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Metaphors Octopuses Live By? – A Cognitive Zoosemiotic Survey on Behavioral Mimicry as Evolutionary Contribution to Conceptual Metaphor Theory

Original Study

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Abstract: I adopt Conceptual Metaphor Theory (CMT) as a cognitive linguistic concept in a zoosemiotic framework to study behavioral polymorphic deception in Thaumoctopus Mimicus. This offers new analytical tools to zoosemiotics and may inform and underpin CMT from an evolutionary standpoint. The lack of studies on metaphorical thought in non-human animals, despite urgent calls for more diverse multimodal examples exbodying cross-domain mappings, reveals a strong anthropocentric bias in cognitive linguistics. A comprehensive theory of language, however, should be consistent from a diachronic and phylogenetic angle.

The paper addresses how and for what metaphor, as an embodied cognitive phenomenon, may have emerged evolutionarily. It is posited that metaphor could have been present in animals before it became engrained in verbal language. This possibility is particularly relevant if we consider that lexical knowledge is not a prerequisite for metaphoric meaning-making, as the basic claim of CMT. I discuss that findings indicating embodied metaphoric processes in animals provide substantiation for cross-domain mappings as residing in cognitive systems.

Keywords: Phylogenesis of Cross-domain mappings; Embodied Cognition; Metaphoricity in Zoosemiotics; Behavioral Polymorphic Deception; Impersonisation and Interpersonality

INTRODUCTION

A substantial body of research suggests that metaphor as a cognitive process is primarily a matter of thought and a tool for general sense-making of multimodal experiences[1], and only secondarily a matter of language (e.g., Zlatev et al. 2021, 46). In addition to this, Gallese and Lakoff (2005, 456) specified that:

> [l]anguage exploits the pre-exist multimodal character of the sensory-motor system [from which] follows that there is no single 'module' for language – and that human language makes use of mechanisms also present in nonhuman primates.

Hence, in cognitive linguistics (henceforth CL), human language is understood as having "emerge[d] from general cognitive mechanisms and processes" (Evans, Green 2006, 501) that already existed prior to and independently of verbal language. It is in this context that the paper explores whether it is possible that conceptual metaphor (henceforth CM) is one such prelinguistic process.

Metaphoricity in the cognitive realm refers to "cross-domain mappings or correspondences between two conceptual domains"[2] (Evans, Green 2006, 286) of experience, which are abductively judged as partially sharing analogue properties, even though one is typically elusive and the other concrete. For a comprehensive overview of metaphoricity I refer to Forceville, Urius-Aparasi (2009), Gibbs (2005), Givón (2002), Johnson (1987), Kövecses (2016), Langacker (2008a), Lakoff (1987, 1990), Lakoff, Johnson (1980) Lemmens (2015), Mandler (1994, 2007), and Vicente (2020).

Given that a) "[s]imple metaphorical thought is learned prior to, and independent of language" as posited by Lakoff (2014, 5) and b) that studies on (potential) cross-domain mappings in non-human species (e.g. Dahl and Adachi 2013; Gómez-Moreno 2014, 2019) have so far been overlooked by cognitive linguistics, there appears to be a strong anthropocentric bias in CL regarding metaphoric cognition.

Since we are talking about a kind of neural activity that must have been fundamental and ubiquitous enough to become reflected in gestural and verbal language, Conceptual Metaphor Theory (hereafter CMT) may profit from a diachronic look at its own object of study. How did metaphor, as a cognitive phenomenon, emerge evolutionarily? We cannot, of course, travel back seven million years and examine the cognitive capacities of a common ancestor of humans and other primates. However, elaborating on a), the possibility that other species living today perform simple metaphorical thinking does arise and should not be ignored.

Thinking about the phylogenetic age of metaphor would provide valuable insights for a CL perspective on language development, especially when the assumption that "metaphor is not just a matter of language, but of thought and reason [and that] [l]anguage is [only] a reflection of the mapping" (Lakoff 1990, 49) was reinterpreted as: metaphor was probably a matter of thought and reason, *before* it became a matter of language as a semiotic sign system. Briefly put, "[n]on-verbal and multimodal metaphors bring biology into the picture" (Gómez-Moreno 2020, 175).

That we are biologically just one more animal species implies that our neural substrates are not structured to operate with qualitative differences from those of other animals, but via gradual ones. CM probably did not emerge all of a sudden as an entirely new capacity in man but evolved along a cognitive scaffolding[3]. Hoffmeyer and Stjernfelt (2015, 22) remind us of the fact that "[a]s always when evolution is concerned there is no distinct event where [XY] happened but rather a gradual change towards [XY]".

It is more likely that the ability to recognize and work with the parallelism between two different perceptual events was recruited from already existent neural organizations during the diachronic development of human language, rather than a metaphorically organized semantic memory arose in one fell swoop in our species. Therefore, it is necessary to look for prelinguistic metaphorical cognition beyond the genus Homo. The discovery of basic cross-domain mappings in non-human species would provide a strong argument for the archaic quality of metaphor as a useful cognitive tool for processing, organizing and responding to perceptual events.

Gómez-Moreno (2020, 177) explains that "cognitivist metaphor research is in need of rigorous analysis of the role of non-verbal and multimodal metaphors in subject-oriented […] specialized knowledge fields". In his pioneering zoosemiotic approaches to behavioral mimicry in the Indo-Malayan octopus subspecies *Thaumoctopus mimicus* (2014; 2019), he considers cross-domain mappings as a plausible psychological explanation for this animal's sophisticated impressions of various marine organisms (2014, 423-424; 2020, 187-203), such as banded sea-snakes, lionfish, soles, and others that co-occur in its environment.

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[1] The adjective "multimodal" serves to highlight cognitive linguistics' finding that conceptual metaphor can incorporate information from the diverse sensory channels (hearing, vision, touch, taste, smell) and simultaneously "can be manifested in [these] various modalities" (Cienki 2008, 20, further recommended readings: works on gestures representing abstract notions).

[2] In cognitive linguistics, the term 'domain' is used to refer to conceptual, content-rich experiences in a uniform way (Langacker 2008a: 44). Research does reflect on the terminological vagueness (cf. e.g. Zlatev et al. 2021), whereby a phylogenetic account of metaphor might mediate.

[3] Analogue to 'semiotic scaffolding', which refers to the expansion of the complexity of sign systems and is thus "a key element in evolutionary processes" (Hoffmeyer 2015, 154; cf. also: Hoffmeyer, Stjernfelt 2015; Maran 2015; Maran, Kleisner 2010).

The way in which the 'Mimetic Octopus'[4] mimics the coloring, anatomy, and swim mechanics of its model species (in their absence), as a strategy to systematically frighten off specific predators, differs significantly in internal structure and complexity from other cases of Batesian mimicry[5].

As Gómez-Moreno's studies show, a less scientistic but more thorough psychological account of the octopus's deception, which I call 'behavioral polymorphic mimicry' (BPM), is possible. By behavioral and polymorph mimicry I mean a purposeful engagement, learned through experience, in modelling a variety of phenotypic appearances through actively controlled movements or color changes that are not caused by the genotype of the species (as is the case, for example, with eye spots on butterfly wings, leaf-tailed geckos, stick insects, anglerfish, wasp-like flies, and even chameleons). This type of deceptive mimicry requires the understanding and goal-oriented exploitation of other species' communicational signals and draws on the animal's agency. How are these holistic impressions developed and realized?

This text points out that imitations of various venomous marine organisms could be induced by bi-directional cross-domain mappings between the visual categorical perception of the physics of other marine animals and the familiar kinesthetic knowledge of the mimic's own body parts. That hypothesis will be discussed in detail and is shown to be not at odds with the directionality of metaphors when regarded from an evolutionary perspective – suitable for mediating between neuroscience and CMT.

It is not easy to understand what is going on in a being's body-mind system, but its sign usage could provide insights into the underlying semiotic logic and embodied cognitive capacities that allow it to derive relevant meaning from its world and act upon it.

An important caveat to be made is that we cannot expect that the cognitive organization of an octopus can be classified 1:1 within the frameworks of cognitive architecture that we are familiar with. Our cognitive infrastructure may differ greatly from those of octopuses. This difference arises from our distinct bodies, environments, and conceptual systems. To be exact, we cannot even claim that octopuses have conceptual systems, which presents a challenge when using propositional language. Non-lexical knowledge, though, also does *not* equate non-conceptual knowledge. This underscores the importance of zoosemiotics: the task of finding effective ways to discuss the cognition and meaning-making abilities of diverse organisms. I therefore speak of '*cognitive systems*' in a more general sense and aim to approach animal behavior from such a cognitive zoosemiotic perspective that enables an appreciation of the phenomenological ways in which they perceive and behave.

Gómez-Moreno (2020, 203) "encourage[s] biology scholars to open up new lines of investigation towards finding evidence of reflective, and perhaps, metaphoric reasoning in non-human species". The same, as I see it, should apply to CL. "[L]ittle has been written about the metaphoricity of zoosemiosis […] from a cognitive linguistic point of view", he explains (2020: 187). This pursuit implies adopting contents from CL to discuss them in zoosemiotic research, which needs to be undertaken with due caution and consideration but in turn then may inform contemporary CL from an evolutionary standpoint.

Building on Gómez-Moreno's theory, I investigate whether the capacity for sophisticated imitation of the cephalopod in question is induced by a conceptual understanding of its own body *in terms of* otherness – which would imply cognitive metaphorical mappings in the format of for instance "MY TENTACLES ARE A SEA-SNAKE; MY HEAD IS A ROCK or "MY BODY IS THE BODY OF A STING RAY (including: ONE OF MY ARMS IS THE STING RAY'S STING)". In this sense, this species' behavior could be understood as a physiological realization or, in Mittelberg's (2013; cf. also Olteanu 2021) terms, an "exbodiment" of metaphoric thought[6] that may enable this behavior.

