

# The ontogeny of the embryonic, foetal and infant human umwelt

**Morten Tønnessen**

Department of Social Studies and Department of Health Studies,  
University of Stavanger  
Kokleheia 3, 4630 Kristiansand, Norway  
e-mail: mortentoennessen@gmail.com

**Abstract.** This article, which envelops a case study and development of umwelt theory, addresses four research questions: At what point does the human umwelt emerge? What *umwelt transitions* can be identified in the ontogenesis of the early human umwelt? What is characteristic of the *umwelt trajectory* of human embryos/foetuses/infants? How are umwelt objects established/crystallized/fixated in the human umwelt?

The early human umwelt is characterized by rapid change, radical transformations, and gradual establishment of the first and most basic umwelt objects by way of exploration and learning. While the human umwelt arguably emerges already at the embryonic stage, the sense-saturated umwelt emerges at the foetal stage. Unlike an adult human's umwelt, but like other altricial umwelten, the umwelt of the human foetus and infant is not fully functional from the perspective of the organism itself. In other words, their basic functioning directly depends on others. Our human sociality is further stimulated by shared undertakings early on in our terrestrial lives which effectively make us part of some specific social system.

**Keywords:** human umwelt, infant umwelt, ontogeny, prenatal umwelt, umwelt theory

## 1. Introduction

The umwelt (Uexküll 1956[1934/1940], cf. also Uexküll 2010), or subjective, experienced world of a human individual does not emerge in one step, but unfolds via a number of radical transformations. Some of these are presented in this article about the umwelt of the human embryo, foetus and infant. Though only three quite short stages of a human lifespan are reviewed, we will see that the question of what

it means to be human has very different answers at different points in time in the course of human ontogeny. Such realizations might be valuable in a “civilization that has long since fallen under the spell of its own signs”, in an era characterized by “the adult insistence (expressed in countless forms of grown-up speech and behaviour) that real sentience, or subjectivity, is the exclusive possession of humankind” (Abram 2010: 42). At their best, infants in particular remind us of our unprejudiced, pre-theoretical humanity, and all the things that are possible for us humans – in fact, they are the clearest evidence that as a species we are potentially open to the world in all its wonder.<sup>1</sup>

Humankind is not the only species that is not born ‘ready-made’. As Starck and Ricklefs (1998: 23) write, many insectivores, all rabbits, many rodents and most carnivores

give birth to small neonates that have closed eyes and ears, and no hair, are generally poorly developed, and are dependent on maternal care for a long lactation period. Newborn marsupials and monotremes are extremes, resembling early embryos, even compared to other altricial<sup>2</sup> mammals. Precocial<sup>3</sup> neonates are found among the ungulates [...] and several rodent taxa.

Given the general correspondence between physiology and *umwelt*, the *umwelten* of altricial species are at the beginning of life radically different from the *umwelten* of precocial species. Briefly put, whereas precocial *umwelten* are largely functional from the outset, altricial *umwelten* become fully functional only gradually. In this sense the *umwelt* of the human embryo, foetus and infant are, unlike that of normal adult human beings, not fully functional.<sup>4</sup>

Just as the characteristic features of mammals imply that all mammal *umwelten* have a few things in common – including perception of lactation – all vertebrate *umwelten* are based on the physiological trait of the dorsal nerve cord, an embryonic

---

<sup>1</sup> By saying this I intend to say neither that humans are *in practice* predominantly open to the world, nor that animals cannot be. First, most adult (and adolescent) humans are prone to commit the ‘anthropocentric mistake’ (Tønnessen 2011: 77) which amounts to confusing human reality with reality as such. Second, as Lestel (2011: 84) proclaims, the animal “invents and innovates”; animals “are individuals which do not always behave as they “should” according to the species-specific schemes developed by scientists.”

<sup>2</sup> Individuals of ‘altricial’ species, whether mammals or birds, are relatively helpless as newborn/newly hatched, and require adult care.

<sup>3</sup> Individuals of ‘precocial’ species are relatively mature and mobile from the moment of birth or hatching, and thus quite independent from the outset.

<sup>4</sup> When making use of *umwelt* theory, we must be aware that the model organism in Uexküll’s theory is an adult organism, and that there are notable exceptions, such as the ones just mentioned. In these cases his dictum that an animal’s *umwelt* only consists of those questions that the animal can answer does not apply.

feature which is later modified to become the central nervous system. This in turn makes vertebrate umwelten radically different from invertebrate umwelten, in particular with respect to the appearance of umwelt objects proper.

### 1.1. The anatomy of the early human umwelt

A key explanation of the enormous flexibility of human beings in behavioural terms has to do with the constraint of the birth canal and our big heads. As Marcello Barbieri (2012: 457) puts it,

[i]n all other mammals, the wiring of the brain takes place almost completely in the dark and protected environment of the uterus, whereas in our species, it takes place predominantly outside the uterus, where the body is exposed to the lights, the sounds and the smells of a constantly changing environment.

