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Abstract:

Languages and their varieties have been widely analysed on the level of speaker populations via corpora, but not on the level of speakers' cognition. An enactive-variationist research agenda is proposed that takes a complex-dynamical-systems stance.

Keywords:

complex dynamical systems, enaction, variety

Title:

An enactive approach to cognitive variationist linguistics. Tying together the individual, interactional and populational perspective in a complex-dynamical-systems view.

1. Introduction

The concept of a *variety* was substantially used and developed in the fields of variational linguistics and dialectology. In recent years the new discipline of perceptual dialectology emerged from these disciplines (Preston 1989). It is interested in the linguistic conceptualisations of speakers and their attitudes towards language variation. A striking discovery is, that some of the observed varieties by linguists seem to play no role in the perceptual realities of speakers (Krefeld / Pustka 2010, 22). The conclusion was that variationist concepts and findings cannot simply be transferred to the cognitive domain (ibid., 23). I will argue that there is a general incommensurability

between structuralist and cognitive approaches to language variation which is generated by different methodologies: on the one side the computer-aided comparison and description of linguistic experts and on the other side the communicative, interactional use of language variation by linguistic laypersons. It will become clear that the development of a cognitive variety-concept is still a research gap. I will argue that the traditional cognitivist paradigm is not suited to do this. It understands cognition based on the computer metaphor and therefore cannot deal with the meaning of human language (Harnad 1990). Language and its varieties emerged for meaningful communicative interaction (*pragmatic turn*). I will argue for the enactivist paradigm instead. It makes use of the living-organism metaphor (Maturana / Varela 1980) which shifts today's Cognitive Sciences in an action-oriented, embodied direction (Engel *et al.* 2016). I will show how a variety concept could be developed in this approach. In the following varieties are understood as cognitive complex dynamical systems bringing together the individual, interactional and populational levels of description. For each level, I will propose a sub-classification according to the ideas of Marr (1982) and Poggio (2012). This will be useful to differentiate the extensively used term *cognitive* in a systematic manner for the layer *implementation, representation, function, learning and evolution*. The result is a layered enactive complex-dynamical-systems concept of *variety* which is only in the beginning of being researched at length and can serve as a road map for the advancement of an enactive variationist research paradigm.

2. Problem of incommensurability of paradigms

In the structuralist expert view of linguists, a variety is a concept that emerges from the analysis of language data. The purpose of this practice is to measure, differentiate and classify written or spoken language material and to identify data patterns that correlate with social context factors. This is performed by trained experts who have an extensive declarative linguistic knowledge. The object of investigation is language data that is temporally and spatially decoupled from actual language use and stored in large corpora with data from many speakers. Computer-aided parallel statistical analysis of hundreds of transcribed forms leads to the construction of virtual varieties which are clearly not comparable to the practices of speakers when using language. The variationist methodology led to a form-fixated concept that understands *variety* in computational terms as a "set of linguistic items with similar social distribution" (Hudson 1996 [1980], 22) or as an *inventory* of elements and rules (cf. Schmidt / Herrgen 2011, 38). These concepts are evidently adequate and helpful in the context of the variationist methodology. However, their transfer to the

field of perceptual dialectology and the cognitive domain leads to distorted conceptions: These are that speakers could interact on the basis of variationist expert knowledge (ibid. 2011, 51) or actually *realize* forms of these methodologically constructed varieties (Berruto 2008, 189). It is just not plausible that speakers possess such declarative linguistic expert knowledge and methodology. But how do they conceptualize context-bound language variation? Speakers use varieties for the purpose of communication, perceive them as social signs and perform them as social practices. By this behaviour they indicate the communication styles of persons or groups (*social indexicality*, Glauninger 2012). Speakers therefore have primarily a procedural knowledge of language variation which they learn and use for the purpose of felicitous communicative action. They do not use linguists' techniques to analyse language but perceive language variation in real-time contexts, where they process variational signs to inform and perform their own real-time actions. In oral contexts language is transient. Speakers only have small-scale experience-based, sequential knowledge about other speakers' speech styles.