Suggesting that the ability to recognize correlations between modally-distinct perceptual events is a widespread cognitive capacity (e.g.: warmth and affection; upright body posture and defense; etc.), I believe that it has been available for a long evolutionary time span and lent itself for recruitment during diachronic language development. This position contrasts with the idea that metaphorically structured semantic memory emerged suddenly in our species (cf. 3.1). This, of course, is no explicit claim of CMT research but since to my best knowledge it has not approached this issue yet, I cannot help but perceive it as an implicit one. It is not the task of linguists to investigate animal cognition but when such an out of the box thought may bring around new material for an existent topic, it is better to address it. The investigation below suggests that metaphorical thinking may have generally evolved as a cognitive tool to aid survival and communication. The "reasoning" probably was there before words were.

To pursue this examination, I later adopt Peirce's tripartite model of sign relations in instances of signification,

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[4] In scientific and everyday discourse, Thaumoctopus mimicus is usually referred to as the 'mimic octopus'. However, throughout this article, the terminology "Mimetic" as coined by Gómez-Moreno (2019) is adopted instead. In his argumentation, the word points towards a more complex, sophisticated and "conscious" form of mimicry than for instance the one chameleons are capable of – and it will be a main issue of this paper to explain why such a distinction is appropriate. For a thorough discussion of (self-) consciousness in octopuses, see Gómez-Moreno (2019).

[5] Details in 2.1.

[6] While Mittelberg (2006, 298) found that the reasoning via conceptual metaphors in concert with "mental imagery, knowledge structures, and bodily experiences" is externalized (exbodied) in gesture, Olteanu proposes to transfer this terminology of the "body as that which externalizes the mind" (2021, 787) to the discipline of biosemiotics, where it fits into the discourse on Uexküll's Umwelt theory and the pluralistic approach. Let us see what we can deduce from the fusion of their ideas.

representation and communication as it has been done in some zoozemiotic approaches (Martinelli 2010, 1; Maran 2017, 6). This framework allows for the identification of metaphoric structures in the modelling processes of organisms, in dialogue with state-of-the-art CL. In what follows, I present the cognitive zoosemiotic programme and CMT as the two areas of science needed to spearhead a cognitive semiotic study of the deceptive behavior of the 'Mimetic Octopus'.

The paper is structured in the following way: The theoretical argument developed in the first section is supplemented by the zoosemiotic case study (section 2), which constitutes the empirical grounding of my hypothesis. The data resulting from this investigation lead to an in-depth discussion of their implications for CMT as a pillar of CL (section 3). In short, this analysis thoughtfully incorporates a zoosemiotic-themed centerpiece within the framework of a CL study.

1.1 HOW COGNITIVE LINGUISTICS CAN INFORM BIOSEMIOTICS AND VICE VERSA

Both for CL and biosemiotics, the body is crucial. The latter by its very nature navigates and mediates between the natural sciences and the humanities. It values and elaborates on knowledge of biology, in adding, what Sharov, Tønnessen (2021, 48) call, an "organism-centered" perspective to its subject matter. It asks how different life forms and species phenomenologically model their species-specific reality based on the evolution of kindred but still divergent bodily and cognitive equipments.

That means, especially with regard to the sub-discipline of Zoosemiotics, that a behavioral, and cognitive dimension of living beings as subjective modelers of their own world is considered important. The environment in which an organism lives and behaves is seen as going beyond the biological definition of a niche. As sciences of communication, biosemiotics and zoosemiotics focus on sign productions and interpretations in living systems – in short, on 'semiosis'. They state that the organism is the factor and reality is the dependent variable (Sebeok 2001, 27). Kull et al. (2008, 43) clarify:

> 'How does the world in which any individual organism finds itself appear to that organism?' – has been often perceived as inaccessible to scientific investigation and has therefore been left unresolved by reductionist biology.

This is where zoosemiotics with Uexküll's Umwelt theory and the 'pluralistic approach' as its main pillars step in. The former is a complex conception of the idea that the environment of an organism is "not purely physical" (Martinelli 2010, 26) but incorporates the elements of species-bound individual interpretation (limited perception possibilities called 'Merkwelt') and the capacity for agency (accordingly called 'Wirkwelt') (Martinelli 2010, 26-27; cf. also: Uexküll, Kriszat 1956, 22, 27; Maran et al. 2011, 12). The latter describes in more ideological terms that planet earth's settings are obtained with completely different eyes and assessed according to most diverse standards by each of its species7.

Within CL, the so-called "4E-Approaches" (sometimes just referred to as *embodied cognition*) are crucial when it comes to understanding the role of the body in shaping language structure and semantics. CL holds that linguistic organization should rather reflect general cognitive principles, not faculties that would be specific to language. In drawing on this 'cognitive commitment' (Amphaeris, Shannon, Tenbrink 2021, 2611, 2612; Evans and Green 2006, 501; Lakoff 1990, 40-46; Lemmens 2015, 90, 91), language is understood as having "emerged from general cognitive mechanisms and processes" (Evans, Green 2006, 501; cf. also Geeraerts, Cyuckens 2010), which largely develop(ed) from embodied and social experiences.

Embodied approaches to cognition do not reduce the body to a vessel for the brain but emphasize it as having an integral role in making up cognitive processes. Without the body there was no source collecting, sensing information that could be neuronally ordered. In this sense, cognition is no isolated brainy rule system, but allows for participatory affective sense-making activities within a highly dynamic bodily network that is intrinsically shapable, developing through organisms' embodied experiences in the world as social beings.

Cognitive approaches "expect language processes to [have evolved and still] function in concert with other perceptual, cognitive and motor processes, not independently of them" (Spivey et al. 2005, 246). Yet few if not no endeavor has been put into seeking to investigate the social parameters and cognitive effort leading to the evolution of CMs. This is somewhat puzzling, as such a perspective would crucially underpin the probability of their existence and structure.

I show that a discourse on this research gap can be opened as a paradigmatic demonstration of a mutual biosemiotics-humanities fertilization exemplary of Favareau's (2017) discussion of the question "Why does biosemiotics need the humanities [and vice versa]?". The discussions will be instances of comparative anthropological zoosemiotics studies (Gómez-Moreno 2020, 191, 204; cf. also Martinelli 2010, 121-163), which investigate semiotic and cognitive commonalities between human and non-human animals. The logic raised here is therefore able to mediate in the "continuity-discontinuity

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[7] For instance, as Maran et al. (2011, 54) illustrate, "in the semiotic sense it is not possible to talk anymore about the forest as such, but about the forest as manifested in a multitude of different Umwelten: an Umwelt of man, an Umwelt of fox, ant, owl, etc. and about the ways these different Umwelten partly overlap and intersect with each other".

debate"[8] (cf. Maran et al. 2011, 10, 57; Sharov, Tønnessen 2021, 282; Gómez-Moreno 2014, 405-406, 423-424).

Like Kull and Velmezova (2015, 2), I figure that "the interdisciplinary union of linguistics and biosemiotics [can] contribute[] to the reconsideration of some linguistic concepts" – that is, by researching the origin and nature of cross-domain mappings beyond anthropocentric investigation. Likewise, CL can provide reasonable ideas for what to investigate in animal cognition and therefore in their specific organization of experience.

Givón (2002, 39) reminds us of the fact that "[l]ike other biological phenomena, language cannot be fully understood without reference to its evolution". Consequently, neither can metaphor in its central role in language, then. Precisely the highly embodied and basic position it takes would make it implausible that humans shall be the only species capable of practical metaphoric thinking. Such a hypothesis requires proper investigation. As Delahaye (2019, 4) recollects,

> [as] a basis of rhetoric[,] it is scientifically impossible to prove the non-existence of something, we can only strongly suspect its absence when the experiments made to prove its existence fail and it is logical and wise to come round to the opinion of "strongly possible non-existence".

1.2 'CONCEPTUAL METAPHOR THEORY' AND WHY IT COULD BE PERTINENT TO STUDIES IN ZOOSEMIOTICS

> [M]etaphor[s] can occur in other modes than language alone. Indeed they *must* do so, for if researching non-verbal […] metaphor does not yield robust findings, this jeopardizes the Lakoff-and-Johnsonian presupposition that we think metaphorically. (Forceville, Urius-Aparisi 2009, 4).

CL treats CMT as one of its major findings. First framed by Lakoff and Johnson in 1980, though meanwhile accompanied by extensively expanded investigations, this theory postulates that metaphors are not only poetic or generally rhetoric linguistic devices. Much more interestingly, they constitute a fundamental and common process of thought – with these CMs plentifully reflected in (verbal) language (Lakoff 1990, 49-50).

This claim belongs to the 'cognitive turn' governed by the assumption that the capacity for language depicts no detached cognitive apparatus in our brains but as Langacker recalls (2008b, 249; cf. also: Bybee, Beckner 2012), necessarily "recruits and adapts a wide array of physical structures, neural circuitry, knowledge, and cognitive abilities that exist independently and serve other functions". Research in this vein proceeded to point to the relevance of the assumption that "[m]etaphors in language can point to underlying conceptual metaphors that influence thought and generally structure reasoning and cognition"9 (Beger, Smith 2020, 12; cf. Vicente 2020, 371).

