ms Torle, the teacher, activates her students' prior knowledge. She wants to elicit a classification of the bee as an insect because the class will later talk about the anatomy of bees, which is prototypical for insects. The first example will show how the teacher uses referential gestures to navigate a complex network of scientific concepts:

- Spatial orientation and extension of referential gestures correspond delicately to the respective referents and their hyperonymous relation.
- The gestural expression is used to shift the thematic focus and to navigate between taxonomic levels of classifications.

The sequence starts with Ms Torle's elicitaton of Y according to the pattern [The X belongs to the Y]:

(1) Invertebrates

```
FT: Ms Torle; DI: Dilan; BA: Batuhan; AU: Aurelia

001   FT: zu welcher großen *gruppe# gehört denn die biene.*
          To which large group does the bee belong.
      ft  ................*shows a large circle with both hands,
                           starting in front of the face, both hands
                           meet again at hip level* holds hands open
                           upwards->
                                 #fig. 1
002        (1.9)*
      ft   ---->*
003        in welche große gruppe könnt ich die biene EINteiln.
           Into which large group can I allocate the bee.
004        dilan.=
005   DI:  =äh:m,(.) wirbellose?
           Uh:m, invertebrates?
006   FT:  ((unvocalized))°<ah:::↓ sehr gut.>°=
           Ah::: very good.
008        =jetzt hast schon *die GANZ **ob#erste** gruppe↑# (.)
           angesprochen?*
           =now you have already addressed the very uppermost group?
      ft                   *stretches both arms above her head with
                            palms open to the front,
                            moves them up and down multiple times*
      ft                              **looks up at her hands**
                                        #fig. 2A        #fig.2B
009   FT:  *die wir**b#ellos**en.*
           The invertebrates.
      ft   *moves hands to 10 and 2 o'clock, palms pointing slightly
            outwards, lets hands then fall to the side*
                  **Head moves slightly downwards**
                      #fig. 2C
```

While Ms Torle formulates her question in line 2, she uses her hands to depict (Kendon 2004: 160) a circle which represents the elicitation goal as 'a large group' [Y] to which the bee belongs (fig. 1):

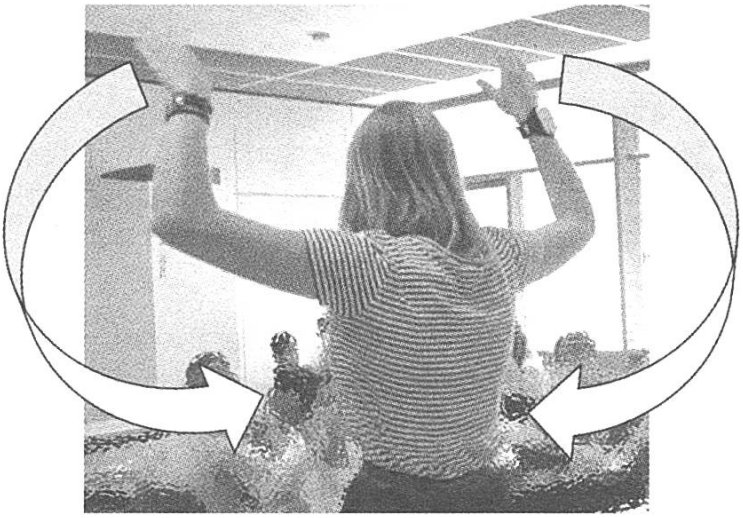

Fig. 1 : Depiction of a large circle (Example 1, line 1)

Afterwards she holds her hands in a post stroke hold for almost two seconds. After a reformulation of her question in line 4 she hands over the turn to Dilan. Dilan responds correctly with 'invertebrates'. Ms Torle confirms the answer in line 7 without marking any need for correction but marks the student's answer with 'already' as outside the thematic focus. Furthermore, she visualizes Dilan's classification as 'above' the focussed taxonomic level: Ms Torle raises her arms several times above her head to twelve o'clock, much higher than the circle in line 2. Her gaze follows her hands while she is classifying the invertebrates as the 'uppermost' ('oberste') group, pantomiming (Streeck 2008: 295) as if she were looking at this category above her head and outside her field of vision. Then her gaze shifts back to the class (line 8, fig. 2B). While she is naming the supercategory 'invertebrates' (line 9, fig. 2C) she draws (Streeck 2008: 293) 'a banner' above her head by moving her hands to ten and two o'clock:

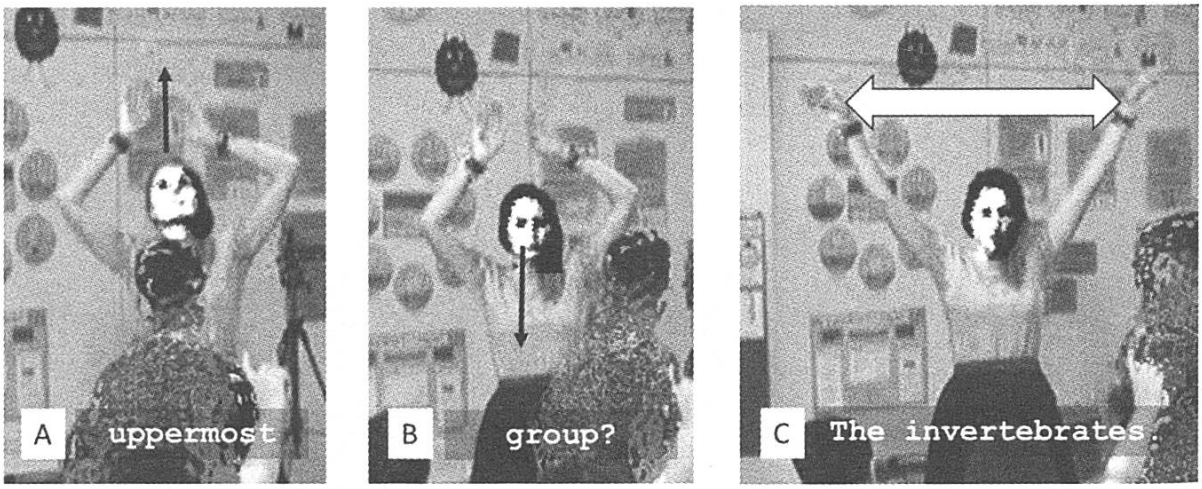

Fig. 2: Stretched Arms, Drawing of a 'Banner': 'The invertebrates' (Example 1, line 8-9)

Ms Torle seems to aim for the subordinate classification[4] 'insects' which is thematically relevant for the following topic of anatomy of bees. By the gestural expression she doesn't mark any need for correction but makes visible that the student's answer is 'above' the focussed level. In other words, she uses gestural resources to shift the thematic focus and guide the classroom talk through a complex network of concepts by establishing a hierarchically organized semantic net.

(2) City States

The second example is taken from a lesson in a class for German as a second language. The class is repeating technical terms concerning the federal structure of Germany.

The second example will show:

- Spatial expansion and scale of the referential gestures correspond to the respective referents and illustrate the distinctive feature [Z] for classification.
- Referential gestures are used to modify an elicitation and provide clues as additional support to find the technical term for a subcategory [X].

The sequence begins after a student has contributed that Germany has 16 federal states which Ms Oderle confirms as correct (line 1-2):

(2) City states

```
FO: Ms Oderle; IV: Ivanka

001   FO:   sechzehn (.) genau.
            Sixteen (.) exactly.
002         mhm.
003         und *drei davon ↑sind* (.) **ivanka (.) was?**
            And three of them are (.) Ivanka (.) what?
      fo        *raises three fingers, palm towards class*
      fo                                **points at IV-->**
004   IV:   (            )
005   FO:   wie nennt man das wenn es nicht ein *ganzes #land ist*
            What do you call it when it's not a whole state
      fo                                        *shows a large circle with
                                                 both hands, starting above
                                                 head level, both hands meet
                                                 again at hip level*
                                                        #fig. 3A
006         sondern *nur eine #stadt* wie berlin bremen und hamburg?
            but just a city like Berlin, Bremen and Hamburg?
      fo            *shows a small circle with both hands, starting on face
                     level, both hands meet again at chest level*
                              #fig. 3B
007   IV:   stadtstaaten,
            City states.
```

4 Invertebrates sum up different classes of animals without a vertebra like insects, arachnids, molluscs etc.

After the confirmation in lines 1-2, Ms Oderle formulates a *designedly incomplete utterance* (DIU) (cf. Koshik 2002) addressed to Ivanka in order to elicit the technical term 'Stadtstaaten' (city states) from her (line 3). As a cue Ms Oderle names the number of city states in Germany and raises three fingers. She reformulates her question in lines 5-6 which indicates that Ivanka's reply (line 4) is not appropriate. Ms Oderle now describes the distinctive features for city states in contrast to the other federal states: to illustrate the spatial expansion of 'a whole state', 'state' is marked prosodically and is supported by a depiction (Kendon 2004) similar to the one given by Ms Torle in example (1) (fig.3A).

