Psychology of Language and Communication 2018, Vol. 22, No. 1

sciendo

DOI: 10.2478/plc-2018-0006

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UTTERANCES AS TOOL-MEDIATED SPECIFICATIONS OF AFFORDANCES - ECOLOGICAL PRAGMATICS

The established descriptions of information structure assume that the basic cognitive unit is a categorization, and that the basic semantic structure is a predication. Descriptions based on these assumptions, however, cannot provide an adequate analysis of certain types of utterances that form a part of activities.

The article presents a solution to this problem based on Wittgenstein's private language argument and the concept of information in Gibson's theory of affordances. The basic cognitive assumption is that performers of activities attend to variations in the environment, for example visibility, and perceive the states of variations (e.g., 3000 feet). A state is defined as a local, temporary occurrence of a stimulus configuration that specifies an affordance. The basic pragmatic assumption, then, is that performers of activities share the states of variations by means of utterances.

This ecological-pragmatic assumption allows for a rethinking of the usefulness of the reference-predicate distinction and bring forward different dimensions of informational analysis of utterances. It is claimed that an informative and accurate analysis of utterances that form a part of activities relies two distinctions: a distinction between a convention based regulation of attention and a convention based specification of an affordance, and a distinction between sharing information and nesting information.

Key words: information structure, Affordances, Activities, topic, focus

1. Introduction: The obsession with static individuals

In this article a new analysis of natural language information structure will be presented. The analysis differs significantly from the established linguistic descriptions of information structure, not only with regard to

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the analysis of the information shared by an utterance, but also with regard to the basic assumptions about cognition and information.

The term *information structure* implies that an utterance is organized into informational units that differ in status with regard to informativeness, and that the differences are formally marked. On a general level, one might distinguish between four different linguistic approaches to information structure: psychological, pragmatic/functional, cognitive and formal. A great majority of the descriptions within all these approaches are based on the assumption that the information conveyed by an utterance is a representation. The terminology and the format of the representation differ, but the idea of information as representation is common. In line with this, information structure has traditionally been illustrated by a number of sentence variants conveying the same representation with regard to truth conditions (see for example Chafe, 1976:27; Gabelentz, 1869:380; Gundel, 2012:585; Halliday & Matthiessen, 2014:81; Mathesius, 1975/1961:85; Talmy 2000:77):

1. The pilot is flying the aircraft
2. The aircraft is flown by the pilot

Information structure, then, is explained as an organization of the representation with regard to saliency. There are different analyses, but the most common assumption is that an information-conveying utterance can be analyzed in a topic-part identifying what is being communicated about, and a comment-part conveying information about the topic. This assumption is supported by, as Lambrecht (1994:132) puts it, "Strawson and two thousand years of largely unchallenged grammatical tradition." In (1) the topic is the pilot; in (2) the topic is the plane. In some approaches topic is the most salient; in others, topic is the least salient.

Different criteria and different terms have been used for the topic-part, for example *point of departure, psychologische Subject, basis, logical subject, thema, old, link, topic* and *fundament*. There seems, however, to be a common criterion: thus, it is generally agreed that topic-parts must be referential, that is, there must be an individuated entity or class/group of entities for the utterance to be about (Gundel, 2012:591; Gundel & Fretheim, 2005:177). Although descriptions that apply a criterion of initiality (Halliday, 1994/1985:39; Halliday & Matthiessen, 2014:88), where the topic-part is the first element of a sentence, seem to be an exception to this generalization, it can be justified as they do not describe a function but a position[1] (Borchmann,

[1] The formal criterion implies that the underlined elements are the topic-part (*theme*) in the following examples: from house to house I wend my way; a loaf of bread is what we chiefly need; no one seemed to notice the writing of the wall; Yes but why do you think he should go; how dreadful she sounds; did you sleep ok; after all, except for music, what did they have in common; on the right is it; turn it down; no don't worry; Maybe we could develop our listening skills; Kate, I must say this fish is cooked beautifully (examples from Halliday & Matthiessen, 2014). The only common feature of the underlined elements is that they are the first elements of the sentence.

2007; Reinhart, 1982; Seidlhofer, 1995). Though not always explicated in the descriptions, the rationale for the criterion of referentiality is epistemological and must be understood from the task that references serve in the basic unit of information in philosophical semantics. This unit is the predication, which, as it is a representation, can be assigned a truth value. A simple predication is a combination of a reference to a particular entity, for example, "the pilot", and a general term, for example, *fly*. The combination entails that the entity referred to *exemplifies* the general term, that is, possesses the property, belongs to the class, or performs the role that the general term specifies (Strawson, 1974). The task of the reference, then, is to give access to the truth value of the representation. In other words, the idea that topics must be referential is closely interwoven with the assumption that predication is the basic unit of information.

The information structure analysis I will present in this article differs from the established analyses in that it is based on the concept of information in ecological psychology. Thus, information is understood as structures in stimuli that specify affordances (Gibson, 1986), that is, possibilities for action (Reed, 1996). The motivation for developing an alternative analysis is that the established descriptions of information structure are proving inadequate when they are applied to language use that forms a part of activities. For example:

3. it's three thousand RVR (Captain to first officer, Southwest 1248 (Gregor, 2006))

The utterance forms a part of the activity of landing an airliner. RVR is an acronym for runway visibility range. With the utterance the speaker communicates that the current visibility on a specific runway is 3000 feet, and, thereby, that it is possible to land on the runway (NTSB, 2007; FAA, 2014A).

Utterances like (3) pose a problem for the established descriptions, primarily because the grammatical subject which is assumed to be the unmarked topic expression in English, is non-referential. This problem has been dealt with in terms of the distinction between categorical and thetic judgments (Brentano, 1925; Marty, 1940). Accordingly, utterances like (3) are considered thetic (Haberland, 2006), and thus topicless (Kuroda, 2005, 1972; Lambrecht, 1994; Rosengren, 1997; Sasse, 1987), which means that they do not establish an aboutness-relation. Instead, the function is to introduce a referent into the discourse representation (Lambrecht, 1994) or to assert the existence of a state of affairs (Sasse, 1987). Likewise, thetic utterances are characterized by having all-new character (Kuno, 1972; Lambrecht, 1994; Rosengren, 1997) or by being logically unstructured (Kuroda, 2005); that is, one cannot distinguish between the cognitive or the logical status of "three thousand" and "RVR".

If we compare these analyses and characterizations with the structure, function and effect you can observe in the activity, they appear not only insufficiently informative but also misleading: First, (3) is not topicless; RVR is a decision factor in scheduled air transport; it determines the pilot's possibilities for action. Accordingly, RVR is a well-established topic of communication within the activity. Second, the speaker is not introducing a referent or asserting the existence of a state of affairs; he is picking out the current state of a known variation in the environment. The state is action guiding, and the language user's cognition of the state will be followed up by practical action guided by the state. Third, one can distinguish between the cognitive and logical status of "RVR" and "three thousand." The former identifies a known, limited set of possible states; the latter picks out a unique, temporary, local, hitherto unknown state.

The discrepancies between the established descriptions of information structure and utterances that form a part of activities are systematic. This applies not only to thetic sentences, but also to holophrases, short forms, sentences with generic subjects, imperatives and coherence (Borchmann, 2015, 2016, forthcoming). The purpose of the present study is to deal with these problems; the goal is to uncover a set of pragmatic and semantic categories that can provide the basis for an informative and accurate analysis of the information shared by an utterance.

The reason for discussing this work outside a narrow linguistic context is that the problems are not specifically linguistic. The discrepancies are merely an indication of a far more comprehensive and fundamental problem, namely that Western metaphysics, as formulated by Seibt (2016), has been "obsessed with describing reality as an assembly of static individuals whose dynamic features are either taken to be mere appearances or ontologically secondary and derivative." The focus on static individuals is linked with a set of interrelated assumptions about knowledge, cognition and information. Thus, it prevails as the assumption that the basic cognitive unit is the categorization of an individual. It prevails in the semantics that form the basis of the established descriptions of information structure, namely as the assumption that the basic unit of information is the predication. It is these assumptions that cause the discrepancies in the analysis of (3). The focus on static individuals is fatal to the analysis of the ability of humans to perform activities and to language use that forms a part of activities. Because what humans attend to and perceive, insofar as they are able to select and control actions, cannot be static individuals but must be the continuous changes of states understood as structures in stimuli that specify affordances. And what humans do with words is not to assign an individual an appearance, a feature or a role, but to share information about variations in the above sense.

Now, there are approaches to language based on a non-representational account of cognition. A particular prominent and vivid approach is *distributed*

language (Cowley 2009, 2011; Hodges et al, 2012; Pedersen, 2012; Raczaszek-Leonardi, 2009; Steffensen, 2012, 2016; Thibault, 2011). According to this approach, language cannot be reduced to a system in the brain but must be viewed "as radically heterogeneous and as spread across space, time and bodies" (Raczaszek-Leonardi, 2009). The primary focus is on "dynamical processes and mechanisms which make language a social-regulatory and coordinating device" (Raczaszek-Leonardi, 2009). The preferred term for these processes and mechanisms are first-order *languaging* (Thibault, 2011) and covers, among other, prosodic contours, gestures, postures, and gaze direction. Utterance patterns like the ones I have discussed above, on the other hand, are second-order language, for example, "patterns (…) that guide and constrain first-order languaging" (Thibault, 2011: 216). Within this framework, descriptions focusing on patterns like (1), (2) and (3) are considered to be biased towards written language (Cowley, 2009:499) and less relevant to the explanation of languaging (Raczazek-Leonardi, 2009:669). The approach presented in the article shares fundamental assumptions with the distributed language approach. But the strategy with regard to utterance patterns is different. The patterns, the functions of which have been described in terms of representation and categorization, are there. Indeed, occurrences of so-called "thetic sentences" are very frequent in, for example, handball players' and road cyclists' spoken interaction (Borchmann, 2015; Kristoffersen et al, 2016). So, instead of ignoring the patterns, the strategy is to describe them in terms of an action coordination device.