This implies that metaphorical thinking to some extent depicts a prelexical mental phenomenon – that is a mode of thought possible in our brains without including words. This construct is strongly underpinned for instance by Mandler's research (1994, 63) laying open the cognitive "[p]recursors of linguistic knowledge". He shows that there is semantics without sentences, for even babies develop coherent concepts of the world in which they find themselves, which are not yet encoded linguistically (but which are, of course, optimal conditions for such encoding). Put simply: "[T]he infant does not wait for language to begin thinking, and thus the problem of packaging meanings into manageable form is a prelinguistic one" (Mandler 1994, 64).

He (2007, 743, 745, 748) argues that a "great deal of conceptual information" can be derived from basic cognitive operations such as categorization, the ability to "generalize across very dissimilar objects" and recognize "abstract analogical similarity […] that leads to metaphorical understanding".

Lakoff and Johnson (1980, 3) hold that "[o]ur concepts structure what we perceive" but cognitive structures are also and in the first place growing *from* perception (Pecher, Zwaan 2005, 1) – a fact naturally appropriate for all species possessing cognition.

More precisely, CMT states that some of our more abstract or complex knowledge about the world, such as our everyday conceptualizations of life, love, time, disputes draw on simpler sensation events such as a journey, warmth, money, machines, battle or war. Johnson (1987, 112) explains that this is the case, because such "metaphor[ical formulations], or analogies, are not merely convenient economics for expressing our knowledge; rather they *are* our knowledge and understanding of the particular phenomena in question". Minds always automatically access the structurally closest stored experience available in order to make sense of novel stimuli.

Interestingly, gestures tend to emerge as automatic hints to source-domains we use in mundane discourse. They make cross-domain mappings underlying the verbal speech event visible and more tangible for the counterpart. Mittelberg (2006, 163) explained that "co-speech gesture ha[s] not only enhanced our understanding of situated, distributed cognition, but ha[s] also resulted in additional evidence for conceptual metaphor".

If it is true that "gestures […] provide a window into

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[8] Discontinuity in this context refers to the "idea that, from an evolutionary point of view, human beings constitutes (sic.) a radical deviation from the rest of the animal kingdom, and therefore the differences between the human and the other animals are of qualitative type" (Martinelli 2010, 208).

[9] In the same moment CMT was criticized for "being too prose-based and descriptive" (Stickles 2016, 9). As to be argued in the final section, my investigation aligns with a call for more empirical data on multimodal metaphors.

the on-line processes of (figurative) thought" (Mittelberg 2006, 163), the question why discussions of the matter so far have not considered how instances of animals' non-verbal communication might also exbody underlying metaphoric thought processes, appears legitimate. If gestural communication in our ancestors preceded verbal expressions and if Mittelberg and Hinnell (2022, 210) are right in saying that "[g]esture indeed reveals essential aspects about […] metaphor", this may be precisely the case because metaphorical actions probably evolved in gesture before they did in language.

Data supporting the phylogenesis of metaphoric thought comes from Dahl and Adachi's investigation (2013) of conceptual metaphorical mappings in chimpanzees *(Pan troglodytes)*. They found that these great apes literally used to think of their high-ranked group members as positioned on a superior pyramidal level than lower-ranked conspecifics. The lower-ranked individuals could be easier identified when photographs of them were presented to the test group on an inferior position in the pyramid image (Dahl, Adachi 2013, 1-7).

This implies the conceptualization of an abstract domain (social status) in terms of a concrete domain (visual scale), reducible to the primary metaphor[10] "dominant is up" (Dahl, Adachi 2013, 5). Along with direct bodily sensations of temperature, texture, pain etc. Image Schemas and Force Dynamics (Talmy 1988) are "our first guides in conceptualizing experience" (Kövecses 2017b, 340). Dahl and Adachi (2013, 2, 5) hence "suggest that conceptual metaphors are not uniquely human and, moreover, that they could have emerged before the development of language [in the common ancestors of humans and chimpanzees]".

Formed through sensory and motor experiences in the physical and social world, image schemas are deeply rooted in long-term memory, where they function as "directly meaningful preconceptual structures" (Kövecses 2017, 324) that "give[…] coherence and structure to our experience" (Johnson 1987, xiv). Therefore, Johnson (1987, 337) holds that they are the most basic mental "substrate of meaning in general" and thus handy building blocks of the cognitive system. Hence, there is no reason why image schemas should be reserved for human conceptualization, only.

The fact that notoriously Image Schemas give rise to CMs (Evans, Green 2006; Kövecses 2016; Langacker 2005, 2008b; Lakoff 1987, 1990; Lakoff, Johnson 1980; Johnson 1987) and lend themselves uncomplicatedly to animal cognition (cf. Gómez-Moreno 2014) consequentially demands an investigation of potential metaphoric thought in animals.

CL research might have overseen this as result of a too narrow-mindedly anthropocentric perspective and in doing so missed what this finding can do in reverse for CMT. A review of the existing literature on image schemas and CMs reveals a consistent emphasis on the substantial role both concepts play in human reasoning. However, the relevant additional information that this is probably the case because both notions may describe phylogenetically archaic cognitive processes and thus may be shared with other species, is never even suggested.

With at least conceptual organization being salient to all other organisms possessing cognition, why should they draw on categorically different parameters for it? If, as Gibbs (2008, 299) asserts, "people sometimes perform whole body actions that clearly represent metaphoric ideas", we should also weigh whether behavioral mimicry is motivated by rudimentary metaphoric thought processes. The subsequent sections will present a more pragmatic line of argumentation, which invites us to think critically about cross-domain mappings as a solely human skill.

2.1 ANATOMY AND 'UMWELT' – A BODY FULL OF NEURONS IN A DANGEROUS WORLD

The Indo-Malayan octopus sub-species *Thaumoctopus mimicus*, fairly new to science (Norman et al. 2001), impresses with its neuronally controlled color- and topography-changeable skin, allowing it to perform a complex and holistic situative mimicry of animals inhabiting the same habitat. The question thus arises as to how it is capable of this.

In order to gain a deeper understanding of the BPM exhibited by *T. mimicus*, I first provide an overview of relevant biological and neurological data, which serves as a foundation for further investigation into the animal's semiotic actions and potential cognitive capacities. A more extensive description of its morphology which led to the suggestion of the new genus "*Thaumoctopus*" is provided by Norman and Hochberg 2005.

Octopuses are eight-limbed mollusks from the *Cephallopoda* class. They stand out among other mollusks by having lost the shell during the course of evolution. As such, they are rather vulnerable and nocturnal animals. As invertebrates, which evolve since the Precambrian approximately 550 million years ago, the mimetic octopus by contrast draws on physiological and behavioral adaptations that allow this taxonomic representative to be day active. It was first discovered during 16 daylight dives between October 1998 and October 2001 by Norman, Finn and Tragenza, in the northern warm coastal waters of Sulawesi and around Gilimanuk, Indonesia (Norman et al. 2001).

Given that it is a strict individualist (Mather, Kuba 2018, 317), that grows up without parental care and thus must learn about its capacity for mimicking other organisms on its own, its ability to come up with both the same and new defence ideas in every generation appears remarkable.

The body measures around "60 cm in length and

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[10] This notion was coined by Joseph Grady, who argues that primary metaphors combine equally basic domains and thereby give rise to more complex metaphors (Evans and Green 2006, 304).

[mostly takes on a] brown and white striped" pattern ([n.a.] 2017: Mimic Octopuses ~ MarineBio Conservation Society; cf. also: Norman et al. 2001, 1755), but is pale beige by nature (n.a. 2017, (675) Mimic Octopus: Master of Disguise - YouTube (min. 00:08-00:12). Without a skeleton, such octopuses would be perfect high-protein food for each predator, if to their advantage this characteristic did not also enable an extreme physical freedom of posture and movement (Gutnick et al. 2016, 147), making this species an "expert contortionist" (Yong 2009, 3).

Considering that "three-fifths of the octopus nervous system is not in its central brain but out in the arms"[11] (Mather, Kuba 2013, 334), entailing certain autonomous cognitive capabilities of its extremities (Gutnick et al. 2016, 148; Mather, Kuba 2018, 316), the conception that it seems as if the octopus's "entire being [was] thinking, feeling, exploring"[12] appears appropriate. In fact, the arm subsystems are very muscular and equipped with hundreds of independently controlled suckers. Each of them contains thousands of sensory cells, which extrapolated to the entire skin results in up to "2.4×10^8 sensory cells" (Gutnick et al. 2016, 148). The amount of information growing from them and light sensitive skin cells must be immense and result in perceptions beyond human imagination. Gutnick et al. (2016, 148) generally explain that "octopus arms are unique, as they are the main method for interaction with the environment, from locomotion to exploration, holding onto items and catching food". Byrne et al. (2006, 202) indicate for instance that even though one would expect all eight arms to be equally qualified for the same tasks, experiments showed that each individual instead has a favorite (frontal) arm for the exploration of objects. This is in line with other studies asserting that octopuses presumably own personality, temperament, self-consciousness and intentionality (cf. f. exp. Mather, Kuba 2018, 314, 316; Gómez-Moreno 2014, 416-418, 422; 2019, 441, 442, 459-461, 463-465).

Their brains "possess[] two separated learning and memory systems [, namely a] visual […] and chemo-tactile [one]" (Gutnick et al. 2016, 144). Then, in pulling-out so-called chromatophores (tiny yellow, red and black-brown pigment sacks) under direct motor-neuronal control (How et al. 2017, 9; Gutnick et al. 2016, 157), the cephalopoda can realize "dramatic, dynamic and rhythmic signals" (How et al. 2017, 2) of color and skin topography changes for means of camouflage and communication in milliseconds (Gutnick et al. 2016, 153-157; How et al. 2017, 1, 2, 9; Mather, Kuba 2018, 309, 317).