As we shall see, the human foetus as well is eventually exposed to sounds, lights and other sensations. Nevertheless, Barbieri is on to something of great significance, namely, that human beings are distinguished by being born functionally premature. He builds on the work of Adolf Portmann (1941, 1945), who noted the shortness of our gestation period relative to lifespan compared with other mammals. Our early birth effectively implies that “the foetal development of our brain [has been split] into two distinct processes, one within and one without the uterus” (Barbieri 2012: 460). The latter phase lasts for the whole first year after birth. This is the crucial biological background for our species’ character of being a generalist species. The implication is that before the structure of our brain has been fixed, we have been socialized to a considerable degree. After the wiring of the brain has occurred, there are much stricter limits to what we can readily adjust to. So while in the first year after birth we are principally open to the world, in the second we are already part of some social system (beyond that of the mother-and-infant, which is somewhat social already in its earlier configuration as mother-and-foetus). Martin (2013: 128) supports Portmann’s characterization of the condition of the human newborn as secondarily altricial, noting that “aside from brain development, newborn human infants are in most other respects like other precocial offspring”. What is distinctively human is not being born immature as such, but being born with an underdeveloped brain compared to the adult brain, and the rapid brain growth that takes place after birth. In many other mammals, the transition from fast to slow brain growth is associated with opening of the eyes and ears. “Human infants are unusual in having open eyes and ears during a yearlong period of fetal-type brain growth after birth” (Martin 2013: 128).<sup>5</sup> It is this

<sup>5</sup> On a more general note, Kleisner (2008: 213) remarks that it “is highly probable that prior to the emergence of vision, most organisms had a semitransparent surface not dissimilar from

fact that allows humans to interact with their environment at a formative stage, and that has been “hugely influential in the gradual emergence of greater adaptability and behavioural flexibility during human evolution” (Martin 2013: 128).<sup>6</sup> In Portmann’s words (1990: 132), “[t]here are very sound grounds for designating this first year after birth as the ‘year in the social womb.’”

Brain development and some other physiological developments are shown in rough terms in Figure 1.

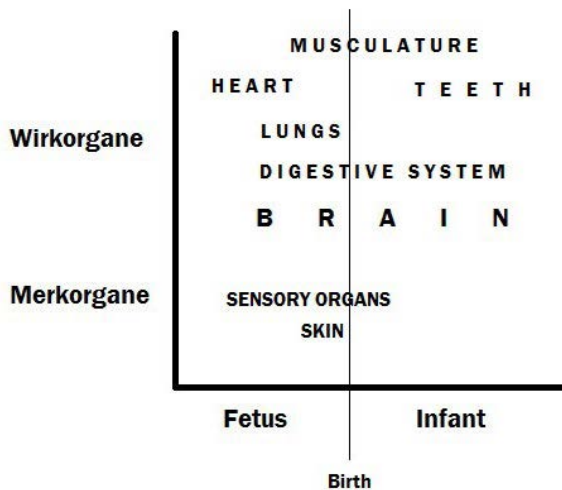


Figure 1. Each organ and physiological system develops according to its own time-plan. At birth only some are fully developed.

As the figure shows, the development of both *Wirkorgane* (Uexküll’s term for effectual organs) and *Merkorgane* (his term for perceptual organs) takes place partly in the womb and partly after birth. While the heart starts beating long before it has acquired its final form, the teeth usually only show up and become functional quite

---

the milky whitish semitransparent coloring of vertebrate embryos”. Building on Portmann, Kleisner defines ‘semantic organs’ as phenomena which enter the Umwelt of another interpreter – “every semantic organ exists at the interface between the expression of physical features and their interpretation” (Kleisner 2008: 217). As far as I can tell, Kleisner’s hypothesis makes good sense.

<sup>6</sup> In this respect the character of the human brain of being underdeveloped at the time of birth is much more important than its absolute or relative size. Though it is surely significant that through hominid evolution the size of the brain has tripled, the brain of the lesser mouse lemur is relatively bigger than the human brain, and the brain of the sperm whale is about five times bigger in absolute terms (Martin 2013: 130, 140).

some time after birth. Since the digestive system also takes time to develop, a human infant is only ready for solid food six months or so after birth. The gradual development of musculature implies that a newborn is physically neither able to walk nor lift its head. Among the implications of the brain's gradual development is that a sense of self only emerges, and language acquisition<sup>7</sup> only occurs, several months after birth. However, the skin is for the most part developed, so the newborn can *feel* this new world of hers, just as she could feel the landscape of the womb, while all the sensory organs are in rapid development and already working.

## 1.2. The ontogeny of the early human medium

The ontogeny of the early human medium (the medium representing one of the four most common types of functional cycles in Uexküll's view) can be said to involve three stages: (1) the embryonic medium (gradually *in utero*); (2) the foetal medium (*in utero*) and (3) the infant medium (terrestrial). In somewhat more detail, we can describe these three initial stages of the ontogenesis of the human medium like this:

- (1) *The embryonic medium*: Embryo transforming from (I) being free/loose in the ovary via (II) being transported to the uterus via uterine tube to (III) being implanted in the uterine wall, and then to (IV) being free-floating but connected to its mother via the umbilical cord.
- (2) *The foetal medium*: In utero, aquatic, the space gradually transforming from spacious to confined, eventually with head fixed.
- (3) *The infant medium*: Terrestrial, increasingly bigger; infant physically unconnected to mother; transforming from orientation lying-down (looking up) to orientation sitting (looking ahead) or crawling (looking down, looking ahead) or walking (looking ahead); and from immobility to mobility.

It is hard to say what subjective experience looks like at the embryonic stage, given that the senses only emerge at the foetal stage. At the foetal stage we can safely assume that we gradually experience our medium first-hand (*sic*) qua whole persons whose experience is *one* and not decentralized in form of cellular biosemiosis only. Yet it is unlikely that we have any experience of being upside down in the final phase lasting until birth, though we surely experience having our heads fixed and the eventually cramped character of our one and only medium.

<sup>7</sup> Language acquisition is not dealt with in this paper, because it is a topic in its own right deserving of thorough analysis. I expect to address it in a separate paper on the umwelt of the toddler. A further prospective paper could have life (and biosemiosis) before conception as its topic.