	linguistic experts	speakers
interpretation	<ul style="list-style-type: none"> - declarative expert knowledge - purpose: description and classification 	<ul style="list-style-type: none"> - procedural user knowledge - purpose: felicitous communicative interaction
task environment	<ul style="list-style-type: none"> - technical equipment - conserved language material - language spatio-temporally decoupled from context - broad, computer-aided, collected, parallel basis of comparison 	<ul style="list-style-type: none"> - no technical equipment - transient stimuli - real-time processing - small-scale experience-based, sequential basis of comparison

Table 1: Differences in the variety conceptions of linguistic experts and linguistically non-trained speakers regarding interpretation and task environment.

An additional limitation of the variationist methodology is that varieties have been analysed mostly on the level of speaker populations. This statistically-based notion of *varieties* and *languages* looks for similarities in the data. Although the results should be interpreted as probabilities, they have often been misconceived as certainties (and as a result as homogeneous *sets*, see above). But several studies show, that the (e. g. grammatical) knowledge in the same language

community may be vastly heterogeneous (Dąbrowska 2012). It seems to be constantly in dynamic change:

The notion of linguistic repertoire [...] refers to individuals' very variable (and often rather fragmentary) grasp of a plurality of differentially shared styles, registers and genres, which are picked up (and maybe then partially forgotten) within biographical trajectories that develop in actual histories and topographies [...]. (Blommaert / Rampton 2011: 4–5)

The axioms, methods and objects of investigation bring forth a paradigm's concepts (e. g. the concept of a *variety*). These (mostly) cannot be transferred to other paradigms (*incommensurability*, Kuhn²1976). Therefore it is not enough to frame the differences between variationist and cognitive conceptualisations of *variety* as a difference in *etic* vs. *emic* perspective as suggested by Krefeld / Pustka (2010). A cognitive variationist linguistics which is concerned with speakers' perception and performance cannot borrow structuralist concepts but must develop cognitive concepts on its own.

3. Argumentation for an enactive cognitive framework

The emerging field of cognitive variationist linguistics, inspired by a speaker-oriented perceptual dialectology, currently faces two challenges: the terminological legacy of the slowly fading mainstream cognitivist paradigm and a lack of methodology. In this chapter I will compare the cognitivist and enactivist paradigm of cognition and argue for the latter to model varieties. Existing cognitive research on language variation has been carried out mostly in the cognitivist paradigm. This framework tried to model human cognition according to the computer metaphor. The human speaker is modelled as a computational machine, processing input and producing output (e. g. Fodor 1983). Although this approach was successful in modelling many aspects of human cognition, it fails to resolve the symbol grounding problem (*SGP*, Harnad 1990):

How can the semantic interpretation of a formal symbol system be made intrinsic to the system, rather than just parasitic on the meanings in our heads? How can the meanings of the meaningless symbol tokens, manipulated solely on the basis of their (arbitrary) shapes, be grounded in anything but other meaningless symbols? The problem is analogous to trying to learn Chinese from a Chinese/Chinese dictionary alone. (Harnad 1990, 335)

The SGP shows that computers are unable to interpret the meaning from linguistic form without human-like representations (Glenberg / Mehta 2008). They lack human *cognitive grounding*: the association of linguistic form with bodily states of biological human organisms and their shared social experiences (Barsalou 1999) resulting in *modal symbol systems*:

Subsets of perceptual states in sensory-motor systems [of living human organisms] are extracted and stored in long-term memory to function as symbols. As a result, the internal structure of these symbols is modal, and they are analogically related to the perceptual states that produced them. (Barsalou 1999: 578)

In the seminal neurocognitive study Pulvermüller (2005) identified correlates of respective motor activations, when subjects perceived the words *kick*, *pick* and *lick*. How should a computer that has no organic human body be ever able to interpret these words in an *embodied* way without having a human body and the possibility to access its system-states? The cognitivists immunisation strategy to this problem is that higher levels of meaning, like abstract nouns, would not require the living body. The neglect of the living body is according to Zlatev (2013) a central failure in any scientific account and brings forth extreme positions like the modularity of mind (Fodor 1983) in the cognitivist paradigm.