These, respectively, are the *physiological* preconditions for the mimetic octopus's characteristic displays of "highly precise, […] goal-oriented" (Gómez-Moreno 2019, 441) BPM as an evolved adaptation to the daily survival challenges it is exposed to. Gómez-Moreno (2019, 448) specifies that deceptive agency here is achieved by the

> mimic/sender […] by simulating signal properties of a second living organism (the model) that are perceived as signals of interest by a third living organism (the operator/receiver), such that the mimic gains in fitness as result of the operator identifying it as an example of the model.

This way, its "outstanding observational skills to recognise and richly impersonate entities in its environment" (Gómez-Moreno 2019, 445), combined with the exact knowledge of its own body's shape-shifting capabilities, compensates its otherwise almost defenseless physical build.

The "phenotypic plasticity in cephalopods" (Fiorito et al. 2014, 14) originally could have evolved for means of merging with surrounding structures via camouflage but in terms of 'semiotic co-option' then was creatively instrumentalized by both sexes (Norman et al. 2001, 1757) for complex, deliberate and essentially holistic BPM of other sea-organisms, too. The sophisticated adaptation of being able to display "conspicuous imitation[s] [of] models of travelling organisms" (Gómez-Moreno 2019, 444) by accurately copying the "movements (and colour patterns) of other living organisms" (Gómez-Moreno 2014, 410) facilitates this species to "avoid potential predators and territorial adversaries" (Gómez-Moreno 2019, 444).

Octopuses are known to be threatened by marine mammals, sharks, moray eels, stingrays, other octopuses and certain fish (Nahmad-Rohen et al. 2022, 22; Mather, Kuba 2018, 316). Against this background, it is especially intriguing to find the mimic octopus credibly mimicking for instance stingrays. This is visualized in section 3.3. To the same effect, it turned out as highly useful for the mimetic octopus to also misguide individuals of the extremely territorial damselfish into thinking two of its tentacles were a banded sea-snake (which in turn is a main predator of the damselfish) (Norman et al. 2001, 1755; Gómez-Moreno 2014, 414-416, 2019, 445f, 463). Also "cruis[ing] along the shallow sandy bottoms of the ocean with confidence" (Klein, n.d., https://octonation.com/mimic-octopus-facts/) as a fake-sole or swimming in free waters in the shape of a highly poisonous lion-fish[13] (cf. Norman et al. 2001, 1757; Gómez-Moreno 2014, 410-416) that no other organism dares to touch, proof as valuable adjustments to a dangerous Umwelt.

Crucially, Norman et al. 2001 (1755, 1758) provided data supporting that according to the particular risky situation, the mimetic octopus decides online which is the most appropriate organism to mimic. In doing so,

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[11] That is approximately 40 million neurons à each tentacle apart from the 180 million neurons in the central brain (Stephen 2021: Nine Brains Are Better Than One: An Octopus' Nervous System | Biomechanics in the Wild (nd.edu)).

[12] Quote by Craig Foster (2020) in the movie "My Octopus Teacher".

[13] For footage see for instance:
Nad 2008: https://www.youtube.com/watch?v=H8oQBYw6xxc&t=4s&ab_channel=marcelnad.
[n.a.] 2017: https://www.youtube.com/watch?v=Wos8kouz810.
Bird 2020, min 05:30-06:00: https://www.youtube.com/@BlueWorldTV

it can also "switch back and forth between mimicry of different model organisms" (Norman et al. 2001, 1755), consequently indicating a facultative usage of deceptive signs, which Norman and colleagues (2001, 1755) call '*dynamic mimicry*' – tantamount to BPM.

From a zoosemiotic standpoint, studying an animal that according to Maran (2017, 73, 47) intentionally "rearranges [its] own bodily structures and expressional capacities to produce the deceptive message" is very exciting. Norman et al. (2001, 1758) write: "No cephalopod species has previously been reported to impersonate individual animals in the absence of the model". Thus generally, "the mimic octopus is the first known species to take on the characteristics of multiple species" ([n.a.] 2017, Mimic Octopuses ~ MarineBio Conservation Society) on its own authority. Surprisingly, How et al. (2017, 2, 10) are proven correct to the present day, when they point out that

> very few studies have focused on the form and function of these patterns, other than mentioning them as brief anecdotes. [...] Using dynamic components of body patterns to deceive intended viewers is a novel area of study that has receive (sic.) little attention in the scientific literature.

This is in line with Gómez-Moreno 2014, who also wonders that little research has been done in the sector of the respective implications for cognitive psychology and cognitive semiotics. He emphasizes that the mimetic octopus's impersonation of for instance a banded seasnake "constitutes a particularly sophisticated semiotic strategy from a cognitive, perceptual, and behavioural (bodily enactment) point of view" (444). In Zlatev's words (2009, 160), rather than portraying just "*imitative capacities* [, these impersonations point to the capacity for] *intersubjectivity*, i.e. the ability to share and eventually to understand the experiences of others".

2.2 TOWARDS AN EMBODIED COGNITION EXPLANATION OF BEHAVIORAL MIMICRY

The mentioned lack of deeper inquiries presumably is due to the fact that standard biological research rarely explores the cognitive and psychological underpinnings of such conduct. There *are* excellent observations and collected data in biological papers relevant in these regards. It is just that these studies reflect little, if not even forget to reflect upon or at least ask about the semiotic and thus psychological dimensions of their findings – although they would contribute decisively to the understanding of biological phenomena. To my best knowledge, both of Gómez-Moreno's zoosemiotic papers on *Thaumoctopus mimicus* (2014; 2019) thus are the only analyses about this species acknowledging that it possesses a subjective Umwelt[14], incorporating a semiotic inspection as an explanation of this species behavior. What is more, at least they raise the chance for superior psychic faculties such as metaphorical thought at play, which however is not explored further there.

Accordingly, so far, I have not encountered an embodied cognition study of the mimetic octopus that would consider individuals of this species as sensitive, thinking, communicating semiotic agents and in the course of doing so approach a detailed understanding of their subjective experience, maybe thoughts and cognitive motivations underlying the deceptive behavior *beyond* the scope of Gómez-Moreno's pathbreaking study (namely focusing potential cross-domain mappings).

Zoosemiotics understands behavioral mimicry not as an instinctive or reflexive mechanism. Instead, it reflects upon the "[r]ole of the [m]imic's [a]ctivity in [c]reating [m]imetic [r]esemblance" (Maran 2010, 246). This perspective may decipher and clarify which semiotic and creative cognitive processes mediate between the mimetic octopus's perception *of* and respective adaptation *to* threats. This 'in-between' was not subject to an extensive analysis before, as it presumably has been judged as black box sealed to scientific inquiry.

So far, we have noted that this invertebrate's evaluations and adaptations to its environment involve a subjective embodied experience and a degree of cognitive flexibility, rather than a fixed and isolated programmed stimulus-reaction coupling. The key question is whether this level of perceptual and cognitive processing is induced by mental acts of mapping own body structures onto the ones of other creatures and vice versa. Valid psychological preconditions for this, as offered by Gómez-Moreno (2019, 563), would be that

> *T. mimicus* has bodily self-awareness (a sense of a core self by virtue of which the octopus feels its body (parts) to be its own and is aware of its position in space) and cognitive empathy (the capacity to use perspective-taking processes to imagine or project into the place of the other)[15].

Additionally, with regard to the structure of cross-domain mappings, it should be stressed that

> the mimic octopus is able to cognitively discriminate, and subsequently, integrate different visual input sources (colour differentiation, shape types levels of thickness, seperateness-linkage discrimination, movement patterns). This capacity is known as perceptual categorisation, which is one of the prerequisites of consciousness [...] (Gómez-Moreno 2019, 462).

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[14] Except for some notes on it by Timo Maran, for instance in the article "Becoming a Sign: The Mimic's Activity in Biological Mimicry" (2010, 247) or his monography "Mimicry and Meaning: Structure and Semiotics of Biological Mimicry" (2017, 15, 72-74).

[15] Cf. also the notion of "*body image*" as described by Zlatev (2009, 152).

That the "mimic octopus' behaviour [...] implies the interplay and close collaboration of cognitive artifacts belonging to different categories" (Gómez-Moreno 2019, 413) could work as dynamic ground for the construction of rudimentary CMs, when adding the aspect of its sensory-motor body-awareness. Besides, note how embodiment and image schemas are implicit to the quote above. Gómez-Moreno provides a practical exemplary discussion of the octopus's impressions of other sea-organisms in terms of concrete image schemas (2014, 407-421). This leads him (2014, 409) to identify "image schemas as the cognitive anchor of non-human intersubjectivity".

Based on that it seems "unquestionable [...] that *Thaumoctopus mimicus* [...] understand[s] one entity ([its] own body) in terms of another (body) for survival purposes" (423), but only a in-depth account of the underlying semiotic and cognitive processes can unveil, whether this can be called a cross-domain mapping. This is approached in 3.3 and 3.4. It proves valuable in light of Gómez-Moreno's earlier analyses (2019, 459) where he already described this animal as "having such complex outer-world knowledge" and "observational access to [it]sel[f] and other selves" that its "body-awareness [bespeaks] a basic form of reflective self-awareness, and [...] cognitive empathy, [...] placing this animal on the dyadic mimetic level of Zlatev's Mimesis Hierarchy"[16].