As for the infant medium, due to our changing orientation as we start to *move around* in our new, terrestrial medium, we are likely to notice aspects of our surroundings that typically go unnoticed in the adult human *umwelt*. For instance, while lying down on its back an infant might (a few weeks after birth) notice the play of shadows on the ceiling or the upper parts of the walls; while sitting she might notice what goes on at the level of an adult's feet; and while crawling she might notice what lies on the floor or the ground. Meanwhile, our mothers have changed from being our first landscapes, in the womb, to being landscapes of a different kind. In the first months after birth, this is (for all but the unfortunate) the place where we rest, and the place where we are fed, and even some months later this is the place which we can always return to – our first *home*, so to speak (long before we start associating “home” with a particular residence).

## 2. Research questions

After these initial sketches of selected aspects of the early human *umwelt* and its physiological underpinnings, I will now present the research questions that I will attempt to address in the course of this paper:

- (1) At what point does the human *umwelt* emerge?
- (2) What *umwelt transitions* can be identified in the ontogenesis of the early human *umwelt*?
- (3) What is characteristic of the *umwelt trajectory* of human embryos/foetuses/infants?
- (4) How are *umwelt* objects established/crystallized/fixated in the human *umwelt*?

The notions of *umwelt transition* and *umwelt trajectory* will be explained in the next section, along with the tripartite *umwelt* model.

## 3. Conceptual framework

### 3.1. Umwelt transitions

An *umwelt transition* is defined as “a lasting, systematic change, within the life cycle of a being, from one typical appearance of its *Umwelt* to another” (Tønnessen 2009a: 49). Whereas early human ontogenesis and birth in general represents a *regular umwelt transition* (or several), from a personal viewpoint our own births are *singular, extraordinary umwelt transitions* (and they might be so from a third-person

perspective too, in so far as a birth in the family radically changes the lives experienced by parents and possibly other family members). In other words, from an existentialist perspective any human birth is a historic event. The umwelt of a human being is *transitional* (i.e., in a process of fundamental change) at least until she or he reaches adulthood, and change is particularly rapid and radical in the womb and during the first year after birth.

### 3.2. Umwelt trajectories

An *umwelt trajectory* is defined (Tønnessen 2014: 161) “as the course through micro- or macro-evolutionary (or cultural) time taken by the umwelt of a creature, as defined by its changing relations with the umwelten of other creatures” and with umwelt objects beyond other living beings. As this definition suggests, the umwelt trajectory of a human infant, for instance, can be conceived of from three different perspectives: (1) from a macro-evolutionary perspective; (2) from a micro-evolutionary perspective; and (3) from a cultural perspective. In this article none of these specific perspectives will be applied in any detail. In case of human embryos it is doubtful that the cultural perspective applies, whereas in the case of human foetuses the cultural perspective might apply to some degree, in so far as the foetus is experientially affected by culturally determined practices (this will not be examined here).

As we can see, the umwelt trajectory notion is relational – it emphasizes those aspects of an umwelt which have to do with the umwelt carrier’s relations to other beings and things. The concept represents an aggregate, collective equivalent to Uexküll’s notion of the *umwelt-tunnel* of a single individual creature [Uexküll 1973[1928]: 108]. Umwelt trajectories can generally be conceived of either as sequences of umwelt-tunnels, or as (sequences of) umwelten of larger complexes (populations, species, life forms). Sequences of umwelt-tunnels can be relevant whenever there are family-bound repeated similarities in experience and/or action or other developments of experiential and/or behavioural character. The latter conception is most relevant in the context of this article: the course through [ontogenical] time taken by the umwelt of a [human embryo/foetus/infant], as defined by its changing relations with other beings and things, where “a [human embryo/foetus/infant]” is to be understood as a *typical* human embryo/foetus/infant and thus as representing the populations of human embryos, foetuses and infants at large in contemporary times.

### 3.3. The tripartite umwelt model

The tripartite umwelt model (first presented in Tønnessen 2011<sup>8</sup>) represents a model of Uexküll's umwelt concept in three different yet interrelated aspects. By *core umwelt*, I mean the aspect of umwelt in which one interacts directly and immediately with other creatures or umwelt objects. By *mediated umwelt*, I mean the aspect of umwelt in which umwelt objects are encountered indirectly by way of some mediation (memory, fantasy, anticipation, modern media, etc.). By *conceptual umwelt*, I mean the aspect of umwelt in which one navigates among umwelt objects in terms of predicative reasoning in general or human language in particular.

But what is meant by *predicative reasoning*? Initially I simply referred to the mental act of ascribing a specific feature to someone or something, and remarked that animals that ascribe specific features to other living beings or objects *as a wilful mental act* (as opposed to as an automated act of perception) are arguably capable of carrying out a fundamental form of logical reasoning. This, however, is not nuanced enough. On second thought I think there is more to mental acts, and to perceptual acts, than will and automation, and I think that what was missing from my first theorizing was the category of the habitual. My claim is that we can generally conceive of six types, or categories, of acts, and that these can be located within the three different aspects of the umwelt:

#### ***Core umwelt***

Automated acts of perception

Automated mental acts

#### ***Mediated umwelt***

Wilful acts of perception

Wilful mental acts

#### ***Conceptual umwelt***

Habitual acts of perception

Habitual mental acts

By an *automated act*, I mean the exact and physiologically based matching of something with something else. By a *wilful act*, I mean the agenda- and interest-driven matching of something with something else. And by a *habitual act* I mean the learned matching of something with something else.

<sup>8</sup> Tønnessen 2011 can be accessed online as [http://dspace.utlib.ee/dspace/bitstream/handle/10062/19250/tonnessen\\_morten.pdf?sequence=1](http://dspace.utlib.ee/dspace/bitstream/handle/10062/19250/tonnessen_morten.pdf?sequence=1), uploaded December 16, 2011.