There are also accounts of language and cognition suggesting or implying that the information shared by an utterance is non-representational (e.g., Reed, 1995; Tomasello, 2008). Nevertheless, the goal of the present study is justified; for whereas these accounts may succeed on the general level, they revert to the traditional pragmatic and semantic categories with all their inherent limitations as soon as they reach the specific level of linguistic analysis.

In section 2, I will consider two accounts of language and cognition suggesting or implying that the information shared by an utterance is non-representational. In section 3, I will outline the approach of the present study. In section 4, I will argue that humans attend to variations in the environment and perceive the states of variations. In section 5, I will account for the concepts of variation and state as information structural categories. In section 6, I will argue that the information that humans share through the use of spoken and written utterances are states, that is, occurrences of stimulus configurations that specify affordances, and, continuing along these same lines, I will present an alternative to the predication. Section 7 is a discussion of the limitations of the approach and the results of the present study. Section 8 is a short summary.

2. Non-representational accounts of information – or prisoners of predication?

Tomasello (2008) argues that human communication relies on a common ground and an ability for shared intentionality, originally evolved in the context of collaborative activities, providing for an especially salient and solid common ground. The most obvious communicative motive related to activities is getting others to do what one wants them to do. The ability for shared intentionality enables humans to do this simply by directing others attention to features in the environment, without requesting. Tomasello illustrates this by examples of pointing:

> People standing in line. The line has moved forward and a man hasn't noticed this because he is turned around talking to the person behind him. Someone from still further back points for him to the newly opened gap.
>
> *Gloss*: Attend to the empty space; please move up into it. (Tomasello, 2008:64)

This and the other examples suggest that there is a close relation between action and the features in the environment that humans attend to and direct each other's attention to. Certainly, Tomasello has not conducted studies of language use that forms a part of activities; but verbal explicitations of this relation can, indeed, be observed within collaborative activities (Kristoffersen, et al., 2016):

4. og der er masser af plads til jer og så skyd for helvede ude fra
   //and there is plenty of room for you and so shoot fucking hell from outside
   (Handball coach to handball players, half-time speech, Nordsjælland, 2016)

The assumption that humans are able to coordinate action by directing each other's attention to features in the environment provides considerable explanatory value for observations of language use that forms a part of activities. Thus, a study of tactical meetings on a semi-professional cycling team ahead of a stage in a stage race shows that the number of directive speech acts is negligible relative to the number of assertive speech acts, and that directives are always conditional (Borchmann, 2015). Rather than coordinating actions by means of directives, the performers coordinate actions by means of assertive speech acts directing attention to features of the environment that determine appropriate action (Borchmann, 2015), e.g.:

5. så er der helt åbent herude//Lit: then there is quite open out here ('it is quite open out here')
   ((speaker is pointing at a route map))
   men så er der jo (0.4) der er åbent fra den side

> //Lit: but then there is (0.4) there is open from this side ('but it is open from this side')
> men der jo ikke å. (0.3) der er jo forholdsvis læ (0.7) fra den her side ikke
> //Lit: but there is clearly not o. (0.3) there is clearly relatively shelter (0.7) from this side right ('but clearly it is relatively sheltered from this side right')
> (Leading sports director to riders, tactical meeting, Tour of Denmark 2014)

As the peloton moves through a terrain the topographical effect on the wind speed varies. The state of this variation affects the possibility for echelons, and thus the appropriate position in the peloton. That is, the team coordinates actions by directing each other's attention to this variation among others ahead of the race. This communicative behaviour is highly adaptive in a dynamic environment where the conditions for appropriate action change continuously and are unpredictable.

So, the basic claims in Tomasello's account provide explanatory value and constitute a framework for analysing language as a tool for directing attention to information in the environment rather than a system of representation. Nevertheless, Tomasello describes the grammar of informing as a categorical structure:

> **Identifying:** as we move beyond requests, the communicator must have ways for making reference to absent or unknown objects and events, (…)
>
> **Structuring:** as we move beyond requests, the communicator must have ways to syntactically mark such things as who did what to whom (including third parties) in the indicated event or state of affairs (Tomasello, 2008:271)

The hopeful reader, thus, is left dumbfounded: How do reference to objects and events and the implied case roles, agent and patient, explain the linguistically mediated coordination of actions? It is as if Tomasello beforehand - regardless of any observations of the context in which language is supposed to have evolved - assumes that the predication is the basic semantic structure. The presumption is supported by Tomasello's (2003) claim: "all peoples have the need to solve in their languages certain kinds of communicative tasks, such as referring to specific entities or predicating things about those entities" (Tomasello, 2003:18). Admittedly, Tomasello refers to studies of hunting, according to which "a small group establishes a joint goal of capturing a certain prey (…) and then they plan their various roles and how they should be coordinated ahead of time" (Tomasello, 2008:186). To an experienced hunter, however, this a caricature of the common ground necessary for successful hunting. Shared assessments of the wind direction,

wind speed, topography, distances and alertness of the prey are essential for the coordination of actions in any kind of deer hunting. Accordingly, observations of language use that forms a part of rifle hunting and bow hunting indicate that the common ground of hunters are far more nuanced than goal and roles. An utterance like the following, thus, is common among rifle hunters:

6. Med en 100 grains Oryx er der en afdrift på 44.3 cm ved 5 m/s på 300 meter.
   //With a 100 grains Oryx there is a drift of 44.3 cm by 5 m/s at 300 m.
   (Rifle hunter to fellow hunters, www.jagtdebatten.dk, 11 April 2012)

With the utterance the speaker communicates that if the bullet weight is 100 grains, the bullet type is Oryx, the crosswind speed is 5 meters per second and the shooting distance is 300 meters, then the wind drift is 44.3 cm. Wind drift is a well-established topic of communication within the activity, and the value 44.3 cm implies that hunters should refrain from shooting or move closer to the prey, not least, because the wind speed and wind direction depend on the topography and are virtually impossible to predict accurately. As with examples 3, 4, and 5, reference to objects or events and predication will get us nowhere in the analysis.

Although (6) may appear rather technical, the environment of our hunting ancestors was also characterized by the constraints described in ballistics, fluid dynamics, meteorology and optics. If human communication evolved in collaborative activities providing for a common ground, the ability to communicate these constraints and pass on the skills to the next generation must also have created selection pressures on linguistic behaviour.

Notice also that whereas Tomasello's pointing example suggests that we attend to affordances, namely an empty space that affords moving into, his grammar of informing presupposes that we attend to objects and events. Certainly, Tomasello points out in the pragmatic analysis that we attend to *perspectives on things* rather than things (Tomasello, 2008:82; see also Tomasello, 2003:13); but it is unclear how the categorical structure is related to these perspectives and to appropriate action. In short, people don't just do what you tell them to do (and it's a good thing too).

The point of this critique is not, of course, that the pragmatic and semantic categories *reference, predication, object* and *event* are useless in any linguistic analysis. The point is that these categories make it all the more difficult to explain how we can coordinate action by sharing attention by means of assertive speech acts.

The gap between the features in the environment that performers of activities direct each other's attention to and the categories applied in the linguistic analysis also appear in anti-representationalist accounts. Reed claims that: "*Language is not a means for transmitting ideas or*

representations; it is a means for making information available to others and thereby contribute to one's own and one's group's activity " (Reed, 1996:155-156). Nevertheless, Reed reverts to the predication based topic-comment distinction in the description of language development:

> The first phase of language development (…) I call (…) *indicational language* because the functional communication skills manifest at this time of life revolves around the child's ability to *select* or *indicate* a *topic* (object, place, event, person) of interest (…) the special combinations of success and limitations of indicational language (…) create selection pressures for radical reorganisation of the child's language (Reed, 1995). In particular, children have to learn how to *comment* on topics, not merely to indicate them. Thus I, call this second phase of language development *predicational language*. (Reed, 1996:153-154)

Once again the question arises: How are references to objects, places, events and persons and comments about such topics related to information in the environment and appropriate action?

The present study endorses Tomasello's (2008) assumption that human communication relies on an ability for shared intentionality evolved in the context of collaborative activities and Reed's (1996) assumption that language is a means for making information available to others, thereby contributing to one's own and one's group's activity. But as both these accounts apply the same semantic and pragmatic categories as the established descriptions of information structure, their goals of linking language and collaborative activities seem difficult to attain.

The first step in the attempt to close the gap between the features in the environment that humans attend to and direct each other's attention to in collaborative activities, one the one hand, and the pragmatic and semantic categories of the linguistic analysis, on the other, is to design an approach to language and cognition that is, firmly based in activities. In the following section I will outline this approach.