What is striking is that Zlatev (2009, 161) describes "dyadic mimesis, [as] the ability to map between one's own body and that of others [...] through a (conscious) process of "projection": what would I see/feel/wish if I were you" as "distinctively human skill". Although, in a highly appreciated personal communication, he seemed open-minded to discuss the case of the mimetic octopus next to the one of the chimpanzees. Through its highly agile and deformable body described earlier, the cephalopod might even experience a much stronger embodied cognitive bonding to the subjects it mimics. I discuss this in 2.3. In general, this illustrates "[t]he assumption that our higher cognitive [...] capabilities are shaped by the architecture of our bodies and the way we interact with the world around us" (Mittelberg 2013, 755) as no human unique selling point but as a highly individual and species-specific one.

The 'zoosemiotic canon', as described by Martinelli (2010, 163) states that "[i]n no case should actions or behaviors be interpreted as the result of an inferior psychic faculty, when it is possible to interpret them as a result of a superior faculty". In line with it, the following inquiry explores whether a tenable statement for the existence of "simple" metaphoric thought in non-human animals (next to the one by Dahl, Adachi 2013) can be mapped out.

2.3 CROSS-DOMAIN-MAPPINGS IN A NON-HUMAN ANIMAL? – "MY TENTACLES ARE A SEA-SNAKE & MY HEAD IS A ROCK"

CMs are made up of a structural analogy between the concrete source and the complex target domain. If this cognitive process in fact underlies the mimetic octopus's various instances of behavioral mimicry, it should be possible to identify such a grounded "similarity, or resemblance between two things or events" (Kövecses 2016, 35) between *T. mimicus* and the perceived features of the environment of the octopus[17].

Due to the limited scope, the further discussion will primarily focus on the venomous banded sea-snake *(Laticauda sp.)* as an important model for the mimetic octopus to mask its true self. This instance of deceptive behavior has been documented best to occur in many individuals of this species[18] (Norman et al. 2001, 1757; Gómez-Moreno 2019, 445) and hence might be best suited for a representative explanation of *T. mimicus'* mimicry behavior. (Nevertheless, all further arguments are largely applicable to the other models as well. Some of such transfers will be provided.)

The sea-snake BPM is coupled to the animal's necessary understanding that only a partial structure of the own body appears appropriate to mimic the sea-snake anatomy, similar to the typical partial quality of metaphoric mappings. In order to form this mimicry to shy away the highly territorial damselfish *(Amphiprion spp.)*, the marine animal first must have recognized the tense interspecies relationship between the sea-snake and the damselfish in the past, thereby appreciating the Umwelt of its predator. Since Norman et al. (2001, 1758) recorded all instances of the sea-snake BPM in the absence of the model, the octopus also needs to be able to memorize or "form a simple though precise *concept* of a banded sea-snake" (Gómez-Moreno 2019, 462). Its selective and reflective attention to subjects in its Umwelt (Gómez-Moreno 2019, 462) via foregrounding might provide the necessary information.

Probably in a highly embodied manner, it reinterprets its own body in relation to this structure including the accurate display of the typical black-white-striped color code of the banded sea-snake via neuronally coordinated activations of chromatophores. This credible behavioral deception looks like/ is the product of the following set of integrative deception strategies:

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[16] This table can be found in Gómez-Moreno 2019, 464 (pointing towards the differences between chameleons and the mimetic octopus, for instance). Further readings are Zlatev 2008 and 2018.

[17] For the record, this resemblance needs to exist only in the octopus's perception, not the human one – but still we might decipher it.

[18] All nine individuals observed by Norman et al. displayed multiple instances of this BPM (2001, 1755-1757).

Fig. 1 "Fully-fledged imitation of a banded sea-snake by mimic octopus" (Gómez-Moreno 2019, 446). Source: Gómez-Moreno, José M. U. 2019. "The 'Mimic' or 'Mimetic' Octopus?: A Cognitive-Semiotics Study of Mimicry and Deception in Thaumoctopus Mimicus." Biosemiotics 12 (3). 441-467.

The octopus "elicit[s] a posture where six arms [are] threated down a hole and two [are] raised in opposite directions, banded, curled and undulated" (Norman et al. 2001, 1755). Nearby its head, the octopus skilfully connects the left free tentacle dancing upright with the other tentacle laying on the floor to imitate the lengthy body of the real snake (Gómez-Moreno 2019, 445). Additionally, its head in the center of the arms seems to serve as rock imitation (460) presupposing that the invertebrate takes the snake's typical behavior of holding onto a stone, to not drift away in the ocean current, into consideration of its performance. That the octopus pays respect to this detail may be indicative that it is aware of the metonymic relation between the rock and the snake. Furthermore, the left arm's tip is made fleshy, in respect to the "globular, though tapering, shape of snake heads" (445). The intentionality of this feature becomes apparent as the octopus "introduces one black dot on each side of the end tip of the arm [as fake eyes]" (445) – while the other tentacles tip appears rather spiky, just as the tail of a snake (445). By controlling these two arms in wave-like locomotion, they form a three-dimensional continuum that looks like a complete banded sea-snake.

Since this complex behavior is so different from usual octopus body postures, my central claim here is that thinking of this in terms of a purely instinctive non-reflective reaction to the threat appears as an inadequate explanation. Instead, the octopus probably is able to realize and thus exploit the physical similarity between the elongated structure of a sea-snake and the structure of its own tentacles. This is interesting exactly because no absolute one-to-one resemblance is evident, at first, but is then constructed.

Given that "[m]etaphors draw attention to similarities between two concepts, thus highlighting a parallelism" (Mittelberg 2006, 38) it is not far-fetched to consider a metaphoric mapping between the kinesthetic knowledge of the octopus's own body parts as the source domain and its visual categorical perception of the banded sea-snake as target domain, as cause for the advanced mimicry. Here, the encounter of the sea-snake is the novel or more alien and thus "abstract" entity to the octopus, whereas its own body is familiar to it. Immediate sense-making would result from the visual stimuli being compared to the own bodily conditions, as the closest available conceptual reference to it. If a respectable overlap is recognized, this best-fit principle could allow the own embodied sensory-motor knowledge to inform the domain of visual perception.

How is this respectable overlap recognized? – in a species-specific embodied "primordial affective[e]" (Colombetti 2014, 2) way. Following Colombetti, it is essential to note that "without the primordial capacity to be affected, no specific emotions and moods [and maybe ideas] would appear". The interspecific understanding and imitation of actions of other sea-organisms by the mimetic octopus seems to exemplify that the appearance and conduct of an individual from a different species could still trigger certain neuronal areas of the pre-motor cortex in the octopus, where no 1:1 equal nervous system could trigger exact mirror-neuronal[19] activity. With its extraordinary body constitution, the octopus, this way, may be capable of identifying which of its body parts feel most natural for imitating others' bodies. Starting from there, cross-domain mappings between the kinesthetic and memorized visual domain of experience could be explained as products of explicit neurological bindings between those otherwise remote brain domains that are now starting to fire in synchrony. What fires together, repeatedly, wires together and can be triggered/accessed afterwards through input from either side of the connection/mapping.

The octopus may have come up with the generalization of the schema ELONGATED GEOMETRICAL BODY as the middle ground between what it *felt* (own tentacles) and what it *saw* (snake body), i.e. what both domains have in common. Although this selective projection seems to imply a double-scope blending between the two input spheres, *Blending Theory* (Fauconnier, Turner 2003) is not apt to fully account for BPM. If it was the only underlying cognitive process, the octopus would have come up with a new meaning resulting from the "novel 'blended' mental space" (Fauconnier, Turner 2003, 58), as is the central argument of blending theory. Indeed the octopus, this way, finds new meaning in its body parts, but their meaning is fixed through the object of mimicry that it aims to satisfy. The new aspect was not invented, it was predefined by the target domain and is tried to be mimicked in the best possible way. Accordingly, there seems to be a grey zone between blending and mapping domains onto each other in such highly bodily informed cases of cognitive processes. The octopus necessarily needs to derive this preconceptual form "ELONGATED GEOMETRICAL BODY" from exact

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[19] See e.g.: Fabbri-Destro et al. 2008; Praszkier 2014; Rizzolatti et al. 2019.

knowledge about its own body and sees it repeated in the body of the sea-snake, sting-like fins of a lionfish, the sting of a stingray and many other animals' structures, which thereby would automatically become potential models to octopus mimicry.

We see that the body is central to species-specific meaning-making. With the recognized similarity between its arms and the lengthy form of the snake, the octopus thus presumably empathically understands the alien organism in terms of its own body parts. This is in line with Kövecses (2022, 39), who reinforces that most frequently it is the context that gives rise to a metaphorical idea.

Until here we have seen, how the octopus interprets other animals' bodies in terms of its own. This, I hold, could enable it vice versa to interpret its own body now in terms of theirs, which would provide it with the information to adapt its body best to perform a mimicry pattern. To try out what it would be like to turn two of its arms into a sea-snake, it perceives these arms now in terms of a sea-snake. An "imaginary test" (Hoffmeyer, Stjernfelt 2015, 25) run based on the memory of their compatibility for this mapping presumably takes place in the sensory-motor system. Gallese and Lakoff (2005, 468) write:

> The understanding of concrete concepts – physical action, physical objects, and so on – requires sensory-motor simulation [, which] as suggested by contemporary neuroscience, is carried out by the sensory-motor system of the brain.