As we implicitly see here, the building bricks of the umwelt can be said to be either perceptual or mental.<sup>9</sup> While in a wide sense all umwelt “content” is by definition perceptual, we observe that the mental, wherever it appears, perfuses the umwelt. In this sense, an umwelt is either not at all affected by the mental, or it is distinguished by it throughout. Living beings that do not conduct predicative reasoning do not have any conceptual aspect to their umwelten, so their umwelten have only two aspects. And since the mental only appears in umwelten that have a conceptual aspect, the number of acts in the repertoire of non-mental creatures is but two:

***Core umwelt***

Automated acts of perception

***Mediated umwelt***

Wilful acts of perception

The simplicity of this latter design of an umwelt illustrates the difference in complexity between living beings with a mental life and living beings without any mental life. Since mental life is correlated with the existence and specific structure of a brain, we have scientific means to ascertain quite a lot about the mental life of other creatures. While initially I defined predicative reasoning as the mental act of ascribing a specific feature to someone or something, and contrasted it with automated acts of perception, we now see that it is not constituted by *wilful* mental acts, but by *habitual* mental acts. Predicative reasoning, in other words, is the learned matching of something with something else, in any shape or form. As such, it is different from wilful acts of perception. In general terms automated acts are code-based, whereas both wilful acts and habitual acts are interpretation-based. Simple creatures such as bacteria are capable of interpretation, and thus of making choices, but they are not capable of predicative reasoning. Furthermore, we observe that predicative reasoning, i.e. habitual mental acts, must also be distinguished from both automated and wilful mental acts.

## 4. The embryonic umwelt

In *Bedeutungslehre* Uexküll (1956[1940]), translated into English as Uexküll 2010: 159–160) applies his familiar musical metaphor to embryonic development:

Biology takes its point of departure from the fact of planned embryonic development, which begins in all multicellular animals with the three beats of a simple

<sup>9</sup> Mental acts as I understand them are always associated with a brain. All animals with a brain – and only these – conduct mental acts. Perception, however, is in this Uexküllian setting a wider term applying to all organisms endowed with an umwelt.

melody: morula, blastula, gastrula. Then, as we know, the development of the buds of the organs begins, which is fixed in advance for every animal species. This proves to us that the sequence of formal development has a musical score which, if not sensorily recognizable, still determines the world of the senses.

In Uexküll's view, embryonic development is planful and unveils the wonder of nature – “[t]he meaning rule everywhere intervenes decisively in embryonic development and makes sure of the formation of a food utilization organ which grows at the right spot for the right carrier of meaning of vegetative or animal food” (Uexküll 2010: 167). All this is well and good, but it says nothing about the subjective experience of the embryo, if such there be. In fact, the notion of “subjectivity” is challenging if not impossible to apply at this stage. As Magnus (2011: 41–42) observes in her article on Uexküll's approach to the time-plans of organisms,

[t]he ontogenetic time of the organism can be divided into the time of becoming and the time of being. The time of becoming equals the time needed for developing functioning organs; the time of being on the other hand covers the time when the organs have acquired their final form and as such are ready for use. [...] The time of becoming, which at least in the case of mammals equals embryogenesis, is described by Uexküll as a technical phase of the organism, and the time of being, which equals the post-embryonic phase, is characterised as a mechanical phase (Uexküll 1973[1928]: 87–90; 1922; 1924: 6–8).

According to Brentari (*forthcoming*), Uexküll believed that embryonic development in itself will “*establish little by little the conditions for achieving an ultimate end*”, and he thus conceived of it as associated with final causality. Central to Uexküll's approach to embryology is his notion of *Bauplan*, the body plan or physical and functional design of an organism (1973[1928]). As Brentari points out this Uexküllian notion is not altogether concise, and his use of it is not consistent. What is clear, however, is that “the regulating influx carried out by the *Bauplan* in the embryogenetic stage is insurmountable” (Brentari, *forthcoming*).

In the remaining part of this section, I will estimate at what point the human *umwelt* emerges, make a few remarks on the process of becoming human, and point out a few further observations on the *umwelt* of the embryo.

#### 4.1. At what point does the human *umwelt* emerge?

Given that endosemiosis occurs from the outset – intra-cellular semiosis even before conception, in the germ cells – and the fact that Uexküll attributes *umwelten* even to unicellular organisms, it is reasonable to attribute an *umwelt* to the human embryo.

But since the brain only develops at the foetal stage, the embryonic umwelt has only two aspects, a core aspect and a mediated umwelt (the latter likely involving anticipation only).

Perceptual semiosis understood as tied to sensory capabilities emerges as the senses emerge in the life of the foetus, and is thus generally not present in this sense in the life of the human embryo.<sup>10</sup> This marks the emergence of a *sense-saturated* umwelt, as distinguished from a simpler umwelt. With the sense-saturated umwelt in place, the developing organism is not only *physically* one but furthermore *experientially* one, and thus capable of responding by conducting actions ranging from reflexes to more complex actions. Unlike the embryo, the foetus *acts* in the strict sense of making whole-bodied choices. In a wider sense, even the human zygote (first cell after conception) – the human qua unicellular – perceives and acts. And paradoxically it does so in a more unified manner than the multicellular embryo – which nevertheless represents a necessary developmental stage.

#### 4.2. Becoming human

Individuation starts at the embryonic stage, but is only completed much later. As Darwin and von Baer (Barbieri, *forthcoming*) and furthermore Haeckel observed, at a certain stage (today called the phylotypic stage, the stage of maximum morphological similarity) to the naked eye the human embryo is very similar to the embryos of other mammals and many other vertebrate animals. This phenomenological fact underlies the common reference to “Carnegie stages”, which represent a standardized system providing a unified developmental chronology of the vertebrate embryo.