[But] “higher levels” of meaning, communication and intersubjectivity presuppose lower ones: evolutionarily, developmentally, but also “synchronically”. Meaning and communication are rooted in the biological, lived and signification bodies interacting with their respective “worlds” [...]. This is important since neglecting the body in theorizing leads to distorted accounts involving at one extreme beliefs in innate “language organs”, and at another extreme, claims that “everything is a text”. (Zlatev 2013: 546)

Therefore, any cognitive approach to language variation should include the body at the axiomatic core of theory. The cognitivist paradigm faces yet another problem. The pragmatic turn in Philosophy and Linguistics now arises in the Cognitive Sciences. Wittgenstein (2006 [1953], *Philosophical Investigations* § 43) and Bühler (1934, 52) had claimed that language is always used *empractically* in contexts of human action. By just modelling the processing of language

computationally the cognitivist paradigm misses the central interactional-communicative purpose of language use. Inspired by ideas of Maturana / Varela (1980) the enactivist paradigm focusses on cognitive processes in relation to the external world:

[E]naction asserts that cognition is a process whereby the issues that are important for the continued existence of a cognitive entity are brought out or enacted: co-determined by the entity as it interacts with the environment in which it is embedded. Thus, nothing is 'pre-given'. Instead there is an enactive interpretation: a real-time context-based choosing of relevance. Cognition is the process whereby an autonomous system becomes viable and effective in its environment. (Vernon / Furlong 2007: 58)

This shift towards an action-oriented, embodied view (Engel *et al.* 2016) where human speakers *enact* not only their biological bodily but also their social world (Zlatev 2013) seems to be an adequate approach to study language variation when we are interested in the conceptualisations of speakers. These are not conceptualized as computers but as living, autonomous, learning, acting, cognitive agents (cf. Takáč / Šeřfránek 2012, 251). How could varieties be modelled in such a framework?

4. Variety as a complex dynamical system

What is a variety in the enactive view? From an enactivist position language systems are constructed by individual speakers when they engage in communicative actions with other speakers of a community of practice. Shared communication systems are not primarily due to genetically predisposed universals. They are mostly the cultural result of frequent communicative interactions of speakers (Steels 2011) who share similar biological human bodies and social collaborative task environments:

In the enactive paradigm, linguistic behaviours are at the intersection of ontogenetic and communication behaviours and they facilitate the creation of a common understanding of the shared world that is the environment of the coupled systems. That is, language is the emergent consequence of the structural coupling of a socially-cohesive group of cognitive entities. Equally, knowledge is particular to the system's history of interaction. If that knowledge is shared among a society of cognitive agents, it is not because of any intrinsic abstract universality, but because

of the consensual history of experiences shared between cognitive agents with similar phylogeny and compatible ontogeny. (Vernon / Furlong 2007: 59)

As pointed out by Vernon / Furlong (2007), the coupling of speakers through communication and other collaborative behaviours is the link to understand the dynamics of language and its varieties. This goes beyond traditional research with a focus on a) the individual in cognitive linguistics or b) the population in variationist linguistics. Varieties must additionally be investigated at the interactional level, but even more should be understood as a complex dynamical system comprising all three levels.

4.1. Individual, interactional and populational level

It is important to note that the enactive paradigm is not restricted to the interactional level only, it connects the individual and the populational level: Speakers' individual concepts of varieties are closely related to variety use with members of the same and in contact with other groups. This relationship can be modelled as a dynamical network. Speakers are the nodes that are connected by social relations and communicative interactions to other nodes. Speakers mutually invent and learn new words, phrases, grammar etc. in conversations which they store individually and which propagate by communicative interactions with others through the network. If communicative behaviours happen frequently and repeatedly in a robust network of people who perform common practices (e. g. working as researchers in the field of variationist linguistics) their cultural language practices will become typical for that respective network (Prochazka / Vogl 2017). To represent these dynamics in one model, all three levels, *individual*, *interactional* and *populational* should be connected and understood as a *complex dynamical system* (Strogatz 2001): a dynamical network of speakers interacting with and learning from each other.