3. Ecological pragmatics

The approach in the present study is motivated by an interpretation of Wittgenstein's private language argument (1968/1953). The prerequisite for learning a language is that there are intersubjective criteria for understanding. Mental processes, as they are private, cannot provide us with such criteria. Criteria for understanding must be external. That which can provide us with external criteria is the non-linguistic behavior that accompanies the linguistic behavior. Activities are interweavings of linguistic behavior and non-linguistic behavior that serve as criteria for the understanding of the linguistic behavior.

In this perspective, thus, activities are where semantic constraints emerge and can be learned and maintained. Therefore, language use must be studied as being a part of activities.

The empirical basis of the study, thus, is language use that forms a part of activities. To reduce the risk of low ecological validity, cognition and language will be studied in natural settings. On that point, the present approach is indebted to Hutchins (1995) and Klein (1999, 2009).

The analytical framework is based on the concept of *activity*. An activity is defined as an organization of tool-mediated solutions of tasks in order to obtain an intended outcome and realize specific values. For example, making a bonfire, grinding a knife, spearfishing, rifle hunting, growing potatoes, baking bread, smoking meat, brewing beer, molding a foundation, roofing, landing an airliner, driving a rally stage, or riding a road bicycle race. Let's analyze the component of this definition and their theoretical provenience.

The term *value* comes from Hodges and Baron (1992) as accounted for in Hodges (2007). Values are defined as: "the boundary constraints on ecosystems that define their dynamics and the directedness of organisms' activities within them (...) values underwrite the self-organizing constitution of niches (...) that guide the selection, coordination, and revision of goals and affordances" (Hodges, 2007:590). Values, thus, have priority over goals. When landing an airliner, safety is a dominating value. This value guides the perception of visibility as an affordance, and this perception may lead to a revision of the goal to land on a particular runway. Values, however, are also multiple, heterarchical and dynamic (Hodges, 2007). That is, activities are guided by multiple values; landing an airliner is also guided by efficiency and viability, and these values might suggest that diverting to an alternate runway is inappropriate (Dekker, 2014:136; Wilkinson, 1994). There is no fixed hierarchy; sometimes safety takes the lead, at other times efficiency. As to the dynamics, values have a developmental dimension. Value heterarchies change: what it means to be a good pilot changes over time. While the intended outcome is subordinate to the values, it is nevertheless necessary to operate with it in the analysis in order to determine when an activity is completed.

Knowledge of the goals and the values, however, is not sufficient to understand the performance of an activity; performance is also constrained by physical laws (Rasmussen et al, 1993). In aviation, for example, the physics of aerodynamics sets fundamental boundaries on the performance (Flach & Rasmussen 2000:157). These constraints will be referred to as *lawful constraints*.

The term *mediated* originates from Vygotsky (1978:26). It covers the mutual dependency between tools and activities: The structures of tools are determined by activities; this is a simple functional relationship. But, at the same time, activities are determined by the tools in the sense that they

enable the performance of activities and contribute to the development of the activities.

Like Vygotsky, I consider language to be a tool. This means that the structures we may extract from linguistic behavior are the way they are because they serve a purpose. Conversely, the mediation implies that linguistic structures are prerequisites for the activity and can contribute to the development of it. This relationship between language and activities is described in terms of niche construction. Niche construction alters the selection pressure so that variants that have an advantage in the altered niche are more likely to be reproduced. Thus, the organism is not only adapted to the niche through natural selection; the selection pressure is partly a result of the organism's own niche construction activities (Odling-Smee et al, 2003).

When the theory of niche construction is applied to language, it implies that "human beings have been selected so as to do well in a niche that includes language - produced by human beings" (Harder, 2010:147). Presumably, language emerges as a simple symbol system and develops in activities where the coordination of actions afforded by the system provides an edge (Deacon, 1997). Thus, the driving forces in the development of linguistic structure are not a mental structure, but the selection pressure that linguistically mediated activities exert on larger time scales.

The subject of the present pragmatic approach is the forces that drive the development of linguistic behavior on larger time scales. These forces are described partly as a set of general, activity-crossing functions that language use serves, partly as a set of general, activity-crossing values (or *maxims*) that guide language use (Grice, 2001/1975). A function is defined as a relation between two communicative tasks. The characteristic of the approach, then, is that it uses activities as models of the niche. This pragmatic approach might be called ecological pragmatics (ses also Hodges, 2009).

As a framework for the analysis of the pragmatic functions, the outlined concept of activity requires the following five steps: 1) describe the intended outcome of the activity and the dominating values, 2) describe the relevant lawful constraints, 3) characterize the tasks that performers must solve in order to obtain the outcome and realize the values within the lawful constraints, 4) describe the information, tools and abilities available for carrying out the tasks, and 5) explain how language contributes to the solution of the task. The analysis of different activities forms the basis for hypotheses about general functions and values of language use. The present study concentrates on functions.

A parallel can be drawn to Wilson and Golonka (2013): they suggest that there are four key questions any embodied cognition research program must address: What is the task to be solved? What are the resources the organism has access to in order to solve the task? How can these resources be

assembled so as to solve the task? Does the organism, in fact, assemble and use these resources? (Wilson & Golonka, 2013:2-3). The difference is that ecological pragmatics considers tasks to be guided by goals and values, focuses on language, and describes general functions rather than task specific solutions. An important common feature, however, is the application of a first-person perspective. That is, information is viewed from the perspective of the performers of activities rather than that of the spectators. Consequently, information is related to specific tasks and limited to the information available to the performers. This feature is crucial for the understanding of the performance of activities (Dekker, 2014; Klein, 1999), and thus for the understanding and analysis of language use that forms a part of activities. Therefore, I will refer to Wilson and Golonka's program in the cognitive task analysis in section 4.

In the next section I will take the second and perhaps most important step to close the gap between what humans direct each other's attention to in the performance of activities, on the one hand, and the semantic and pragmatic categories of the linguistic analysis, on the other. Thus, I will consider what humans attend to and perceive in the performance of activities.

4. Tasks and information in a dynamic environment

Sitting at our desk or standing in a classroom, it is easy to deceive ourselves into thinking that what we perceive are objects: We point to or grasp an object and, perhaps, accompany the movement by a designation, for example, "chair." But this is significantly more difficult when circling in a glider 500 meters above the ground at 85 km/h. In this case, if what you perceive is objects, you will not survive very long.

Taking a starting point in an activity-specific task, I will try to convince the reader that humans who perform activities in dynamic environments attend to state changes and perceive states. The task is to control the airspeed while thermalling in a glider. The description of the task is based on 14 months of ethnographical studies in the activity of soaring. The observations include 55 flight hours; the collected material includes manuals, textbooks, video recordings with head mounted cameras during flights, interviews with student glider pilots and audio recordings of lessons, briefings, debriefings, radio communication between skilled pilots during flight, and communication between student glider pilots and gliding instructors during flight.

4.1. Information and control of the airspeed

As to the lawful constraints, a glider works, like any other airplane, due to air moving at a certain speed around an aerofoil. The shape of the aerofoil causes a lower air pressure on the upper surface than on the lower surface.

This pressure difference causes an upward force that counteracts gravity. If the airspeed is too low, the plane is helplessly left to gravity and falls to the ground; if the airspeed is too high, the plane will disintegrate. For the sake of the goal and values of thermalling, the airspeed must, furthermore, be kept within a narrow area of this envelope. When thermalling, the goal is to gain height by exploiting columns of rising air. A dominant value is safety; this may require an airspeed of 85 km / h.

The pilot controls the airspeed by adjusting the angle of the aerofoil (*AoA*) relative to the air flow. This angle is regulated by changing the pitch (see Figure 1). The airplane is equipped with an elevator on the tail plane which can be moved up and down via a stick in the cockpit (see Figure 1). If the stick is pulled back, the elevator deflects up causing a downward force on the tail. The primary effect is that the nose pitches up. This increases the AoA, and, as a secondary effect, the airspeed decreases. If the stick is pushed forward, the elevator deflects down causing an upward force on the tail. The primary effect is that the nose pitches down, and the AoA is reduced. The secondary effect is that the airspeed increases.

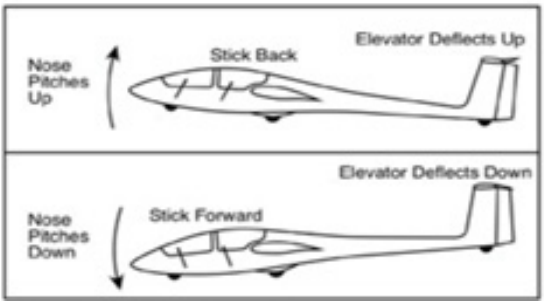


Figure 1. Pitch control in a third person perspective.

A glider is designed to be static and dynamically stable, that is, the forces and momentums arising from a disturbance of its equilibrium will restore it to its equilibrium, and these forces will cause a steadily decreasing impact on the equilibrium. Furthermore, gliders are equipped with a mechanism that maintains a chosen position of the elevator control stick. Thus, if all else is stable, the plane will maintain its equilibrium, and the airspeed will be constant. But everything else is not stable. Due to the dynamics of the atmosphere and local differences in temperature, pressure and topography, there is local variation in the direction and velocity of the vertical movement of the air, and, thus, turbulence. Indeed, the weather conditions that afford thermalling are characterized by large local variations in the vertical movement of the air. Likewise, the pilot will disturb the equilibrium state by additional rudder movements in order to utilize the narrow columns of rising air. Consequently, the plane's equilibrium around the pitch axis will be constantly disturbed

while thermalling. The pilot's task is to control the airspeed under these circumstances.