In terms of umwelt, i.e. subjective experience, we gradually individuate and become first animal, then human, then eventually persons.<sup>11</sup> At the transition from embryo to foetus we are in the process of becoming recognizably human, but as we have seen we start out as general animals. These observations are in line with Karl Ernst von Baer’s classic view (1828) that in the embryo, general animal features

<sup>10</sup> Interestingly, Chamberlain (1997) reports that experiments show that “[j]ust before 8 weeks gestational age, the first sensitivity to touch manifests in a set of protective movements to avoid a mere hair stroke on the cheek”. At 10 weeks, skin sensitivity extends to the genital area. This suggests that the tactile sense is the first to emerge, and that elements of a sense-saturated umwelt start to develop already at the embryonic stage.

<sup>11</sup> Abram (2010) thematizes “becoming animal” in a different sense – something akin to realizing in thought and deed that we do have an animal (wild, embodied) nature, all through our lives. In Abram’s sense we do not develop from being animals to being something else. But what I am referring to is our becoming *general* (generic) animals, on the embryonic stage, which is something quite different. In this sense any animal becomes a general animal before it develops into a specific kind of animal (and in some cases even a person).

develop before more specific features. In accordance with Uexküll's postulate concerning the correspondence between anatomy/physiology and *umwelt*, we should perhaps refer to the *umwelt of the mammalian embryo* or *the umwelt of the vertebrate embryo*, rather than the *umwelt of the (early) human embryo* – at least at the initial stages.

Though we generally develop from the generic to the specific, it is worth keeping in mind that we, as human beings, retain several characteristics that we have in common with other species even as adults. For example, as mammals we share physiological traits such as mammary glands, hair and the neocortex with all other mammals. These physiological characteristics are reflected in correlated capacities, experiences and behaviours, and in this sense we can talk of a common *mammalian umwelt* even at the adult stage.

### 4.3. Further observations

In this brief paragraph I address the second and third research question with regard to the human embryo. An *umwelt* transition that can be identified in the ontogenesis of the human embryo is related to the embryo's transition from being fed via the yolk sac to being fed via the umbilical cord, which transforms the embryo's relation to nutrition. As for the *umwelt* trajectory of embryos beyond this, in one interpretation the sperm cell and the egg are endowed with each their *umwelt*, and their union in the zygote marks the creation of a merged *umwelt*, namely the embryonic *umwelt*. Unlike the *umwelt* trajectory of an adult organism, the *umwelt* trajectory of embryos in general are typically predominantly if not altogether fixed to following one specific path. In mammals the relation to the mother organism is particularly pertinent.<sup>12</sup> For vertebrate embryonic *umwelten* in general, we may say that epigenesis consists of a stepwise physiological unfolding which results in a sense-saturated *umwelt* when the embryo becomes a foetus.

Last but not least, we observe that the question "What is it like to be an embryo?" does not make as much sense as the question "What is it like to be a foetus?" If we were to state what it is like to be an embryo and a foetus respectively from an experiential point of view, our first remark would be that whereas being an embryo amounts to being the unwitting focal point of apparently disjointed, fragmented processes of biosemiosis, being a foetus implies, for the first time in ontogenesis, having one whole, integrated experience. Just as the cell might very well be the smallest,

<sup>12</sup> Note that one might critically ask in what sense the mother organism is a salient *umwelt* object to the human embryo, as subjectively experienced (it constitutes its immediate medium, but is it thereby recognized and objectified as such?). Determining at what point an embryo, or foetus, becomes an *umwelt* object to the mother, at the very least as conscious idea, is much more straightforward.

most basic semiotic system, the umwelt of the early foetus is generally the simplest, most basic instance of a sense-saturated umwelt.

## 5. The foetal umwelt

The common understanding of the concepts “innate” and “inborn” is problematic. Both refer to that which is possessed by an organism at birth, and both notions are usually contrasted with that which is learned. The illegitimate assumption implied is that learning in general only occurs *after* birth. Now, surely birth represents a world-changing umwelt transition on several points – but it in no way represents the beginning of learning. The foetus too learns, as it acts and perceives. The fact that we are born with some abilities, then, does not in itself imply that these abilities are not learned but rather inherited. Though *terrestrial* life represents a new (and lasting – and ultimate) phase in our lives, it is not at all the case that life begins at birth.

### 5.1. Umwelt transitions in the foetal umwelt

Perceptual semiosis proper emerges as the senses emerge, one by one, in the life of the human foetus. This marks the creation of a sense-saturated umwelt. Aspects of the foetal *Umgebung* (surroundings, physical environment) are depicted in Figure 2.

The coming to be of a sense-saturated umwelt is certainly the most central umwelt transition in the foetal umwelt – or more specifically, the transition from a “mindless” umwelt to a sense-saturated, mindful umwelt. In terms of the tripartite umwelt model, we can observe that once the sense-saturated umwelt emerges there is a successive emergence of first the core umwelt and the mediated umwelt, and then of the conceptual umwelt as defined by the occurrence of predicative reasoning. This implies that the foetus starts relating to new kinds of objects. With a sense-saturated umwelt and a brain in development, the human foetus furthermore starts to reason, i.e. it (as a whole, as an organism with central coordination) starts to *learn* how to match something with something else. Its knowledge accumulates as the foetus interprets what it experiences.