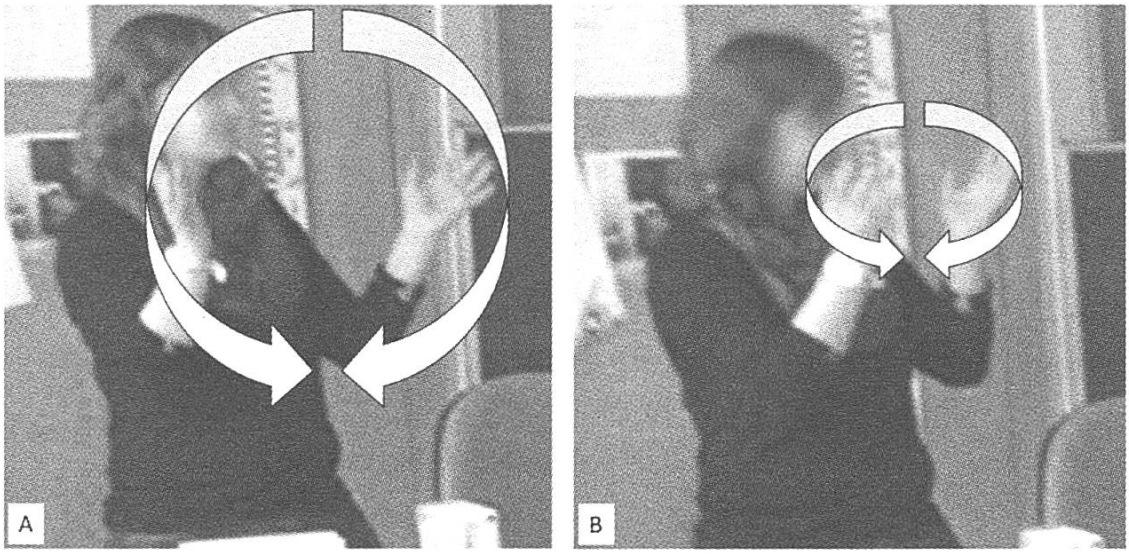

Fig. 3: Scale of circle gestures (Example 2, line 5-6)

She then contrasts this first expression with 'only one city' by depicting a much smaller circle in the same way as before (fig. 3B). Thus, Ms Oderle's modified second elicitation is more elaborate and the contingently and individually tailored support enables Ivanka to give a correct answer in line 7.

Ms Oderle uses the same circular gesture to represent the terms 'federal states' or 'city states'. In doing so, she points out that both have the status of federal states and are in a meronymic relation to Germany. However, the different scale of the referential gesture in conjunction with the verbal expressions makes the distinguishing feature of spatial extent comprehensible for classification as either a federal state or the subcategory city state.

3.2 Elicitation of distinctive features of a class

The third example is taken from a science class (5. Grade) about the biological class of reptiles. Ms Giesser, the teacher, activates students' prior knowledge. After she has collected the already known classes of vertebrates in classroom talk, she wants to elicit the features that distinct vertebrates from invertebrates.

The third example will show, how Ms Giesser uses referential gestures to specify and enrich verbal information:

- A meronymic relation that is not expressed verbally is modelled by referential gestures.
- The elicitated distinctive feature for a classification 'vertebral column' is enriched by a self-marking (Streeck 2008: 29) in form of a self-referential pointing gesture.