Following Wilson and Golonka (2013), we can ask: What are the resources the pilot has access to in order to solve this task? A glider is equipped with an airspeed indicator (see Figure 2). The airspeed indicator measures the dynamic pressure the airflow exerts on the plane and is thus directly related to the airspeed. The indicator conveys information about the airspeed, and thus, whether it is too low or too high relative to the required airspeed. The problem is that airspeed is a secondary effect of the primary effect of the control, namely, the movement of the elevator. If you use the airspeed indicator to control your airspeed, you will always be lagging behind the change in pitch that has caused the change in airspeed. To control your airspeed you must assess information about the primary effect, that is, the change in pitch that causes a change in airspeed. The pilot must, therefore, pick up information about the pitch.

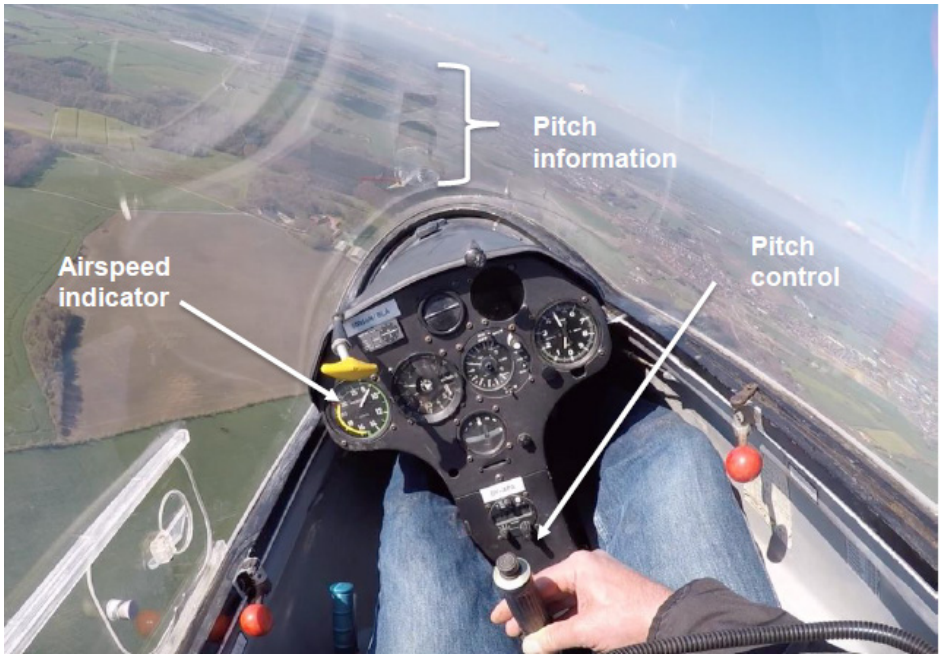


*Figure 2.*Airspeed information and control in a first-person perspective.

There are two kinds of information about pitch. Rotational state changes around the longitudinal axis can be registered by the archways in the inner ear. The problem is that the archways only register changes, and that they are unreliable under the accelerations they are exposed to during flight (Leibowitz, 1988: 100-101). The only reliable information about pitch available to

the pilot is visual kinesthetic information, namely the gap between the center of the outflow of the optic array and the separation of two hemispheres of the ambient arrays at the horizon (henceforth GCH) (Gibson, 1986). One way to make this information about pitch perceivable to the student glider pilot is to describe it as the distance between the upper edge of the nose and the horizon (see Figure 2). Any change in pitch will cause a change in this distance.

GCH varies constantly during thermalling as a result of the dynamics of the environment and the pilot's rudder movements. In order to control the airspeed, the pilot must attend to this variation and perceive the actual gap as information about how to move the stick. If the gap increases the pilot must pull the stick back; if the gap decreases the pilot must push the stick forward. When the pilot moves the stick, it will cause a change in pitch, and thus a change in GCH. This new state will be new information about GCH, and so forth, in a continuous perception-action loop.

The ability to pick up information about GCH well enough to control the airspeed has to be learned. The student pilot will typically start by focusing on the airspeed indicator. By verbal instructions the instructor will guide the student's attention to the distance between the upper edge of the nose and the horizon and, additionally, perhaps cover the airspeed indicator with tape. Gradually, the student will be able to control the airspeed by focusing on the distance between the upper edge of the nose and the horizon. Over time, the student will be able to pick up information about GCH well enough to control the airspeed through peripheral vision.

As to the question of whether we attend to objects or to changes, and whether we perceive objects or states, the point of the above description is this: You cannot control the airspeed if you do not attend to the continuous changes of the pitch and perceive states of this variation as information about how to move the stick. And skilled pilots are able to control the airspeed under the conditions of thermalling.

4.2. A bold generalization

Controlling the airspeed is just one of the tasks that the pilot must solve. The performance of this activity involves carrying out many other tasks, each of which requires that the pilot attend to a number of variations (see also Flach et al, 2003; Ritchie, 1988). This applies to very small time scales like the variation in GCH. But it also applies to variations on longer time scales. During flight, the pilot must pick up information about variations like height, course, groundspeed, distance to terminal areas, etc. These vary over minutes and hours. In the preparation for the flight, the pilot seeks information about wind direction, wind speed, visibility, ceiling, sky condition, temperature, dew point etc. These vary over hours and days. Whereas the immediate state

of a number of these variations cannot be used to control actions, they can be used to select actions. Thus, the performer must also pay attention to these variations and perceive the actual states.

The claim is that this can be generalized to other activities, for example, stage rally, road cycling, rifle hunting, scuba diving, spearfishing, beer brewing, etc. Those who perform these activities must attend to state changes and perceive states in order to select and control actions. It applies to all human activities, in fact, to any goal-oriented movement; even the philosopher who reaches for the chair must attend to the distance between his hand and the chair in order to succeed in his attempt to illustrate that what we perceive, are objects. The reason I focus on tasks in tool-mediated activitiesis that language use forms a part of these activities as well as exercising the ability to perform the activities. This makes it possible to investigate whether and how language use is related to variations such as airspeed.

Attending to variations in order to perceive states is not the only cognitive activity going on. Performers of activities also relate variations to each other and predict and cause states of variations. However, attending to a variation in order to perceive the current state is a prerequisite for these activities. Therefore, this relation to a variation is considered the basic one. The working assumption is, thus, that the basic cognitive unit in human performance of activities is the pick up of a state.

5. Variations and states

In this section I will define variations and states. The purpose is not to contribute to ontology or epistemology. The definition is instrumental and should enable an informative and accurate basic analysis of the information shared by an utterance.

Variations are changes in the stimuli that surround us: in the ambient light, sound and smell, in pressure, vibration and temperature, among others. A simple example of a variation is the one the driver experiences when he turns his head and looks in the side view mirror before changing lanes on a highway: sometimes there are vehicles coming from behind, sometimes there are not (see Figure 3). Variations are constrained by forces that can be described and predicted in physics; but variations must not be confused with physical variables and parameters. Variations are what people are able to perceive, and people do not perceive, for example, the wavelength of electromagnetic radiation, an object's coordinates in space, the kinetic energy of an object or the molecular movements of a substance. In other words, variations do not belong to physics, but to psychology, including psychophysics, cognitive science and social psychology. However, this does not mean that variations have a dubious ontological status, or that knowledge about them has a dubious epistemological status. Variations exist: they are features of

the environment, relative to our sense apparatus (Gibson, 1986; Turvey et al, 1981), and they are reliable information about the forces that affect our lives (Chemero, 2011; Millikan, 2000).

Variations can be misleading in terms of the forces that affect our lives, and, in particular, the ability to attend to them and differentiate the states of them must be learned through exploratory activity, exercises and guidance (Adolph, 2008; Gibson & Pick, 2000; Gibson & Rader 1979; Plumert, 2004; Zukow-Goldring & Arbib, 2007). This, however, does not contradict the fundamental assumption.

Variations are flows, but they are bounded and structured. Variations consist of states and transitions between states. Transitions between states differs from states. They are not information in the same sense as states; if transitions are perceived they are perceived as meta-information, namely, information about the end of a state and/or the imminency of a state. Transitions are important for predicting and for the timing of actions. However, as they are considered meta-information, they will be left out of the basic analysis. Thus, according to the basic analysis, variations consist of states. The side view mirror variation above, for example, is distinguished in two states: 'presence of vehicles coming from behind' (henceforth PVB) and 'absence of vehicles coming from behind' (henceforth AVB). A state is a configuration of stimuli that is, differentiated perceptually from another configuration of stimuli. In the example, the state PVB is differentiated from AVB.

The unique occurrence of a configuration of stimuli is tied to a location and exists only temporarily. Thus, a given PVB or AVB will sooner or later cease to exist. However, the structure common to a number of occurrences is a reoccurring structure. A unique PVB that ceases to exist will sooner or later be replaced by a new PVB. This PVB, however, will also cease to exist, and so on. In other words, you can distinguish between state types and occurrences of state types. This is illustrated in Figure 3.

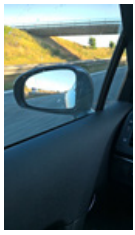
Time:	T1	T2	T3	T4	T5
Locality:	Mirror	Mirror	Mirror	Mirror	Mirror
Occurrences:	O1	O2	O3	O4	O5
					
State type:	PVB	AVB	PVB	AVB	AVB

Figure 3. Snapshots of a variation in a driver's side view mirror. See description in the text.