4.2. Layers of analysis following Marr (1982) and Poggio (2012)

The term *cognitive* has been used for a lot of different phenomena on different levels of description. The result is that there is sometimes a misunderstanding in communication between researchers in the field of cognitive linguistics. Marr (1982) introduced a differentiation for the term *perception* on the individual level in *computation*, *representation/algorithm* and *implementation*. "Trying to understand perception [in our case the perception of varieties] by studying only neurons is like trying to understand bird flight by studying only feathers: It just cannot be done"

(ibid., 27). Poggio (2012) added two more layers to it: *learning* and *evolution*. Table 2 gives the example of how mathematical addition would be understood on the respective layers.

evolution	addition as an evolving practice
learning	mechanisms and processes of how addition is acquired
computation	the function of addition
representation and algorithm	the representation of ‘nine’ in binary (<i>1001</i>), decimal (<i>9</i>) and roman numbers (<i>IX</i>) and the different operations of <i>adding</i> in these different systems
implementation	electronic calculator / organism

Table 2: Layers of cognitive analysis illustrated at the example of mathematical *addition* (cf. Marr 1982 / Poggio 2012)

To apply this differentiation on enactive variationist research will help to enhance the communication between researchers and connect the field with other disciplines more easily.

4.3. Combination of levels and layers to a matrix

For the enactive complex-dynamical-systems view of varieties, the layers of Marr (1982) and Poggio (2012) are applied to the individual, interactional and populational level resulting in 15 subfields of analysis.

levels by Marr (1982) and Poggio (2012)	complex dynamical systemicity		
	individual level	interactional level	populational level
evolution			
learning			
computation			
representation and algorithm			
implementation			

Table 3: Combination of the individual, interactional and populational levels with the layers of Marr (1982)/Poggio (2012) resulting in a matrix for an enactive research agenda of understanding *language* and *varieties* as complex dynamical systems.

The matrix in table 3 represents extensive research for an entire paradigm of enactivist cognitive-variationist linguistics. *Varieties* which are conceptualised as a complex dynamical system can be investigated from all the resulting 15 subfields with its own objects of investigation, methodology and research questions. When enactivist researchers speak about a variety, they will be able to indicate a) on which level in which subfield their research is situated and b) which role their research plays with respect to adjacent subfields and with respect to the overall complex dynamical system. For specialist it is important to keep in mind to make their research intelligible for specialists in other areas.

5. Objects on investigation and research questions

In the following sections the content for the respective cells in the matrix are addressed: the respective objects of investigation, methods and research questions. Although, it is not possible to give a comprehensive overview of existing research, research gaps and methods for all the subfields. For a more detailed presentation and discussion see Ahlers (2018). Also, the paradigm is quite young. Most of the existing research has addressed *language* in general terms and rarely *varieties*. Hence, I will focus on developing research questions and presenting objects of investigation. This will help structuring the emerging field and suggest a road map for future enactive language variation research.

5.1.1. Individual level of analysis

On the individual level, the object of investigation is a) the body, brain and mind of individual speakers and b) their external task environments are. Subdivided by the layers of Marr (1982) / Poggio (2012), the *implementational* analysis of varieties happens at the level of neurons and neural networks. The *representation* of varieties are modal symbol systems consisting of form-concept pairs that include variety typical forms, concepts and contextual associations: The representation of meaning of linguistic forms is analysed in an embodied account (Pulvermüller 2005) where perception and production of language are in close connection to the conceptual system as modal perceptual symbols. Algorithms concern the mechanisms of mental simulations (Barsalou 1999 and 2008) and physical actions (e. g. Ahlers / Fink 2017). On the *functional* level, varieties are for communication but also in the tradition of Vygotsky (2002 [1986]) cognitive tools. The function of variational perception is the categorization of other speakers' utterances in real-time situated action. This includes knowledge activation and information gathering about the possible

social background of others (status, knowledge, cultural practices, goals, attitudes etc.). The function for production is the adequate choice and performance to realize communicative goals in interactions with others. On the layer of *learning*, individual acquisition and memory mechanisms are investigated, e. g. statistical, declarative or procedural learning. These allow on the *evolutional* level the development variational knowledge creation and diminution.