According to Chamberlain 1997,<sup>13</sup> at the foetal stage sensitivity to touch extends to palms at 11 weeks, soles at 12 weeks, all of the abdomen and buttocks at 17 weeks, and nearly every part of the body by 32 weeks. In parallel, the foetus acquires the capacity to stretch and to move its hand to the head or face very early, and the same goes for opening and closing the mouth, and swallowing. “Spontaneous movement

<sup>13</sup> Chamberlain, David B. 1997. The fetal senses: A classical view. Retrieved from: <http://birthpsychology.com/free-article/fetal-senses-classical-view>.

occurs earliest, probably expressing purely individual interests and needs. Evoked movement reflects sensitivity to the environment. For example, between 10 and 15 weeks g.a., when a mother laughs or coughs, her fetus moves within seconds” (Chamberlain 1997). The structures for tasting are present at 14 weeks, and the nose develops between 11 and 15 weeks. The foetus’ hearing abilities are evidenced by the effect that sounds can have on the foetal heart rate. By 26 weeks, the heart rate is also affected by projections of light on the abdomen of the mother, which suggests that the foetus has by then acquired the sense of vision. It is around this time that the foetus starts opening its eyes. Chamberlain further notes that “at the time of birth, vision is perfectly focused from 8 to 12 inches, the distance to a mother’s face when feeding at the breast.”

Along with motor skill developments (and brain development), the emergence of a sense-saturated *umwelt* enables the foetus to start exploring its own body, and its immediate surroundings, mainly by tactile means. As Stuart (2010: 313) remarks,

[o]ur sensed and felt co-agency begins as soon as movement starts [...] Neither mouthing nor sucking and licking in this context are involved with eating and nutrition, rather they are [...] affective dialogical means of exploration, and it is in this exploration, this non-propositional questioning of its world of felt-being-with, that the pre-nate is establishing its first field of values.

## 5.2. The *umwelt* trajectory of foetuses

What else is characteristic of the *umwelt* trajectory of foetuses? The mediated *umwelt* develops, e.g., by way of dreaming (i.e., experience-based fantasies experienced during sleep). The first dreams have little material.<sup>14</sup> Gradually anticipation is complemented with memories – which in turn affect the foetus’ anticipation of events.



Figure 2. The foetal *Umgebung*. Perceptual semiosis proper emerges as the senses emerge in the life of the foetus, thus marking the emergence of a *sense-saturated umwelt*.

<sup>14</sup> Later on, as a young infant, the child will likely dream about life in the womb.

At this stage the mother of a child, whom the foetus only knows from the inside, is its first, original landscape – mother/Earth. Given the pregnant-woman-and-foetus symbiosis, referring to the auto-communication of this system is as relevant as referring to communication between the two. The umwelt of the human foetus, writes Stuart (2010: 313–314), “can be better described as its *Mitseinwelt*<sup>15</sup>, the felt-being-with, for its experience is affectively-laden co-engagement.” According to Stuart (2010: 308–309) *enkinaesthesia*, “the reciprocally affective neuro-muscular dynamical flows and muscle tensions that are felt and enfolded between co-participating agents in dialogical relation with one another”, starts in the womb. We feel the presence of someone, and start coordinating our movements with this someone, already before birth. This arguably represents the beginning of human sociality.

## 6. The infant umwelt

At birth we are already somewhat attuned to the ways of our mother. But socialization intensifies dramatically in the first year after birth. As Thibault (2000: 294) observes, research into infant semiosis “shows very clearly that from the very earliest stages of the child’s meaning-making, that is, well before the onset of language, the processes involved are in fact fundamentally dialogic and intersubjective.”<sup>16</sup> And infants are not simply being *raised* by adults. In Hodges’ words (2007: 587),

[c]hildren [...] are not passive recipients of guidance by adults; rather, children’s actions increasingly scaffold the activities of caretakers. By nine months, if not sooner, children are babbling, taking a major role in games, resisting the influence of adults, and to some extent setting their own agendas[.]

The further development of sociality in infancy and beyond is reflected in gradually decreasing dependency on others. Unlike an human adult’s umwelt, the umwelt of the human infant (and foetus) is not fully functional – and this is the case in two senses: Firstly, several of the umwelt objects in these umwelten are not concise and stable, but diffuse and unstable. And secondly, since both the foetus and the infant depend on the actions of others, important biological functions are carried out in a

<sup>15</sup> A term coined by Martin Heidegger; literally the world of “being-with”.

<sup>16</sup> As Sears (2003: 76) points out, video-analysis “of mothers talking to their newborns shows the babies moving their heads in a rhythm synchronized with their mother’s speech. [...] Analysis shows that the length of time mother pauses between bursts of language exactly equals the length of the response from her baby. Thus what seems like a monologue to a casual observer is really a dialogue”.

distributed manner, by others, not by the organism itself. In short, this has the effect that the infant cannot make it on its own, but depends on being cared for.

Abram (2010: 38) succinctly states that

[f]or a long while, the soft body of our mother, with her pliant breasts and warm belly, her deep eyes and gentle voice, is coextensive with the rest of the world. Slowly, however, this nourishing presence differentiates into a plurality of interpenetrating dimensions, into mothertouch and groundtouch and skyglow and night (into ticklegrass and fathersong), all echoed by a deepening differentiation within oneself, as the body learns to coordinate the actions of its various limbs and to move within the cosmos.

Figure 3 illustrates the infant umwelt.



Figure 3. The infant umwelt: What are the characteristics of the subjective, experienced world of the human infant? Photo by the author.

One of the illustrations in Uexküll's *Streifzüge durch die Umwelten von Tieren und Menschen: Ein Bilderbuch unsichtbarer Welten* (Uexküll 1956[1934/1940]: 43; cf. Uexküll 2010: 67) shows a church as seen by a child and an adult. His point (Uexküll 2010: 69) is that we must imagine animals and humans "as having a soap bubble



around them, closed on all sides, which closes off their visual space and in which everything visible for the subject is also enclosed". Visual space is according to Uexküll (2010: 63) walled about by an "impenetrable wall, which we shall call the horizon or the farthest plane". The farthest plane determines what objects we see in terms of enlargement and shrinking, as opposed to the closer objects which we see as near or far. Uexküll stresses that objects have "entirely different dimensions" in the umwelten of adults and children. The newborn's visual space is characterized by "an all-encompassing farthest plane" (Uexküll 2010: 66) – in other words, to the newborn human being, for whom depth vision is poorly developed, no objects are experienced as being near or far, instead they are experienced as increasing or decreasing in size.