The example shows the elicitation of Z in a classifying statement according to the pattern [X belongs to Y, because Z]:

(3) Vertebrates

```
FG: Ms Giesser; ME: Mella

001 FG: warum heißen diese *fünf gruppen.
        Why are these five groups named.
    fg                      *lifts open left Hand, palm directed to class->
002     *die amph#ibien,* die fische,* die vö#gel,* die reptilien,*
        The amphibians, the fish, the birds, the reptiles,
    fg *touches left thumb w. right index finger (IF)*
                        *touches left IF with right IF*
                                  *touches left middle finger with right
                                   IF*
                                              *touches left ring finger
                                               with right IF*
                 #fig. 4A                    #fig. 4B
003       *und die# säugetiere,=*
          and the mammals,=
    fg    *touches left little finger with right IF*
                  #fig. 4C
004       =wieso *heißen die WIRbeltiere.
          =Why are they named vertebrates.
    fg           *turns left Hand palm up->
005       (0.3)
    fg    ---->
006       wieso sind des die fünf WIRbeltier#gruppen.
          Why are these the five vertebrate groups;
    fg    ------------------------------------------->
                                             #fig. 5
007       was haben *diese fünf# gruppen geMEINsam.*
          What do these five groups have in common.
    fg    ---------->*lifts open hand, palm directed to class, moves hand
                      slightly forwards and backwards*
                                #fig. 6
008       (1.0)
009       äh: *mella.*
          Uh: Mella.
    fg        *points to ME*
010 ME:   die ham alle eine wirbelsäule?
          They all have a vertebral column?
011 FG:   a*#ha?
    fg     *nods, walks in front of the blackboard, strokes down her
             vertebral column with her left hand->
            #fig. 7
```

Ms Giesser starts her elicitation in form of a why-question with a repetition of the classes of vertebrates she has just collected with the students. She supports her repetition by temporally coordinated counting gestures: While she is naming the classes of vertebrates her open left hand is lifted. As she names the classes of vertebrates she counts them by touching with her right index finger the fingers of the left hand one after another (line 2-3):

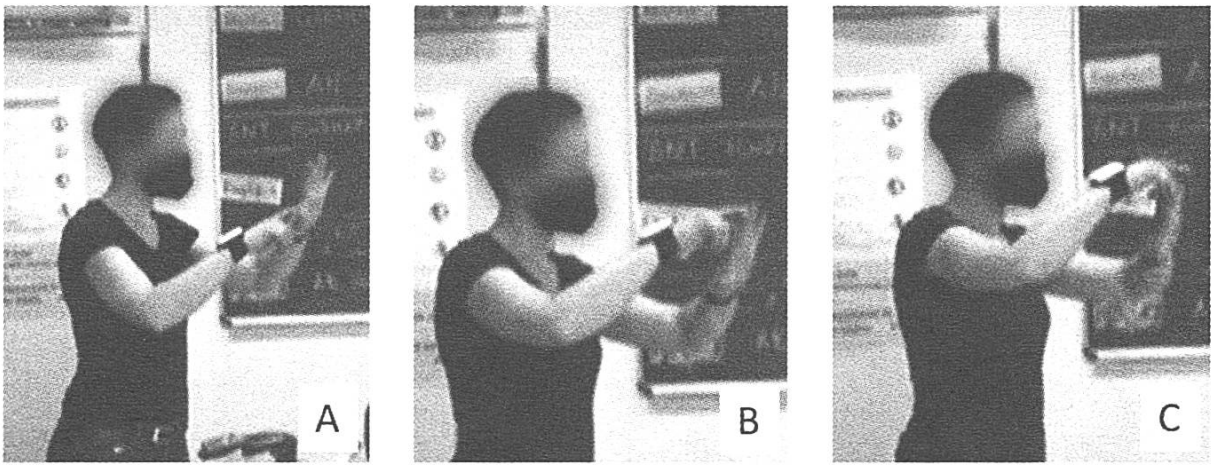

Fig. 4: Counting (Example 3, line 2-3)

Thus the extended fingers of Ms Giesser's open left hand represent the five named classes of vertebrates and her hand as a whole embodies the superordinate totality of vertebrates. In this way, she illustrates the meronymic relation of the five classes of vertebrates, which is not expressed verbally here.

In line 4 she begins to repeat and modify her question three times. First, Ms Giesser adds the technical term "WIRbeltiere" (vertebrates), which she highlights prosodically and which already gives a cue to one distinctive feature sought for. Meanwhile she turns her still open left hand palm up to signal "readiness to receive" (Kendon 2004: 264) the answers.