This simulation, again vice versa, contributes to or rather *is* the octopus's sense-making of the other sea-organisms. As above, I emphasize that this simulating is not necessarily conscious but rather an immediate affective pre-motor resonance to the octopus's memory of observing the sea-snake in the context of perceived danger (for the damselfish) in the past. The smart move is a) to remember this relationship between snake and fish and b) the idea to reform this relationship actively in case of the need to appear superior to the dangerous fish. By recalling the sea-snake "mental" image, both cognitive processes, i.e. accessing the embodied sea-snake memory and the feeling/conception of the self, align again. Overall, this would exemplify Gallese and Lakoff's (2005, 468) thought[20] that "understanding requires simulation" and that "imagination, like perceiving and doing, is *embodied*, that is, structured by […] constant encounter and interaction with the world via […] bodies and brains" (456), in an animal case. If *"[i]magining and doing use a shared neural substrate"* (456) then the same cross-domain neural pattern that is active during such simulations only needs to be drawn on when the octopus actually intends to perform the mimicry act. The result would be that these acts are actually no secondary imitations at all but exbodiments of how the octopus in fact sees/ understands the other animal.

These perspective-taking strategies as cognitive resonance to new stimuli appear as strong contenders for the octopus's cognitive empathy (Gómez-Moreno 2019, 441, 452, 459f, 463). This is intriguing, as to the end of the mimesis, an experience that was made in the visual mode is transferred to/ realized in a tactile experience – bespeaking a highly complex physical commitment to intersubjectivity or rather *intercorporeity*[21]. This multimodal construction bears crucial connections to Kövecses' (2016, 35) comment: "When we conceptualize an intangible or less tangible domain metaphorically as, and from the perspective of, a more tangible domain, we create a certain metaphorical reality".

In sum, there might be a double structure of metaphor underlying *both* the idea *and* the final execution of the sea-snake imitation. Inversing the mapping between self-perception (source domain) and the object to mimic (target domain) may be possible, because "[t]arget and source in multimodal metaphor may *both* be concrete entities" (Forceville, Urius-Aparasi 2009, 11) (concrete in the sense of material) and thus are equally apt to serve as ground informing the other domain of experience. That will become important when we talk about the evolutive development of metaphoric thought in 3.1.

What we can deduce is that the octopus, based on this "[e]mbodied cognition" (Zlatev 2009, 150), starts a dialogue with/ reasons about its Umwelt in terms of modelling it with the help of its body as a source of information and meaning[22]. In respect to the pluralistic view of zoosemiotics, it is important to note that such meaning-making (with its origin in a neuronally controlled physiology with eight highly sensitive and independently "thinking" limbs) must enable this invertebrate an enormously rich sensory-motor perception and experience. It results in a very unique complex "*phenomenal* Lebenswelt" (Zlatev 2009, 151), that humans hardly can empathize with, due to very different bodily constitutions.

The capability to understand that the same signals that are typical for the sea-snake can be produced and sent by its own body presupposes "self- and hetero-perception" (Gómez-Moreno 2014, 416), as well as creative imagination, if not being a form of possible-world-thinking (cf. Gómez-Moreno 2014, 416; Martinelli 2010, 46).

Via a smart rearrangement of its own bodily structures and coloring, the mimetic octopus basically exploits the *interpretant* that the skin pattern together with the other characteristics of a sea-snake evoke in the damselfish. In this sense, this posture, in combination with

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[20] Closer inspection of their argumentation in section 3.1.

[21] – i.e. an embodied sense for others' bodies (term coined by Merleau-Ponty (1908–1961); meanwhile integral part of the 4E approaches to cognition and phenomenology, more specifically).

[22] Generally, this is in line with Olteanu, who bridges (human) social semiotics and biosemiotics in this regard (2021; cf. Maran 2017: 83-99 for modelling in mimicry regards).

the "purposeful, intentional movement" (Gómez-Moreno 2014, 416), suggests that the invertebrate deliberately deceives others in "using signs being aware that they are signs" to them (Martinelli 2010, 46). Following Maran (2017: 8), this, in semiotic regards, indicates *thirdness*. A more in-depth description of the semiotic correlations at work follows in 2.4.

The natural link between deliberately initiated deception and metaphorical reasoning, which is argued here to be reasonable, can best be underlined by reference to Zlatev's (2000, 2921) "mimetic hypothesis". He proposes that the "crucial factor for the emergence of self-consciousness *is* the ability to map between one's own subjective body-image and those of others" (my emphasis)[23]. Zlatev (2000, 2922) explains that a "['mirror view' on one's own body] [can be reached when] the actions of the other are mapped onto (possible) actions of oneself". Alike anatomical preconditions help reflecting about the own bodily skills. Similarly, the mimetic octopus appears to learn to try out other sea organisms' shapes co-occurring in its Umwelt, based on a developed bodily concept of the model in question. As a loner, individuals of other species are its only interaction partners – at least on the daily basis.

Becoming aware of a correspondence between the bodies of others and the own may enable an objectified view onto the own corpus (Zlatev 2000, 2922) but it may also help animals to discover a greater range of possible postures, movements (and color patterns) of themselves. If then put into praxis, this means: *experiencing the own body in terms of some other entity or someone other than one by nature is*. The chance that here a certain degree of self-awareness and the capacity for cognitive empathy mutually fortify each other in learning processes is relatively high (cf. Zlatev 2000, 2924)[24]. In fact, knowing that other living entities also think, have needs and behave in predictable manners appears as crucial precondition for the invention of "adaptive goal-oriented" (Gómez-Moreno 2014, 418) mimicry behavior.

The biosemiotic definition of mimicry deviates from biological approaches while bearing clear resemblance with a semiotic account of gestures, that are capable of exbodying metaphoric thought, as explained earlier. To this end, note the affinity between the sentence "the gestural sign shares features with the 'perceptive model' of the object, and not the object itself" (Mittelberg 2006, 10) and Maran's (2017, 9) description:

> [W]e can specify mimicry from a semiotic viewpoint to be not a resemblance of one organism to another but rather a *resemblance of messages (cues or signals) of one organism to the messages originating from another being (that usually belongs to a different species), or to some feature of the environment, or to generalisations of either of those.*

A semiotic analysis of the cephalopod's mimicry hence bears more structural cues about a) the logic underlying the octopus's behavioral mimicry, and b) how this may align with rudimentary metaphoric thought.

2.4 UNDERLYING SIGN-SYSTEM OF IMPERSONATIONS BY *THAUMOCTOPUS MIMICUS*

> "'What resembles what to whom in what respect?' The apparent similarity of this question to the Peircean definition of sign as 'something which stands to somebody for something in some respect or capacity' (CP 2.228) is not a coincidence, but points to the deep semiotic nature of mimicry" (Maran 2017,35).

The octopus's deceptive BPM of a banded sea-snake, following the logic of Peirce's sign typology, could be constituted like this: From the point of view of the octopus, the percept of the real sea-snake *(Laticauda sp.)* functions as ***'object'*** for the octopus's engagement in a full mimesis of this species. As said earlier, this act of perception of said organism is self-referential, whereas the act of self-perception is other-referential. The latter ultimately can result in the recognized potential of the self for mimicry, based on the apprehended similarity/ '*iconic ground'* between object and self. The iconic ground is what connects object and mimicry. Importantly, the "[p]erception of similarities (which is an iconic ground) will give rise to an icon only when it is combined with the sign function" (Sonesson 2012, 84). This holds true for the octopus, since exploiting the effect of the poisonous snake on the damselfish is its primary idea/goal behind the mimicry.

Hence, the performed mimicry act emerges as *icon* (from the octopus's point of view) and can be called the actively formed sign or '***representamen***'. Drawing on the two species' partially alike appearances in combination with the intentional intensification of what is alike, plus the hiding of those structures that would disturb the mimicry, puts *iconicity* right at the heart of this deception. More specifically, since the octopus realizes a mimicry that is not a mere outline of the original species but aims to portray it in the most holistic and realistic way possible, it can be characterized as "*absolute icon*" (Maran 2017, 56). The predator by definition of deception is neither allowed to identify a difference nor likeness between both species – it completely mistakes the mimic's message for that of the model, allowing the mimic to go unnoticed.

Consequently, it is correct that a resemblance occurs in mimicry only from the standpoint of the mimic itself, in the biosemiotic mode of *representation*, not from the side of the interpreter who judges with the experience of a "generalized image" (Maran 2017, 62; cf. also 126) of a sea-snake. Maran (2017, 77) explains, "a seme is

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[23] – to be specific, in five steps (see: 2922).

[24] Further readings: Bryant 2021; Castro and Wassermann 2012; Fernandez and Zahavi 2020; Shettleworth 2000; Zahavi 2010.

a very particular morphology, shape, colour pattern, odour or behavior according to which the species is immediately recognized". Crucial here should be the black-white stripes, as well as the ELONGATED GEOMETRICAL FORM of the poisonous snake as '*seme*' that catches the eye of the damselfish. The octopus makes use of the fact that "[i]n most cases, mimic[] and model[] are not simultaneously present and the receiver needs to rely on its memory when encountering a suspicious object" (Maran 2017, 114).

Since *T. mimicus* communicates something that is not true, the propositional character of such a deceit becomes apparent and points to a straight non-verbal lie. This would be no far-fetched thesis, as Eco described "semiotics [as] the discipline studying everything which can be used in order to lie" (Eco 1976: 7). In zoosemiotic regards, we study an animal that is able to deliberately recreate the signaling code of dangerous species to evoke the respective sensation in its predators, without being able to adhere to the implication, namely venomousness. The double aspect of claiming something about something one creates to be seen (to be *not* seen) meets Peirce's concept of a '*dicisign*' (Maran 2017: 38)[25].