If we take a closer look at the unique occurrences of PVB, we see that they are quite different; the color of the vehicles coming from behind differ, the sky conditions and ceiling differ, and the topography differs. The same goes for the unique instances of AVB. This raises the question: What is the criterion of similarity? The answer to this question is based on the assumption that perception and action are closely linked; so closely linked that, as Gibson puts it, "to see things is to see how to get about among them and what to or not to do with them" (Gibson, 1986: 223). That is, perception serves behavior. The features of the environment we perceive are coined *affordances*, that is, the possibilities for action (Reed, 1996) that the environment offers the organism. The criterion of similarity, thus, is that the unique states specify the same affordances. O1 and O3 specify an obstacle for lane-changing, whereas O2, O4 and O5 specify a possibility for lane-changing. This criterion applies to all the state types that a variation consists of. Thus, a state is an occurrence of a stimulus configuration that specifies an affordance.

The assumption that performers of activities perceive affordances implies a concept of information that differs from the concept of information in the established descriptions of information structure. Information does not comprise representations of the world, but are specifications of affordances (Gibson, 1986; Turvey, et al., 1981). Thus, information is not something that is, transported from a sender to a receiver, but something that surrounds us, that we attend to and that we can share attention to (Tomasello, 2008). The essential attribute of this concept of information is that it is action-guiding, and, therefore, that there are external criteria for the pick up of information in the performance of activities, namely the act that the specified affordance affords. The criterion for the driver's pick up of an AVB, thus, is the driver's lane-changing. The criterion for the glider pilot's pick up of a GCH that specifies an airspeed that affords stalling is the pilot's forward motion of the stick.

The second question that the assembly of states in the illustration raises, is: What is the criterion for delimiting a variation to a number of state types? There are two criteria that both must be met. The first is that instances of the state types can satisfy the need that motivates a perceptual action by a skilled performer of an activity, for example, a driver’s looking at the side view mirror before a lane change. Here, occurrences of both PVB and AVB can satisfy this need. The basis for this relationship between stimuli and perceptual action is that each of the affordances specified will influence the outcome of the act that depends on the information pick up. Thus, whereas both PVB and AVB are information about the outcome of lane-changing, this does not apply for the color of the cars, the ceiling or the topography, and therefore these stimulus configurations do not belong to the variation.

The second criterion is that the types of a variation are mutually exclusive. That is, an occurrence of a state type excludes occurrences of all the other state types of the variation. This is evident in the example of the side view mirror. But it is probably less obvious that it also applies to tiered variations such as pitch, airspeed, height and wind speed. From a logical point of view, a higher value implies a lower and does not exclude an even higher value. In the performance of activities, however, stimuli are differentiated on the basis of their relevance for selection and control of actions. Thus, as a specification of an affordance, an airspeed of 85 km/h excludes 65 km/h and 105 km/h. Each value requires a different action in so far as they are differentiated.

Many of the tools we use to provide and share the states of variation are, of course, based on physical dimensions and logical relations. An airspeed indicator, for example, is based on physical dimensions and logical relations, but whether the differences between indicated values are differentiated and how, depends on a variety of factors, among others the ability of the perceiver and the goals and the values of the activity. That our measuring instruments are based on specific units in specific relations does not mean that what we perceive is the same unit and has the same structure.

A variation can now be defined like this: a variation is an open set of local, temporary, mutually exclusive occurrences of a limited set of reoccurring configurations of stimuli that specify an affordance. A state is a local, temporary occurrence of a reoccurring configuration of stimuli that specify an affordance. These two concepts are suggested as alternatives to the concepts *object/thing/person* and *category/property/class/role* in the analysis of information and cognition.

6. Utterances as tool-mediated specification of affordances

In the previous section I have described variations as changes in stimuli such that an occurrence of a stimulus configuration replaces an occurrence of another stimulus configuration in a limited set of configurations. These configurations of stimuli are defined as information in the Gibsonian sense. In this section I will argue that performers of activities share information in this sense through the use of utterances.

6.1. The arguments for connecting language and affordances

It is not easy to base a semantic analysis on Gibson's concept of information, because Gibson is very clear with regard to the separation of affordances and language. The separation is stated in the following quote:

> The fact that a stone is a missile does not imply that it cannot be other things as well. It can be a paperweight, a bookend, a hammer, or a pendulum bob. It can be piled on another rock to make a cairn or a

> stone wall. These affordances are all consistent with one another. The differences between them are not clear cut, and the arbitrary names by which they are called do not count for perception. If you know what can be done with a graspable detached object, what it can be used for, you can call it whatever you please.
>
> The theory of affordances rescues us from the philosophical muddle of assuming fixed classes of objects, each defined by its common features and then given a name. As Ludwig Wittgenstein knew, you cannot specify the necessary and sufficient features of the class of things to which the name is given. They have only a ”family resemblance.” But this does not mean you cannot learn how to use things and perceive their uses. You do not have to classify and label things in order to perceive what they afford (Gibson, 1986:134)

Here, Gibson is driving a wedge between categorization and perception, and, by assuming that we use language to categorize, he simultaneously drives a wedge between language and perception (Borchmann, 2016). As Gibson puts it in the prominent dictum: ”Perceiving precedes predicating” (Gibson, 1986:260).

The main reason for my attempt to connect language and affordances is that Gibson presupposes that we use words to categorize things. This assumption is consistent with the representational semantics that forms the basis of the descriptions of natural language information structure. However, it is not at all given that predication is the basic pragmatic function. In any case, predicating is not what the pilot does with words when he says: "it's three thousand RVR" (see example 3). The same applies to the handball coach (see example 4), the sports director (see example 5), and the rifle hunter (see example 6).

The first argument for connecting language and affordances, thus, is that Gibson's separation is based on the assumption that predication is the basic informational function of language. The second argument is that Gibson only to a very limited extent includes tool-mediated behaviour in the description of perception. The theory of affordances has an evolutionary rationale (Reed, 1996): our perceptual system is the result of the selective pressure exerted on our species. Accordingly, Gibson uses the term niche and describes a niche as "a set of affordances" (Gibson, 1986:127-128). Gibson also notes that "the environment has been partly converted from the natural materials of the earth into various kinds of artificial materials [by man] (...) To change what it affords him" (Gibson, 1986:130). But Gibson does not take the changes of the selective pressure that such changes may cause into account. A wide range of activities are conditional on sharing information about affordances, the specifications of which are unavailable for the perceptual system. The pilots in example 3 are sharing information about the visibility on

a runway more than hundred miles away, 30,000 feet below them. And visibility specifies the pilots' affordances; indeed, Gibson himself points out visibility as an affordance (Gibson, 1986: 130-131). The fact that visibility is an affordance for the pilots and that the difference between, for example, 2800 feet and 3000 feet is a difference that makes a difference in terms of affordances, is a result of the construction of aircrafts, radios, landing systems, transmissometers and computers, among other tools. Tools both enable and require that we distinguish between stimulus configurations in new ways. This is distinctive of tool-mediated activities.

The third and last argument is based on the private language argument: If it is information in the Gibsonian sense we share by the use of language, then there are external criteria for understanding, namely the action that the specified affordance affords. The criterion that the pilots have understood the utterance "it's three thousand RVR" is that they try to land on the runway (see example 3); the criterion that the riders have understood the utterance "så er der helt åbent herude" (then there is quite open out here), is that they position themselves in the front of the peloton under the specified condition "herude"(out here) (see example 5); the criterion that the rifle hunters have understood (6) is that they refrain from shooting under the specified conditions "100 grains Oryx", "5 m/s" and "300 meter". A semantic analysis based on this concept of information makes it possible to explain how semantic constraints emerge and change, and how they are learned and maintained.

Therefore, the working assumption is that performers of activities share information in the Gibsonian sense by means of spoken and written utterances. The claim is that all we have to do to recognize this is to study language use that forms a part of tool-mediated activities. In the following, I will show that utterances that form a part of activities relate to variations in the sense described in section 5. Taking a starting point in an example, I will first describe the linguistic specification of an affordance as a basic pragmatic information-structural function. Then I will describe the basic semantic structure that serves this function.

6.2. The fundamental aboutness-relation in language use that forms a part of activities

The analysis is based on observations of spoken and written language in a variety of activities, including activities within soaring, scuba diving, beer brewing, spearfishing, stage rally, masonry work, rifle hunting, semi-professional road cycling and scheduled air transport. In these activities, an utterance with a pragmatic function like the following is very common:

7. runway four right RVR is three thousand (Approach controller to pilots, American 1420 (NTSB, 2001))

The utterance forms a part of landing an airliner. It is uttered by the approach controller in a radio transmission to the pilots (NTSB, 2001). RVR is the distance over which a pilot of an aircraft, on the centerline of the runway, can see the runway surface markings. The utterance conveys information about this distance on runway 4R, Clinton National Airport at the time of communication.