Fig. 5: Left hand palm up (Example 3, line 4-7)

Ms Giesser holds this gesture until her third reformulation of the question (line 7) which again contains a prosodically prominent cue: The elicitation aims for a feature that all these classes have in common ('gemEINsam'). During line 7 she lifts her open left hand again as in line 2-3 but now moving her hand:

Fig. 6: Moving open hand (Example 3, line 7)

The movement starts exactly while she is verbally referring with a deictic expression ('these five groups') to the five named classes of vertebrates. By that she again visualizes the meronymic relation between the five classes and the concept 'vertebrates'. While her left hand was static when counting in line 2-3 she now enlarges the referential gesture by moving her hand, which makes her gesture more prominent. After the turn-allocation-component (Mazeland 1983: 97) in line 9 Mella answers correctly with a first distinctive feature: 'they all have a vertebral column'. Although it is the answer to a supposedly known information question for Ms Giesser, she responds in line 11 with the change-of-state token (Heritage 1984) 'aha', thus marking the relevance of the answer. Additionally, Ms Giesser turns to show her profile and strokes down along her spine:

Fig. 7: Strokes down vertebral column (Example 3, line 11)

Ms Giesser's stroking along her spine enriches the corresponding verbal information (fig. 7): All vertebrates – including humans – have a vertebral column as a distinctive feature. In doing so, she emphasises and amplifies the correct named-distinctive feature [Z] for the rest of the class.

4. Discussion and conclusion

This study set out to gain a better understanding of the multimodal co-construction of classifying statements in subject related classroom discussions. We did this in order to shed light on the communicative and pedagogical functions of referential gestures in interplay with verbal classifying statements in classroom interaction. The analyses reveal in detail how teachers use verbal and embodied resources, especially referential gestures, to co-construct grammatical patterns with students to express classifying statements and thus work on concept formation.

The analyses show that referential gestures can enrich, specify, or even replace the verbal components of classifying statements. This matches previous findings (cf. Pozzer-Ardenghi & Roth 2008; Belhiah 2013). Previous research has also analysed gestures and other phenomena of multimodality in terms of their characteristics, pragmatic functions and in the context of specific school subjects (see section 1.2). Our research has broadened these perspectives by looking at multimodally realised classifications that are used across subjects. We can also provide a more detailed insight into the local pedagogical functions of this communicative procedures: The focussed patterns for classifying statements are used to encode complex linguistic and content-related knowledge and semantic relations in the fields of biology and geography.

Regardless of the learning object, all examples show the contribution of referential gestures to the co-construction of classifying statements:

- Spatial orientation and extension of referential gestures precisely correspond to the respective referents and their hyperonymous or meronymous relation [X / Y], respectively their distinctive features [Z]
- Verbal expressions for semantic relations or distinctive features for a classification are enriched or substituted by referential gestures.
- The gestural expression is used to shift the thematic focus and to navigate between taxonomic levels of classifications.

Each of the shown examples is embedded in more extended sequences of negotiation that cannot be presented in full here. However, the chosen grammatical patterns appear in our data as frequently used building blocks and are often combined in interaction during more complex processes of concept formation: For example, as mentioned in example 3, Ms Giesser first elicited the names of the vertebrate classes [X] before eliciting the distinguishing feature [Z]. The different elicitations follow the patterns shown in table 1 and can be

combined as needed. In this way, the teacher can navigate the class through complex taxonomic orders and break down complex concepts into manageable parts. In examples (2) and (3), the students correctly complete the missing parts of the corresponding pattern, which suggests that they understood the statement as a whole and the concept it represents.

Classifying statements according to the shown patterns can be assumed to be ubiquitous in classroom talk across all subjects. However, such complex hierarchical orders with many levels are typical for the natural sciences, which is reflected in examples (1) and (3).

The grammatical patterns which are used for classifying statements seem to be simple on the linguistic surface, but they encode complex information. The gestural components are therefore crucial to illustrate and make understandable the complex structures of meaning expressed with these simple patterns. The contribution of verbal and embodied resources to classifying statements and thus to concept formation in classroom interaction seems therefore evident. Nevertheless, further research on the effectiveness of such communicative procedures would be desirable, especially with regard to students' understanding of classifications realised in this way.

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Appendix: Multimodal Transcription Conventions

Transcription of multimodal actions (Mondada 2013: 56)

* *	delimit description of teachers' actions
+ +	delimit description of students' actions
-->	action described continues until the same symbol is reached
>>-	action described starts before the excerpt's beginning
...	preparation of action
fig.	screen shot
#	indicates the exact moment at which the screen shot has been recorded