However, there is another double scope to this dicisign. Stjernfelt (2014, 1024) writes, "[d]icisigns are [...] signs which may be assigned a truth value" and they can result from "perceptual judgement". I said earlier that the octopus's imitations could show how the animal in fact sees/ makes sense of the other animal. What appears to us as a propositional lie must therefore not necessarily be one to the octopus, in order for the deceptive BPM to work. The truth value/dicisign the octopus operates on is "MY TENTACLES ARE A SEA-SNAKE", "THE SUM OF MY ARMS ARE THE SPIKE-LIKE FINS OF A LIONFISH", "MY BODY IS THE BODY OF A STING RAY (including: ONE OF MY ARMS IS THE STING RAY'S STING") (see 2.3, Fig. 1); 2.4, Fig. 3), 6)) and so on. Being capable of becoming/ perceiving itself as other species, i.e. interpersonality, might be just its reality – we don't know that. Whether conscious intention to fake an appearance or actually believing in the appearance, both could be results of multimodal cross-domain mappings and have the effect of deceiving the receiver of the dicisigns.

Drawing on the investigations of the earlier sections, the relationship between the sea-snake as a model and the octopus as mimic can be moreover classified as an example for the sign qualities of an "*emon*" (Kull 2018, 140), which links the representamen to the object in terms of empathy. Kull (2018, 141) explains:

> The emon as based on the capacity of imitation may co-occur with the existence of emotions and the phenomena of empathy. There is evidence for the existence of capacity for imitation in several species of mammals and birds, while there is almost none in non-vertebrates.

This is probably correct in reference to worms, snails and insects but if the mimetic octopus's mimicry results from its capacity to kinesthetically empathize with its models, as discussed earlier, octopuses should be included in Kull's list.

We cannot know whether the cephalopod is aware of its capability to influence others' cognitive processes, which would align with *metasemiosis* (Martinelli 2010, 46f). But we can say with some certainty that it learned about the advantage of morphing into gestalts that are recognized by its predators as dangerous or uninteresting. Therefore, the crucial factor in this BPM sign-relation making up the '***interpretant***' is the octopus's knowledge about what it does/ a certain understanding of its own conduct. It is private to the octopus and by the essence of the deception different from the damselfish's interpretant.

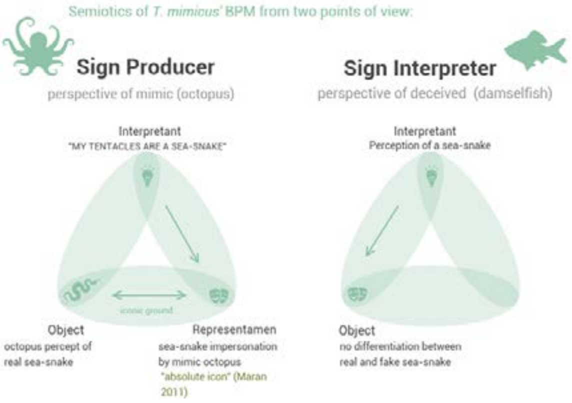

Fig. 2 The semiotic sign system underlying T. mimicus' deceptive behavior of impersonating a banded sea-snake; from the perspectives of the message sender and the receiver.

The linguistic anthropomorphism is just an aid to the reader as to emphasize the as reasonable suggested cognitive metaphoric mapping.

The notion of metaphor in such cases of mimicry hence would be limited to the subjective embodied cognitive activity underlying the octopus behavior, that we mapped out earlier. It is not that the mimicry appears to the damselfish (as an interpreter of the deceptive sign) as metaphor. It explicitly should be only spoken of metaphorical thought potential in organisms if the cross-domain mapping takes place within an animal's cognition (here only applicable to the octopus). Accordingly, I hold that the mimic's outer appearance in this case is a visual manifestation or externalization of a subliminal "metaphorical conceptualization or idea" (Müller 2008, 233) – just as gesture can be in human communication. The difference is that there the metaphor is also understood or intuitively processed as such by the counterpart. In human interaction metaphors are rather not used for deception but in contrary terms as means to support

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[25] – which has already been subject to an intense discussion about deceiving attempts in Femmes Fatales Fireflies (El-Hani et al. 2009).

Fig. 3 *“THE SUM OF MY ARMS ARE THE SPIKE-LIKE FINS OF A LIONFISH”*
T. mimicus imitating a poisonous lionfish to cross open waters (Source: Sylvain Le Bris 2013: Mimic Octopus from Lembeh Strait, Indonésie on 18 June, 2013 at 12:14 PM by Sylvain Le Bris · iNaturalist).

Fig. 4 *“I AM A FLATFISH”*
T. mimicus frequently imitates a flatfish to cross sandy ocean-bottoms (Source: Sara Thibaud 2023: Mimic Octopus from Mabini, Batangas, Philippines on 18 March, 2023 at 12:06 PM by Sara Thiebaud · iNaturalist).

Fig. 5 *“I AM A GIANT CRAB”*
With its arms arranged at the opposite sides of its body, a crab-like look and feel may be a quick and effective defense mechanism to appear unattractive to damselfish and other predators on open sand areas, where no nearby pit allows for a sea-snake mimicry.
(Source: Caleidoskopable 2017: https://www.flickr.com/photos/41059842@N03/6234370217)

Fig. 6 *“I AM A BRITTLE STAR”*
Oftentimes photographed in the more soft and dynamic shape of a brittle star fish, this posture may allow the cephalopod to observe its surroundings steady and unnoticed.
(Source: Caleidoskopable 2017: Mimic Octopus from Seririt, Bali, Indonesia on 28 July, 2017 at 02:53 PM by caleidoskopable · iNaturalist).

Fig. 7 *“MY BODY IS THE BODY OF A STING RAY (including: ONE OF MY ARMS IS THE STING RAY’S STING)”*
T. mimicus imitating its predator, a sting ray, to travel open ground quietly. (Source: Kuiter: Mimic Octopus mimicking Stingray Photo)

mutual understanding. Reconsidering the perspective of the marine animal can still though exemplify a biosemiotic interpretation (Olteanu 2021) of Mittelberg's concept that "the body [is] particularly able to personify dynamic and perceptible aspects of figurative thought" (Mittelberg 2008, 149).

It can be noted as well that the impersonations by the mimetic octopus obtain their credibility to the receiver of the deceptive messages since they all rely on the primary metaphor UP IS SUPERIORITY as antonym to "LACK OF CONTROL IS DOWN" (Gómez-Moreno 2020, 188). By that it is meant that the octopus draws on the counter-"psychological" effect of not fleeing or hiding in front of its predators but instead takes on most upright, widely visible and extravagant shapes.

Metaphor also depicts a sub-type of *icon* in the Peircean school (Mittelberg 2006, 119). The requirements for *metaphor iconicity* (Mittelberg 2006, 121, 132f) are fulfilled, in a basic sense, because for the octopus the strange organism is thinkable in the sense of and thus realizable via its own body as the domain of experience. If I am right, the diverse exbodiments of such across-domain-thinking, look as follows. All impressions by the mimetic octopus depict interpretations of (parts of) its body *in terms of* something other than what they by nature are.

3.1 NEUROLOGICAL SUGGESTIONS FOR A PHYLOGENETIC DEVELOPMENT OF CROSS-DOMAIN MAPPINGS

Earlier I claimed that inversing the mapping between self-perception (source domain) and the object to mimic (target domain) may be possible, because the target and source in a multimodal metaphor can *both* be concrete entities. Until here, we discussed *why* such cross-domain connections are a conceivable explanation to the octopus's BPM. Now, I aim to underpin *how* it may work on a neurological level adding an evolutionary angle and illustrate in how far this may bridge the gap towards bridging CMT and neurology, at all.

To this date, underpinning CMT neurologically appears difficult for cognitive linguists. That is, as Zlatev et al. (2021, 48) put it, because "neural connections are in general bi-directional, which contradicts the basic directionality of metaphor". IDEAS ARE FOOD but FOOD is not an IDEA. PERSONALITY IS TEMPERATURE but TERMPERATURE is not really linked to PERSONALITY.

Such a backpedalling, however, may be a bit too hasty, because it disregards a phylogenetic interpretation of Lakoff's 2014 paper: With his theory of the "brain's metaphor circuitry" derived from interdisciplinary effort, he plausibly explains that metaphoric thought does not rebel against the natural neural circuitry formed between different brain regions but just reflects the higher quantity of source domain synapse activation opposed to little target domain synapse activation, in humans, resulting in the strengthening the former and weakening of the latter (6). "Still, there will be neural connections going in opposite directions" (6), so that this "asymmetric activation pattern" only determines the dominant directionality we encounter but does not inhibit/ block abstract-to-concrete informing completely (6-8). Therefore, the directionality of metaphoric reasoning is not a matter of qualitative kind but one of degree. Abstract target domains are understood in terms of/ mapped onto embodied source domains but these sensory-motor source domains thereby crucially inform those non-sensory-motor target domains. This implies mutual interaction.

Since "abstract reasoning in general exploits the sensory-motor system" (Gallese, Lakoff 2005, 473) it can be expected that the more complex social life became evolutionary for humans, the more abstract situations and (emotional) experiences had to be made sense of in terms of this embodied sensory-motor system. The larger the difference/span between the complexities of concrete and abstract domain grew the more activation went from source to target. Target to source mappings became less in number – at least when used in praxis.