RVR is a prototypical example of an activity-specific variation: Visibility varies in the performance of the activity, over time and from place to place. The current state specifies the pilots' affordances, and the pilots attend to (and must attend to) the variation and adapt (and must adapt) their actions to the affordances that the state offers. For safety reasons, the relation between states and affordances has been standardized within scheduled air transport, partly by regulations that guide the provision and communication of information about visibility, partly by constraining the relation between RVR-values and affordances conventionally. Regarding the provision of information about RVR, a computer-controlled transmissometer automatically generates an RVR value. Within FAA's jurisdiction, RVR values are reported in 100-foot increments from zero (0) feet through 800 feet; 200-foot increments from 800 through 3,000 feet; and 500-foot increments from 3,000 through 6,500 feet (FAA, 2006). According to FAA orders, the local control must issue the current RVR value to each aircraft before landing or departure if it is below 6000 feet (FAA, 2010).

This system enables the pilots to determine the state of the runway visibility when they plan the approach. The approach controller makes information about the visibility available to the pilots in a situation where the pilots do not have the possibility of perceiving the visibility. Visibility is crucial to the pilots' control of actions during approaches and landings, and thus also for their selection of actions; they may, for example, choose another runway or divert to an alternate airport. That is, to pick up information about visibility is a well-established cognitive task in the activity of landing an aircraft.

As to the standardization of the relation between RVR-values and affordances, there are specific requirements for landing on each and every runway in an airport. These requirements are specified in an approach chart available to the pilots. The relation implies that an RVR-value can specify an obstacle for landing as well as the use of a specific landing system. Furthermore, the variation in visibility is related to other variations so that it constrains the understanding of the states of these variations as specifications of affordances, for example, friction on the runway (braking action), wind speed and wind direction relative to the orientation of the runway.

In the present case, the maximum crosswind component for landing on a runway with an RVR less than 4,000 feet is 15 knots (American's Flight

Manual, 1999). The last reported wind direction and wind speed was 320 degrees and 23 knots, and the orientation of runway 4R on Clinton National is, according to the designator number 4,[2] 40 degrees. This implies that the crosswind component was 23 knots[3]. Thus, the current visibility combined with the actual wind speed and wind direction specified an obstacle for landing at 4R.

On the basis of this model example, the relation between the utterance and the variation can be described as the following pragmatic function: The speaker picks out *an occurrence of a state type* among the state types of *a variation*, and thereby *excludes* occurrences of all the other state types of the variation. This relation corresponds to the relation that the glider pilot establishes when he perceives the current GCH as information about whether to push the stick forward or pull it back; it corresponds to the relation the driver establishes when he turns his head and looks in the side view mirror to determine if there are obstacles to a lane change. And it corresponds to the relation you establish when you put your hand under the shower to perceive if the water has a temperature that affords showering. In other words, it corresponds to the relation established by an action of a perceptual system - an *information pickup* (Gibson, 1986: 239-250).

In this case, however, the relation is linguistically mediated. Here, it is an occurrence of the linguistic form *three thousand* that indicates the occurrence of a state type. The configuration of stimuli that the pilots would be able to perceive if they were on the final approach to runway 4R is replaced by the configuration of stimuli that the linguistic form *three thousand* poses.

Now, the main point in Gibson's theory of affordances and information is that information specifies affordances. The relation is a law-based (i.e., if the information is there, the affordance is there by law) one-to-one relation (i.e., the stimulus configuration that specifies an affordance is a unity); it is rich, complete and independent. So, if we are to base a semantic description on Gibsonian information, there must be an equivalence between the described linguistically mediated relation and the specification.

Regarding the one-to-one relation, the linguistic configuration of stimuli differs from the non-linguistic configuration of stimuli the pilots could perceive on the final approach. The latter can be used to control action in so far as there is immediate and direct feedback if you turn your head and if you move forward. The former, however, will not give you immediate and direct feedback, and, therefore, it cannot be used to control action. However, the linguistic configuration can be used to select action (Golonka, 2015:

[2] The designator number for runways is the whole number nearest the one-tenth of the magnetic azimuth along the runway centerline when viewed from the direction of approach (FAA, 2013).

[3] Wind speed multiplied by sine of the angle between the wind direction and the orientation of the runway. Sin(80°) is about 0.985.

247), for example, whether to land on a runway or not. Likewise, the linguistic configuration of the stimuli *three thousand* is an independent unit in the sense that if you replace this configuration of stimuli - and this configuration only - with another configuration of stimuli, for example *five thousand*, the specification of the affordance also changes. Notice also that the linguistic configuration is the only available from a first-person perspective, and it is sufficient for selecting an action.

Regarding the law-based relation, the linguistically mediated relation differs from the specification. If the affordance is there when the configuration of stimuli is there, it is not because of a law, but because of a convention (Golonka, 2015). This means that there are a number of sources of error and that the linguistic configuration may be misleading with regard to the affordance. However, the linguistic configuration is generally a relatively reliable source of information. Humans seek to ensure its reliability partly by regulation and partly by sanctioning misleading use. Referring to Barwise and Perry's concept of *constraint*, Chemero (2011) suggests that the linguistically mediated relation between information and affordances, on the one hand, and the specification, on the other, are different in type, but not in kind. In so far as linguistic configurations of stimuli can be used to select action and are based on a constraint, they can be considered information in the Gibsonian sense. However, it is appropriate to distinguish such linguistically mediated, convention-based specifications from non-linguistic, law-based specifications. Therefore, I use the term *tool-mediated specifications* for linguistically mediated relations. An utterance that picks out a state, thus, is a tool-mediated specification of an affordance.

Utterances may relate to variations in other ways. A speaker may, for example: a) identify a variation without picking out a state, b) recommend that the listener causes a state of a variation, c) predict a state of a variation, d) indicate that there is a relation between two variations, or e) indicate a specific relation between two (or more) variations (Borchmann, 2013, 2015). But it is the assumption that picking out an occurrence of a state type among the state types in a variation, and hence excluding occurrences of the other types of states in the variation, is the simplest and most fundamental relation in language use that forms a part of activities. This relation, therefore, is the basis for the definition of the pragmatic, information-structural function of topic-comment: Ontologically, topic is a variation, that is, an open set of local, temporary, mutually exclusive occurrences of a limited set of reoccurring configurations or stimuli that specify an affordance. The pragmatic task connected to topic is to identify the variation of which the speaker/writer picks out a state to be shared with the listener/reader. The comment - or *focus* as I prefer - is ontologically a state: a temporary local occurrence of a configuration of stimuli that

specifies an affordance. The pragmatic task connected to focus is to pick out a state in order to satisfy the listener's/reader's presumed need to pick up the state of a variation. The relation between topic and focus is exclusive: by picking out an occurrence of a state type, occurrences of all the other state types in the variation are excluded.

This relation between the two tasks is a function in the sense described in section 3, that is, it is assumed to be one of the driving forces in the development of linguistic structures. Accordingly, this function forms the basis for a semantic analysis of an utterance. The semantic analysis is a claim that the pragmatic function is coded in a given language, i.e. that there is a conventional constraint between a linguistic structure in stimuli and a function so that if the structure occurs then the function is served.

6.3. The specification - a basic semantic structure

The semantic structure must be described on the basis of the component that enables the establishment of the described relation to the variation. This component is a limited set of linguistics forms. A model example is the RVR-set. It can be noted: RUNWAY VISUAL RANGE [*100, 200, 300, 400, 500, 600, 700, 800, 1000, 1200, 1400, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000, 3500, 4000, 4500, 5000, 5500, 6000*]. This is an activity-specific paradigm that makes it possible to differentiate between the state types of an activity-specific variation. The individual linguistic forms the paradigm is composed of are common. The linguistic form *three thousand* can be used across activities by virtue of a weak conventional constraint on the use of the form. The division and delimitation of the paradigm, on the other hand, are activity-specific (see also Raczaszek-Leonardi 2009: 667); this is determined by the need to distinguish between state types in order to control and select actions so that the goals of the activity are achieved and the values realized. Thus, in other activities, the visibility paradigm is different; this applies, for example, to scuba diving. Note that this difference does not indicate that the substance is unformed before language casts its shadow on it (Hjelmslev, 1993/1943), but, to the contrary, that the substance is formed and exerts pressure on the paradigm's form. This relation also means that a linguistic form obtains its semantic value by being a part of an activity-specific paradigm.

A very clear example of the attunement of paradigms to the niche is what rally drivers use to distinguish between changes in direction. The British club system includes, in addition to the direction paradigm [*right, left*], an angle paradigm [*one, two, three, four, five*], where one is the smallest and five the largest angle, and a paradigm for the change of radius [*tightens, opens*] indicating, respectively, that the radius becomes smaller and larger throughout the turn. These linguistic forms specify the speed that the curve

affords so that *one* affords the highest speed and *five* the lowest, and so that *tightens* affords deceleration and *opens* affords acceleration. The following quote by a rally driver indicates how carefully attuned the paradigm is relative to the affordances offered by the environment:

> If I hear "three left opens" I will punch the throttle before the apex and start sliding wider as we go past the blind spot. If all goes well, we will save a little time; if the co-driver has made a reading error or I've made a description error we will certainly go off the road. (Andrew Comrie-Picard, a professional rally driver)

The quote also reveals the mechanism behind the attunement of the paradigm: There are external criteria for understanding.