5.1.2. Interactional level of analysis

On the interactional level the object of investigation is the verbal communication, a joint activity of speakers. These are *implemented* in the communicative couplings of speakers in mutual task environments. The interactional level is at the core of the enactivist approach. “[The] enactive proposal is participatory and dialectical: there cannot be interaction without individual participants whose roles, skills and higher forms of autonomy and cognition could not exist without and are shaped by social interaction” (Di Paolo / De Jaegher 2012: 13). Communicative couplings are introduced by ostensive signals (e. g. eye-gaze) which activate the others attention on the neural level (Frith / Frith 2010: 169). The further question of “how [do] speakers and addressees take one another into account while they are processing language[?]” (Brennan *et al.* 2010: 301) is answered by mechanisms that are implemented at the individual level of cognition but work mainly for interactions: e. g. mirror neurons as a bottom-up approach to mutual understanding (Rizzolatti / Sinigaglia 2010) and neural top-down structures that relate to the representation of others’ intentions by inductive reasoning (*theory of mind*). The *representations* are speakers’ jointly produced conversations. These are interactional means (e. g. question-answer pairs) established by the speakers *ad hoc* or as shared linguistic patterns that recur in the practices of the community (Selting / Couper-Kuhlen 2001; Friston / Frith 2015). Conventionalised practices facilitate the co-creation of mental simulations in the coupled speakers and the interpretation and performance of community-specific styles.

“Sociolinguistic (or cognitive) variation” usually refers to transient stylistic differences in speech. In this case, speakers share a model of what their choices of register say about themselves and make different choices of self-representation in different social contexts. For example, they may choose to show solidarity with other members of their social group in one setting and compete for status in another. (Boster 2001: 217)

On the level of *learning* the mechanisms and outcomes of communicative coupling-processes are the object of investigation: e. g. mechanistic *structural priming*, *accommodation*, intentional *synchronization* and *communicative grounding* (for an overview see Ahlers 2018). The level of *evolution* addresses the linguistic choices and the development of mutual linguistic sign repertoires within and across conversations.

5.1.3. Populational level of analysis

On the populational level the object of investigation of communities of linguistic practice. The *implementational* comprises networks of speakers and the history of their interactions. The *representation* of varieties are intersubjective conventionalized repertoires of language signs and normative expectations about their use. These are embedded in the cultural practices of the respective community. The *function* on this level is effective verbal communication for the whole community: effective couplings of even unacquainted speakers of that community. *Learning* of varieties happens through intergenerational transfer, and through the development of varieties in frequent and recurring conversational couplings of community members in close interdependence with mutual group practices. The cultural *evolution* of varieties emerges through dynamics in the network activities of the respective community. It should be noted that a community of practice is not to be seen as one encapsulated group of speakers with few connections to other communities. According to the transcultural position (Welsch 1999), speakers in modern societies are involved in many different communities of practice and know various registers, styles and varieties.

5.4. The complex-dynamical-systems matrix

In the following overview, research questions and objects of investigation are presented in a matrix style to recognise differences and interdependencies between levels from the complex-dynamical systems perspective. Researchers in one subfield should aim for results that do both: a) advance knowledge in the respective subfield and b) make the results applicable and relevant to adjacent subfields and the overall complex-dynamical-systems view.