In the remaining part of this section, which concludes the current article, I will first outline some umwelt transitions in the infant umwelt and comment on the umwelt trajectory of infants. Given the richness of infancy, I will proceed to sketch the ontogeny of the infant *Wirkwelt* (world of action), and then end by theorizing on the establishment of umwelt objects.

### 6.1. Umwelt transitions in the infant umwelt

The umwelt transitions in infancy are too many to mention systematically in the scope of this article. Some of the most important ones, however, are related to

- being born (terrestrial medium, breathing, out-of-the womb sensations, mother transforming from medium to social companion);
- being breast-fed;
- gradually expanding social, enkinaesthetic interaction and coaction;
- objects explored by tactile and gustatory means;
- gradual emerging sense of self and other;
- starting to eat solid foods;
- changing sleep patterns;
- starting to walk (via sitting and perhaps crawling);
- slowly learning to make use of language.

Besides these umwelt transitions in the life of the infant, we can observe that as a result of the birth of an infant, umwelt transitions of a social character occur in the lives of parents, siblings, and other relatives, all of which "become" something new (mother, father, brother, sister, etc.).

Figure 4 alludes to infant exploration and discovery, which gradually becomes increasingly central to the human infant. The pathways of exploration are largely governed by the development of various motor skills.



*Figure 4.* The infant umwelt is characterized by exploration and discovery as the infant learns to control its limbs and to make deliberate use of its senses. Photo by the author.

In her doctoral thesis on picture understanding in young children, Lenninger (2012: 182–183) distinguishes between iconization – i.e., generalization anchored in the individual’s selection of similarities and dissimilarities – and conventionalization, i.e. generalization as filtered by culture. She notes that by five months of age, infants start perceiving objects in realistic pictures as salient. According to her analysis, there are three developmental phases at the infant stage:

- (1) In the very first months, visual features are organised meaningfully (for instance, faces are recognized) even though the child does not yet experience similarities and dissimilarities;
- (2) from five months of age or so iconization dominates, and
- (3) by 12–15 months of age children start distinguishing between the picture and the objects in the picture.

Conventionalization, “like iconization, [...] influences infants’ making of meaning from the start”, Lenninger (2012: 183) observes, but given that it is grounded in social interaction it becomes gradually more important. “It is the dominant means of meaning construction in [...] communication games, which come to play a prominent role before the end of the child’s first year” (Lenninger 2012: 183).

## 6.2. The umwelt trajectory of infants

What else is characteristic of the umwelt trajectory of infants? While Freud and Piaget portrayed the newborn human as asocial and egocentric, Martin Buber (1970[1923]), who took a phenomenological stance, was in Bråten's words (2009: 3) one of three seminal thinkers whose work in the 1920s pointed in another direction. To Buber, the I-Thou relationship (e.g. between mother and child) is unmediated, and nothing intervenes between the I and the Thou. Though the mother-and-child is still in some ways *one* living system, birth represents the individuation event *per se*. After birth Mother remains a landscape, but gradually the child orients itself more widely. In Neumann and Cowley's words (2013), "[t]he baby attends to repeated action or, in Maturana's terms (1978), how each orients to the orienting of the other." Hrdy (2009a; cf. also 2009b) examines human evolution, and theorizes that

our empathetic impulses grew out of the peculiar way that children in the genus *Homo* were reared. I believe that at an early stage in human evolution, our bipedal ape ancestors were increasingly cared for and provisioned not just by parents but also by other group members, known as *alloparents*.

"Shared care", claims Hrdy (2009a), "coevolved with empathetic awareness; mothers and infants benefited from intuiting who would help and who would hurt." As Zlatev (2012: 12) summarizes:

Reviewing the ethological, anthropological, and developmental psychology literatures, Hrdy builds up a case for the proposal that the crucial reproductive turn that occurred with *Homo erectus* nearly two million years ago was not to monogamy but to *alloparenting* or "cooperative breeding". That would account both for the greater gregariousness of our species towards non-relatives and the willingness of infants to bond and communicate with other than biological parents.

The infant umwelt is co-constituted by human others via their practical care for the infant, which ideally establishes a caring and safe environment.<sup>17</sup>

<sup>17</sup> The influence goes both ways – the presence of a baby *does* something to how adults behave, too. As Copley (*forthcoming*: 236) writes with reference to the work of Malloch and Trevarthen (2009), "[a]dults were consistently found not just to be speaking to neonates but doing so in tandem with a repertoire of gestures and 'musicality', where the latter does not imply only song [...] but a particular kind of rhythm in movement and talk [...] The sing-song way of talking to infants, 'motherese' (Trevarthen and Delafield-Butt 2013), is commonly observed and seems almost automatic, despite the content being incomprehensible to the child [...]"

### 6.3. The ontogeny of the infant *Wirkwelt*

Similarly to the overview in 6.1, the one given in this subsection cannot be comprehensive in any way. This said, the *motor skills* of importance in the infant *umwelt* include:

- sucking reflex;
- grasp reflex;
- gradually fine-tuned facial expressions and gestures;
- gradually fine-tuned vocalizations (including of crying);
- voluntary sucking and grasping;
- coordination of hands;
- coordination of hands and feet;
- approaching full-body coordination.