I argue that the initial understanding process of a new metaphor still requires axion potentials to travel back and forth in both directions between two newly suggested issues. For instance, if we are introduced to a sophisticated new metaphor in a poem, we usually need a bit more time to make sense of it in comparison to discourse situations, in which we draw on already established cross-domain mappings. The metaphoric sentence invites us to compare the abstract context given to the concrete context given in the phrase. In following this suggestion, neural paths are built from brain areas participating in framing the abstract concept towards those clusters framing the more concrete phenomenon mentioned in a given phrase. But one also tries to verify that suggestion by seeking for the common feature between both in applying the basic characteristics of the concrete domain to the abstract domain, using the same path. This suggests that metaphorical sense-making does necessarily draw on the bi-directionality of neural connections, sending and receiving signals in both directions. Also consider these examples: 1) Feeling affection for someone does not come for no reason with the use of language reflecting a certain comfortable warmth that we appreciate. 2) Difficulties are oftentimes conceptualized as physical burdens. But everytime a friend of mine masters weightlifting at the gym, he says it reminds him of not being a victim to his daily challenges, making him stronger and feel more confident to tackle them[26].

As initial metaphoric reasoning in evolutionary regards must have a structural origin, Lakoff's paper, together with the previous investigation of the octopus allows raising the assumption that phylogenetically early neural circuitries enabled cross-domain-informing between yet homogeneously concrete/physical experiences with strong axomatic connections in both directions. This

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[26] For further data, consult examples of Lakoff 2014: 7,8.

architecture, as I see it, remains valid when it comes to people understanding/forming new metaphors, but once established, context usually suggests only one practical direction that then becomes strengthened.

This not only underpins CMT in evolutionary and neuronal regards but indicates also that CMs, as we find them in thought and language today, cannot have emerged without such a scaffolding. Favareau et al. (2017, 10) emphasize similarly (with a focus on semiosis), that

> it should be obvious to anyone pursuing an evolutionary account of living organisms that the human use of signs and need for meanings could only be the result of similar processes in evolutionary history. Where else could human semiosis come from? We can say with some certainty that human minds are the way they are because they are a part of the natural world and they share its patterns and habits of evolutionary growth. Codes and channels, and the information they make possible, do not spring fully formed from the head of Zeus, appearing only in Homo sapiens.

And "[a]s always when evolution is concerned there is no distinct event where [XY] happened but rather a gradual change towards [XY]" (Hoffmeyer, Stjernfelt 2015, 22). Givón (2002, 19) mentions in similar regards that the "evolutionary functional extension of pre-existing 'modules' is […] a recurrent theme in the neurology of language".

The finding of simple cross-domain mappings in other than the human species would depict a substantial argument for the phylogenetic archaic quality of metaphor. Naturally, I don't intend to argue that "primitive" metaphoric thought must have already existed in the common ancestor of octopus and human – quite to the contrary: if it exists in both these very distanced species, in different degrees of complexity, we are confronted with independent data illustrating convincingly that metaphor in challenging contexts can serve as an effective cognitive adaptation for interpreting, structuring, and responding to multimodal sensory experiences.

Scholars of CL urgently call for more diverse praxis examples that can concretely underpin the reality of multimodal cross-domain mappings as a cognitive process (e.g. Beger and Smith 2020, 5-8; Kövecses 2016; Gibbs 2008, 292, 300). The octopus case-study here contributes a separate instance of what may be non-linguistic embodied metaphor as "naturally-produced data" (Cienki 2008, 18) in the wild. It would be rather odd if such a complex cognitive process as we study it in humans, had in its entire complexity arisen out of the blue in our species, without being able to find any indicators for a gradual development. It makes more sense that reasoning via CMs developed in the literal Darwinian sense in a recursive or progressive manner providing higher 'semiotic freedom' to the subject. By that it is meant the development of richer semiotic capacities through an agent's interpretation of its Umwelt and identification of possibilities to act in it (Hoffmeyer 2015, 153f) – "cheating and deceit" (156) being one such example.

Metaphoric thinking prior to human language development hence does not jeopardize current cognitive linguists' account of how language in alliance with general CMs works. On the opposite, it would confirm the notion of metaphor as a not exclusively linguistic exercise and thereby as an underpinning property of language. CL could dare thinking more out of the box to for instance recognize the potential of supporting CMT through its potential applicability in other species. Metaphoric thought and speech from this perspective is only and all the more natural. Metaphor is nothing extra that language can do – it may well be one of its basic characteristics and if so, probably evolved first, before the very emergence of language.

CONCLUSION

If conducted from an anthropocentric perspective, studies on CMT run the risk of missing how an incorporation of an evolutionary and non-human animal account for cross-domain mappings can contribute relevant arguments for the cognitive originality of CMs. This survey developed the argument that CMs are a cognitive phenomenon not specific to human language or reasoning. There is much more work to do, in order to reach clarity in this regard, yet I tried to name, elucidate, and discuss some such thoughts.

Accompanied by examples of the likely "reality of metaphoric thinking in animals" (Gómez-Moreno 2014, 423, cf. also Dahl and Adachi), the text aimed to raise CMT researchers' awareness for the thesis that phylogenetically early metaphoric cognition was not developed in the mode of human verbal language but was a matter of non-linguistic thought. This conception resulted intuitively from adding a diachronic angle of interpretation to the reading of studies on metaphor in gesture, and articles dedicated to explaining the multimodal nature of metaphor in general. The paper recurred to the paradigmatic works 'Metaphors We Live By' (Lakoff, Johnson 1980) and Johnson's 'The Body in the Mind' (1987); individual works (Lakoff 1990; Evans and Green 2006; Pecher and Zwaan 2005; Stickles 2016; Kövecses 2016, 2017, 2020, 2022) and several articles investigating the cognitive pre-conditions of language (Givón 2002; Mandler 1994, 2007). I showed that biosemiotic research can commence a dialogue with these cognitive linguistic works and can significantly contribute to the above thesis. Overall, this approach led to this consequence: If lexical knowledge is not a prerequisite for metaphoric sense-making, as the basic claim of CMT, the discussions indicating embodied conceptual metaphoric structures in non-human cognition provide evolutionary clues for why cross-domain mappings are essential to humans' cognitive systems and therefore to their thoughts and languages. They are literally inhabiting them since we can think.

From this point of view, the complex CMs humans live by today are evolved versions of a much older general dynamic neuro-cognitive phenomenon that can prove effective independent of species. The capacity of mapping abstract intangible concepts onto concrete physical sensations and actions having mappings between two equally physical experiences as phylogenetic forerunners could be a hypothesis to investigate more thoroughly.

Metaphorical thought, as I conclude, comes from/evolved for the reason of understanding perceptive events (early on in concrete target domains only) that could not be made sense of without seeking advice/consulting another domain of experience. That is, the sensory-motor system lending itself oftentimes for certain analogical inferences about the object of curiosity. The octopus instance suggests that "[m]etaphor [has been] [...] anchored in embodied perceptual and kinesthetic experience" (Mittelberg 2008, 141) right from its early structural stages of development, which is an optimal fit to Olteanu's proposal to transfer the notion of the "body as that which externalizes the mind" (2021, 787) to the discipline of biosemiotics.

In light of evolution and the zoosemiotic framework, human and non-human brain capacities were argued to emerge as subjects to relative and gradual differences, and not to qualitative ones. In several steps I clarified that the semiotic scaffold underneath the octopus's communication of false signals points to the establishment of coherence between two different domains of this animals' experience – thereby allowing for modelling the one in terms of the properties of the other, based on a certain iconicity between both. In fact, this small octopus seems not only to understand its environment through cross-domain mapping, but it also even exploits this capacity to solve critical situations through shapeshifting and smart moving. Here, the structure of metaphor is used to pre-model ideas to lie to survive.

The description of metaphoric thought in animal cognition in this investigation is limited to the perspective of the sign producer's mental organization. By definition of deception, it is not valid as a successful interpretation as metaphor by the predator.

Although theoretical, I have adopted this interdisciplinary perspective in order to demonstrate exemplary benefits of teamwork between cognitive linguists and zoosemioticians. Apart from the feedback for CMT, we have seen that such a study adds fascinating zoosemiotic insights into how the octopus may perceive, organize and interact with its Umwelt. It is an example of the interplay between endo- and ektosemiotic processes (chromatophore level and interspecies communication), bespeaking that there is more to its impersonations than defining them as Batesian Mimicry. Such a classification only scratches on the surface of the semiotic dimensions underneath these behavioural deceiving acts, motivating them in the first place.

The study decisively recognised the subjective experiences and creative ideas of animals as a significant factor in evolution. The video material and my analyses of it provided data/arguments for the thesis that "phenotypic plasticity in cephalopods" (Fiorito et al. 2014, 14) has been creatively instrumentalised for complex, deliberate behavioural mimicry of other marine organisms – namely through cross-domain mappings as a psychological scaffolding for this semiotic co-option.

Cognition is not only mental, it connects to, grows from and tries to establish coherence between the body's experiences. CMs are manifestations of that.

Future research could further explore existing biological studies of various instances of apparently creative animal behavior for indirect evidence of possible metaphorical cognition at play, and ideally try to replicate the situations under ethically justifiable laboratory conditions with different tests to visualize and compare neuronal activity using fMRI scans.

Generally, widening up the scope of embodied cognition research to investigations beyond human language and behavior could contribute to inform the same.

CL experts could moreover reinterpret their discussions and arguments for the soundness of CMT from the evolutionary perspective introduced here in more detail than is possible here, and thereby test that a purely anthropocentric approach to understanding cross-domain mappings is not scientifically tenable. In order to be allowed to pursue studies based on the exclusion of metaphorical thinking of non-human animals, quantitative indices for the probability of "strongly possible non-existence" (Delahaye 2019, 4) would have to be documented and evaluated by scientists. For a start, this text rather points in the other direction.

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