These paradigms, one might add, have been the object of metalinguistic communication within the activity; but this does not mean that they are determined by the metalinguistic communication. A study of the language use of a semi-professional cycling team during a stage race (Borchmann, 2015) reveals that there are a number of carefully attuned paradigms. For example, a paradigm for differentiating the topographical effect on wind speed (see example 5), and a paradigm for differentiating wind direction relative to road direction. None of these paradigms has been the object of metalinguistic communication; they simply emerge in the performance of the activity. Nonetheless, paradigms, however locally and periodically stable they may be, are, of course, changing over time, and the division and delimitation of a paradigm can be more or less fuzzy depending on the goals, risks, values and developmental stage of the activity. This is an essential feature of paradigms as a temporary result of an ongoing attunement to - and contribution to -niche construction processes (see section 3).

Even if the division and delimitation of the paradigm is determined by the variation, there is not necessarily a one-to-one relation between the linguistic forms of the paradigm and the state types of a variation. Thus, two different linguistic forms can pick out an occurrence of the same state type. In the situation of utterance 7, the linguistic forms *three thousand* and *three thousand five hundred* will indicate an occurrence of the same state type. In this case, the relation between the linguistic form and the state type is determined by a limit value. This limit may differ from situation to situation. This feature of the paradigm is related to the fact that the performers of the activity need to use paradigms across situations within the activity. A paradigm must, in other words, be *effective* (Barwise & Perry, 1983). However, an occurrence of a linguistic form that forms a part of a paradigm will always pick out a state. There is, thus, a conventional constraint between a linguistic form within a paradigm and a state type, but it is unilateral like the material implication: if linguistic form, then state. This constraint is the semantic *value* of the linguistic form.

Based on this component, the semantic structure of utterance 4 can be described as follows: By using a linguistic form within a limited set of linguistic forms used for differentiating the state types of a variation, all the other linguistic forms within the paradigm are excluded as non-informative. That is, in language use that forms a part of activities scalar implicatures are not *conversational* (Grice, 2001/1975; Levinson, 2000), but conventional.

If we look at example 7, we can see that the semantic structure is realized syntactically so that the variation RVR is identified by the head of the grammatical subject, and the semantic value that picks out the state is realized as predicative. Such sentences have been considered categorical in the tradition (Lyons, 1977) and analysed semantically as predications. The crucial point in the alternative description presented here is that this is not a categorical utterance, and that it is misleading to analyse it as a predication. First, what is identified by the headword (*RVR*) of the grammatical subject is not assigned to a general concept, class or category. What is identified with the headword is the most general in the sense that it *includes* the unique entity picked out by the predicative. Second, the term related to a particular entity is not the subject-term, but the predicative. The semanticist might, perhaps, be tempted to say that the relationship is inverse: that what is indicated by the predicative is placed under the general term indicated by the grammatical subject. However, the unique entity picked out by the predicative is not placed under a general term; it is already placed, so to speak. It is a predefined option in a limited, predefined set of possibilities. In order to distinguish the described semantic structure from the predication, I will use the term *specification*.

The specification includes two constituents. One is a linguistic form that identifies a variation; the other is a linguistic form that specifies an affordance. In fact, none of these are *references*. What makes variations ontologically distinct is that they exist through occurrences that exclude each other. Thus, you cannot pick out a variation in any accurate sense of the term reference (Clark & Bangerter, 2006; Reimer & Michaelson, 2017; Searle, 1969; Strawson, 1950; Sullivan, 2012). What you can pick out is a state. In other words, variations exist on different timescales than states: they cannot be perceived, but must be experienced over time. As to the epistemological status of activity-specific variations, the ability to differentiate the states of variations must be learned through action-perception feedback loops in the performance of the activity. Thus, when a variation is identified by words like *RVR*, it is misleading to call it a reference. It is rather a regulation of the listener's attention, a cue as to which specific, learned ability to differentiate states of a variation the listener should use in order to

pick up the information the speaker wants to share with the listener by means of the utterance. As James notes: "Large tracts of human speech are nothing but signs of directions of thought" (James, 1890/1950:253-254). This applies to words like *who*, *where* and *when*; but it also applies to more specific terms like *RVR*, *airspeed*, *temperature, height, wind speed, wind direction* and *drift*.

One might say that a speaker's identification of a variation points both ways: to the listener and to the world. It is an attempt to establish a relation between the listener's ability to differentiate states of a variation and the state of a variation. The semantic "content" of the word the speaker uses to identify a variation is, thus, neither an object or class of objects, nor a representation of an object or class of objects, but an *ability*. Borrowing a term from Reed, I will call an ability to differentiate states of a variation a *mode*, because it is "a mode of regulation of action and awareness appropriated by one person from among the regularities promoted in their populated environment" (Reed, 1996:177). As the variation is identified through a mode, the constituent that identifies the variation is called a mode cue. The *mode cue*, then, is a convention-based regulation of the listener's/reader's attention.

The constituent that specifies the affordance is called the *value*. There is an interesting merging of the algebraic, the ethical and the linguistic meaning of the word *value* in the description of language use that forms a part of activities: a numeric value such as 3000 is a value for good or ill when it forms a part of a linguistic paradigm that serves to differentiate affordances. Some might regard the relation between a linguistic form that serves to identify a unique occurrence, on the one hand, and a unique occurrence, on the other, as a reference. However, there are good reasons to avoid the term *reference*. First, the term is closely linked to predication, and thus to the idea of information as representation. Second, the use of the utterance units that typically realise a value, for example, *three thousand, masser* (*lots*), *helt åbent* (*quite open*), *44.3 cm, left* and *opens*, have been considered to be non-referential within semantics. Instead, one could say that the semantic value of a linguistic form is that it *replaces* (Wittgenstein, 1968/1953: §244) a configuration of stimuli that lawfully specifies an affordance. The conventional constraint, thus, is that the speaker/writer undertakes the obligation and can be held liable for the existence of an affordance, if he or she produces a linguistic form that conventionally replaces the configuration of stimuli that lawfully specifies he affordance.

The concepts mode, mode cue and value are semantic categories and are suggested as alternatives to the concepts 'subject'/'argument', 'reference' and 'predicate' in the semantic analysis of an utterance. We can now, at long last, make an informative and accurate analysis of the basic information structure of utterance 3:

It's [three thousand]VALUE [RVR]MODE CUE

Topic (identified via the mode): runway visual range
Focus (picked out by the value): three thousand

That is, the utterance is neither thetic nor categorical, but a specification.[4]

If we apply this analysis to a corpus of language use that forms a part of activities, a number of questions arise that cannot be answered within the limits of this article. In the final two subsections, however, I will attend to two issues regarding the linguistic realization of the specification: 1) Words that enable the identification of variations are not particularly frequent in some types of language use. Thus, in some utterances that specifies an affordance there is no mode cue. 2) An utterance can convey more than one value, and therefore more than one specification.

6.4. Identification pars pro toto

As we have seen, the specification can be realized syntactically in different ways. In (3) the mode cue is realized by the verb phrase (or predicate). In (7) the mode cue is realized by the noun phrase (or grammatical subject). These two examples have been carefully selected to illustrate the shortcomings of the established descriptions of natural language information structure. A more common realization of a specification in skilled performers' language use, however, is the following:

8. eighty (captain to first officer, US Airways Flight 1549, 2009)

The utterance originates from the cockpit of an airliner during a takeoff roll. By means of the utterance, the captain and the first officer share the value that can be read on the airspeed indicator in the captain's side of the cockpit, namely, 80 knots. Eighty forms a part of the paradigm AIRSPEED DURING TAKEOFF ROLL [*eighty, V1, rotate/VR*][5]. The aircraft is accellerating during the takeoff roll, and the three airspeed values of the paradigm will be read out by the pilot who is not flying as the airspeed increases. For example,

15:25:09 ((Takeoff engine power is applied))
15:25:20 Pilot not flying: eighty
15:25:21 Pilot flying: checked
15:25:33 Pilot not flying: V one, rotate
15:25:36 ((The aircraft lifts off))
(CVR transcript, US Airways Flight 1549, 2009)

[4] Dummy-subjects such as 'it' are not considered to be references to situations as suggested by Chemero (2011:140), but parts of the illocutionary frame indicating the illocutionary force (Hansen & Heltoft, 2011; Verstraete, forthcoming).

[5] It can be other values than eighty (e.g., hundred) depending on the type of aircraft and runway, and the paradigm can comprise other calls depending on the airline.

Each of the airspeed values specifies an affordance. Eighty specifies the possibility to reject the takeoff if an engine fire or a similar critical malfunction occurs. ”*V one*” specifies an obstacle for rejecting the takeoff, and, thus, that they have to take off even in case of an engine fire; *rotate* specifies an airspeed that produces sufficient lift for takeoff and, thus, the possibility for takeoff.

I have claimed that the specification is a structure that comprises two constituents, each performing a task: the mode cue identifies a variation, and the value replaces a state. Accordingly, the structure of the information conveyed by the utterance must be analysed like this:

Topic: airspeed
Focus: eighty

In so far as there is no formal representation of the identification of the variation, it seems that the semantic analysis of the utterance is misleading. However, it is precisely the activity framework and the concepts mode, mode cue and value that make it possible to describe utterances like these as complete.