levels	complex dynamical systemicity		
	individual level	interactional level	populational level

evolution	How does perceptive and productive variety knowledge evolve and develop throughout a speaker's lifetime?	How does language and shared variety knowledge evolve and develop in conversation?	How does variational knowledge evolve and develop in and between communities of practice?
learning	How is variety knowledge acquired regarding perception/production? Which implicit/explicit processes occur in learning a second variety?	How are varieties learned in communicative interaction? Which implicit/explicit processes occur in joint sense-making/communication?	How are established varieties transferred to new members within and across generations?
computation	Which function do varieties have on the level of individual cognition? What are the effects of variety perception and production on individual thought and behaviour?	Which function do varieties have on the interactional-communicative level of cognition? Why and how do speakers handle perceived variation/perform it in joint communication activities?	Which function do varieties have on the level of speaker populations? Why and how are varieties used in social contexts?
represent. / algor.	How are variation phenomena represented in the individual mind? What are their cognitive representations and mechanisms?	How is variation represented in conversational speaker interactions? By which joint operations are they instantiated?	How is variation represented in communities of practice? Which social operations produce and control them?
implement.	How are varieties implemented on the level of neurons, neuronal networks and brain structures?	How are varieties implemented on the level of interaction in conversations?	How are varieties implemented in speaker networks/communities of practice?

Table 4: Matrix of the enactive language-variation paradigm filled with research questions for the respective subfields.

levels	complex dynamical systemicity		
	individual level	interactional level	populational level

evolution	cognitive maturation and cultural development of variational knowledge (sign repertoires)	development of conversations and mutual variational practices	cultural evolution of varieties and the emergence of network activities of communicating speakers
learning	depending on the context (acquisition, learning, contact): e. g. associative, statistical, (un-)supervised, inductive, corroborative learning	joint action / communication behaviour: e. g. alignment, mutual priming, communicative grounding, imitation	recurring variational linguistic communication behaviour in networks of speakers / communities of practice
computation	variety as a communicative and cognitive tool, categorial perception and production of socio-semiotic variants, mental sense-making and enacting linguistic action	variety typical communicative coupling, build-up of normativity expectations, joint communicative empirical action, mutual sense-making in conversation	smooth communicative couplings with unacquainted speakers within/between speaker communities that match task environments and social practices
represent. / algor.	hybrid, with other varieties connected modal symbols systems (simulators) connecting the language and the conceptual system.	linguistic means and patterns of interactionally bound utterances in conversations facilitating the mental couplings of speakers	normatively expected, intersubjective, conventionalised variational linguistic sign repertoires spread in communities of practice
impl.	neurons / neural networks / human organism	coupled speakers in conversations	networks of speakers (communities of practice)

Table 5: Matrix of the enactive language-variation paradigm presenting objects of investigation for the respective subfields.

6. Summary

Recent research in perceptual dialectology, that has been interested language variation from a speakers' perspective, noted that the term *variety* as developed in the structuralist field of variationist linguistics/dialectology could not be transferred to the cognitive domain. I analysed this problem as a matter of incommensurability of paradigms. Structuralist-variationist and cognitive research on language variation differ in a) objects of investigation and b) in methodology. The

result is that *variety* means different things for linguists and for speakers. The development of an adequate cognitive approach to language variation was identified. To investigate and model language variation adequately from a speakers' cognitive point of view, I argued for a shift from a cognitivist to an enactivist approach by addressing the symbol grounding problem. The enactivist framework is more suitable as it models speakers not as computers, but as living, autonomous, learning, acting, cognitive agents with social needs. I presented a complex-dynamical-systems view of language variation to connect loose strands of research on the individual, interactional and populational level in one unified model. To get a better overview of the different subfields of cognitive research, I introduced the descriptive layers of Marr (1982) and Poggio (2012). The result is an overview of sub-fields in form of a matrix. This might be helpful to better connect ongoing specialized research to neighbouring sub-disciplines and to facilitate more intelligible research that might contribute more effectively to research on the complex-dynamical-systems level. This systematic approach might function as a road map for an enactivist research paradigm on language variation by identifying new relations between subfields and by bringing forth new research questions, methods and new integrative approaches to tackle the enactive complex-dynamical-systems view of language variation in a joint effort.

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