The above realization of the specification can be explained by two conditions and a distinctive feature of a value. Firstly, performers of activities attend to certain variations at certain times. This is the criterion of the ability to perform the activity. In this case the ability to perform the activity comprises an airspeed mode. This means that both the captain and the first officer attend to the airspeed at the time of the utterance. Thus, an airspeed mode cue is redundant. Secondly, the speaker and the listener share the conditions for an information pickup; therefore, it is not necessary to communicate the conditions under which the state can be picked up. A distinctive feature of a value is that it forms a part of a paradigm. Consequently, there is a *pars pro toto* relation between an occurrence of a value and a paradigm. A speaker who chooses a semantic value, thus, can identify the paradigm *pars pro toto* - insofar as the listener is a skilled performer of the activity and therefore able to differentiate the states of the variation as well as the linguistic forms of the paradigm that serve to distinguish the states of the variation. Thus, "eighty" both identifies a variation and replaces a state.

According to this analysis, it is misleading to call holophrases like *eighty* elliptical or incomplete. Such characterizations are based on the assumption that the basic semantic structure is the predication. If, however, we analyse them as specifications, they are complete in every sense (see also Bühler 1965/1934:155-156; Raczaszek-Leonardi 2009:660).

6.5. Nesting

In the analysis of example (7), I ignored the part ”runway four right.” This part is, in fact, required when a controller issues an RVR value (FAA, 2010). But this does not apply to the pilots' communication about RVR. Here, the specification of the runway is typically left out (as in example 3), presumably because pilots already share information about which runway they consider to land on when they seek information about RVR. Thus, this part cannot be considered a constituent of an utterance that conveys information about RVR. However, the occurrence of the linguistic form *runway four right* does raise the question: which general function does this form serve, and how is it related to the function topic-focus?

I have described this function and the relation in detail elsewhere (Borchmann, 2015, 2016). Here I will restrict myself to the main points. In so far as a runway is a set of affordances, and in so far as these affordances change from runway to runway, the linguistic form *runway four right* can be analysed as a specification: [runway]MODE CUE [four right] VALUE.

When two specifications such as "runway four right" and "three thousand RVR" are combined in one utterance, it appears that they have different epistemic statuses: Specification 1 is dependent on specification 2, and specification 2 can be chosen by the speaker and is hypothetical, whereas specification 1 cannot be chosen by the speaker, but is determined as soon as specification 2 is chosen. In this case, the RVR-value 'three thousand' is dependent on the runway value ‘four right’. This prevails in the semantic constraint of the utterance: The speaker does not undertake the obligation that the state 4R can be picked up and thus that the affordances of 4R are available to the listener, but solely that if the state 4R can be picked up by the listener, then the state three thousand can be picked up. In other words, the relation between the two specifications corresponds to the material implication. In addition, the relation is characterized by a difference in priority: Specification 1, the dependent specification, is the one that picks out the information to be picked up by the listener. Specification 2 specifies the conditions for the information pick up. If the conditions for the information pickup are shared by the speaker and the listener, specification 2 may be omitted (see example 3 and 8). Specification 1, on the contrary, cannot be omitted as it is a constituent of an information conveying utterance.

The function of the specification of the conditions I have called *nesting*. In order to distinguish the specification that serves this function from the specification that serves the function of sharing information, I call the constituents of the former specification *nesting mode cue* and *nesting value*, and the constituents of the latter *sharing mode cue* and *sharing value*.

The relation between the sharing function and the nesting function is the message function. Utterance (7) can now be analysed like this:

[runway]NESTING MODE CUE [four right]NESTING VALUE [RVR]SHARING MODE CUE [is]NESTING VALUE [three thousand]SHARING VALUE

Topic: RVR
Conditional variation: runway, time
Message function: RVR as a function of runway and time
Conditional state: four right, now
Focus: three thousand

This relation between the two functions nesting and sharing is distinctive of sentence-based utterances that form a part of activities (Borchmann, 2015, 2016). Example 4, 5 and 6, thus, can be analysed like this:

og der [er]NESTING VALUE [masser]SHARING VALUE af [plads]SHARING MODE CUE til jer
// and there [is]NESTING VALUE [plenty]SHARING VALUE of [room]SHARING MODE CUE for you

Topic: room
Conditional variation: time
Message function: room as a function of time
Conditional state: within the current time frame
Focus: plenty

og [så]NESTING VALUE ANAPHOR [skyd]SHARING MODE CUE for helvede [ude]SHARING VALUE [fra]SHARING MODE CUE
//and [so]NESTING VALUE ANAPHOR [shoot]SHARING MODE CUE fucking hell [from]SHARING MODE CUE [outside]SHARING VALUE

Topic: shooting distance
Conditional variation: room
Message function: shooting distance as a function of room
Conditional state: plenty
Focus: outside

så er der [helt åbent]SHARING VALUE [herude]NESTING VALUE
//then there is [quite open]SHARING VALUE [out here]NESTING VALUE

Topic: topographical effect on wind speed
Conditional variation: locality

Message function: topographical effect on wind speed as a function of locality Conditional state: out here

Focus: quite open

Med en [100 grains]NESTING VALUE [Oryx]NESTING VALUE er der en [afdrift] SHARING MODE CUE på [44.3 cm]SHARING VALUE ved [5 m/s]NESTING VALUE på [300 meter]NESTING VALUE.
//With a [100 grains]NESTING VALUE [Oryx]NESTING VALUE there is a [drift] SHARING MODE CUE of [44.3 cm]SHARING VALUE by [5 m/s]NESTING VALUE at [300 metres]NESTING VALUE.

Topic: drift
Conditional variation: bullet weight, bullet type, crosswind speed, distance
Message function: drift as a function of bullet weight, bullet type, crosswind speed and distance
Conditional state: 100 grains, Oryx, 5 m/s, 300 metres
Focus: 44.3 cm

The analysis of the message function illustrated above is claimed to be an informative and accurate description of utterance patterns as action coordination devices. The analyses above support the assumption that the need to determine the state of a variation and share it with others in order to coordinate (non-linguistic) actions could be a driving force in the development of linguistic structures. Instrumentally, the analysis can be used to uncover the knowledge-how that *shows* itself in the practitioner's language use: The analysis identifies the practitioner's selection, differentiation and linking of information in the environment.

7. Discussion of the limitations of the approach and the alternative analysis

The requirement that there be external criteria for understanding is a limitation of the approach as a general approach to the functions of language. Because it implies a downgrading of certain types of language use even if they serve important purposes, for example, phatic communication (Jakobson, 1970; Malinowski, 1946/1923). This, however, is an inevitable consequence of applying a meaning criterion; one remembers Ayer's (2001/1936) *nonsense*, Austin's (1962) *void* and *parasitic*, Grice's (2001/1975) *violations* and Frankfurt's (2005/1986) *bullshit*. Perhaps it is therefore most appropriate to consider the criterion to be a guideline in studies, with special regard to closing the inferential gap between linguistic and non-linguistic actions.

Whereas the established descriptions of information structure are based on narrative language use, the alternative description is based on language use that forms a part of activities. The relation between these types of language use is described by Malinowski in the following way: "Narrative speech is derived in its function, and it refers to action only indirectly, but the way in which acquires its meaning can only be understood from the direct function of speech in action" (Malinowski 1946/1923: 313). The characteristic

'indirectly' points to an essential difference between narrative language use and language in action. It corresponds to the difference I have described with the distinction between the third-person perspective and the first-person perspective. Narratives imply a third-person perspective on action, and it is exactly this perspective that establishes the gap between what performers of activities attend to and the linguistic categories. Phylogenetically, there are, pace Tomasello, good reasons to assume that language in action is basic and narrative language derived. Ontogenetically, however, this cannot be taken for granted. It is an empirical question. But at least the alternative provides a new way to explore it.

The next crucial step in evaluating and developing the information structure analysis presented here is to determine what potential it has in the analysis of predications. This is also an empirical question, and an attempt to answer this question is beyond this article.

8. Summary

The starting point was a number of discrepancies between the established descriptions of the natural language information structure and language use that forms a part of activities. These discrepancies were traced back to the one-sided focus on static individuals within Western metaphysics. The focus on individuals prevails in the established descriptions analysis of the information conveyed by an utterance: a reference to an individual (Topic) and a categorization of the individual (Comment).

I have tried to solve these problems by proposing an alternative to this analysis. The alternative is based on the assumption that what we attend to is not static individuals, but variations, and that the basic cognitive unit is not a categorization of an individual, but a differentiation of states. I have defined states as information in a Gibsonian sense and argued that humans share states by means of utterances. This implies 1) that the pragmatic category Topic is a variation; 2) that the pragmatic category Focus is a state of a variation; and 3) that the basic aboutness-relation is a relation between a variation and an utterance that picks out the state of a variation. In order to distinguish between Gibson's law-based specifications and utterance-based specifications of affordances, I have described such utterance-based specifications as tool-mediated specifications of affordances.

As an alternative to the semantic categories *reference, subject/argument* and *predicate*, I have suggested the categories *mode cue, mode* and *value*. The sharing mode cue identifies the topic; the sharing value picks out the focus. The mode is described as an ability to differentiate the states of a variation; the mode cue is described as a conventional regulation of the listener's/reader's attention; the value is described as a conventional replacement of a structure in stimuli that lawfully specifies an affordance, with a linguistic form.

Finally, I have described the basic combination of specifications as a relation that corresponds to the material implication and involves a prioritisation of information: The consequent is the information to be shared by the speaker/writer and listener/reader by means of the utterance; the antecedent is hypothetical and specifies the conditions for picking up the information to be shared.

The central claim is that these analyses can solve the problem that characterizes the established descriptions of information structure, and close the gap between what humans attend to in the performance of activities and linguistic analysis.

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