The fingertips and tip of the tongue are the spots on our human bodies where our tactile space is most fine-tuned, and our tactile capacities are the most acute. Infants' tendency to put things into their mouths can therefore be motivated not only by gustatory exploration, but tactile exploration as well. By touching an object with the fingertips, and then putting it into one's mouth in order to use the tongue to continue the examination, the infant has investigated it in the thoroughest way possible by tactile means.<sup>18</sup>

Development of motor skills does not only trigger ever new pathways of exploration and discovery. The actual use of motor skills can, perhaps not surprisingly, also be of use to the infant. This simple fact contributes to confirm that infants, as human beings of other ages, are agenda-driven creatures with a certain awareness of their (immediate) interests and needs. In Thibault's (2011a: 67) words:

In time, the infant can elicit desired responses in others by calling up the appropriate motor command (e.g. proto-imperatives). He or she can control vocal and other bodily behaviours in concert with others (and later solo) that establish a consensual domain of consistent motor-sensory relationships. These motor-sensory relationships bias perception in value-weighted ways that lead to higher-order behavioural control. Thus, control of vocal tract and other gestural activity mean that the gesture can be used to get others to fulfil one's needs and wants.

Within an Uexküllian framework, *umwelt* objects have various *functional tones*. In the *umwelt* of the human infant, these are among the *umwelt* objects that are central (as characterized by their functional tones):

---

<sup>18</sup> Touching is sometimes combined with pointing – in other words, the infant points at something that it simultaneously touches. In this way, it invites another to take part in full-fledged, shared exploration.

- lie-things;
- taste-things;
- grasp-things;
- touch-things;
- play-things;
- sit-things;
- climb-things;
- shake-things;
- throw-things;
- bite-things.

Given the infant's sensational preference for repetition of "the new", virtually *all* things might for a period attain the quality of e.g. grasp-things, shake-things, or throw-things. As for play-things, in Tønnessen 2009b: 574–576 I theorize that there are broadly speaking four categories of play: role play (predominantly iconic – with behavioural/social roles as object of play), sensational play (also called *elemental* play; predominantly indexical – with the pleasure of sensation being the object of play), perceptual play (predominantly symbolic – with rules of perception as object of play), and mind games (where privacy of perception is object of play). I further remarked that further distinctions can be drawn between social play vs. solitary play, etc. All the mentioned categories apply, I think, to infant play at different stages, which probably starts predominantly with sensational play, followed by perceptual play, and eventually role play, which continues in ever new forms throughout childhood.

Figure 5 depicts shared joy.



Figure 5. The umwelt of a healthy, thriving infant is characterized by joint undertakings and shared joy (and shared sorrows). Its world is fundamentally social. Photo by the author.

#### 6.4. The establishment of umwelt objects

At around one year after birth, infants tend to enjoy repetition of certain simple actions that they are in the process of learning to carry out, or have just learned – say, to throw this or that on the floor, or to place something on top of, or inside, something else. From an adult’s perspective, these activities may appear to be somewhat pointless, and the infant’s continued fascination with them is looked upon as either entertaining or (eventually) tiresome. From the child’s perspective, however, these activities likely do their work by helping to establish umwelt objects and the child’s relations to them. The child learns and confirms that a watch, and a remote control, has the quality of being throwable by throwing them on the floor again and again, and likewise learns and confirms that a tiny basket has the quality of being stackable by repeatedly placing one tiny basket on top of another. The child learns by doing, and does what it learns – i.e., immediately applies, practices, its knowledge – at least for as long as the fascination of the new lasts.

Repetition of successful activities is accompanied by – and often preceded by – trial and error, i.e. exploration of the possible. Whenever an infant errs in an attempted action, an adult might think that the child simply does not know what it is doing. For the infant, however, meaning is simply *in flux*, i.e. unstable. Only for the adult (or the mature teenager) has the meaning carried by umwelt objects become altogether stable and predictable. As mentioned earlier in this article the human umwelt is transitional until we reach adulthood. Transitional umwelten are life-worlds whose objects are in a process of change – emerging, vanishing or changing in character. And in some cases, such as in the infant’s umwelt, many umwelt objects are not fixated – their meaning is diffuse, unclear or uncertain, rather than concise and stable.<sup>19</sup>

The infant phase of human life stands out in the context of establishment of umwelt objects, because in this phase a wide range of umwelt objects are established *for the very first time*. Later in life, when umwelt objects acquire new meaning, they are in a sense re-established (changed) rather than established (emerging).<sup>20</sup> Given

<sup>19</sup> Abram (2010: 32) is on to something similar when he writes about “the way ostensibly inert things in a home are drawn into new life by an infant’s curiosity and pleasure – the way their shapes are received and welcomed by a small child, and enjoyed in their peculiarity and wonder long before those objects are named – before their boundaries become definite, their strict utility and purpose defined”.

<sup>20</sup> As Neumann and Cowley (2013: 19) observe, “by 3–4 years of age, second-order constructs [linguistic abstrata] (and wordings) exert tight constraints on how children act, think and feel”. Language, and the specifically human conceptual umwelt, plays a crucial role in the establishment of umwelt objects beyond infancy (and to some extent in late infancy). Thibault (2011b: 95), referring to Cowley (2008: 340) and his demonstration of our metalinguistic practices guiding us “to seek out words as what we think we hear in vocal activity”, writes that [f]or instance, mothers prompt infants to repeat the words that they (mothers) believe to

that the sense-saturated umwelt emerges already at the foetal stage, we can talk about establishment of umwelt objects in the womb too, but in the foetal umwelt we must assume that umwelt objects, at least as a rule, remain diffuse – their biological function or function elsewhere is seldom or never clear-cut. On the other hand, from the infant umwelt onwards, one after another umwelt objects acquire meanings which are gradually specified and eventually fixated. Their meaning is thus, in these processes, crystallized, and we can safely and unequivocally say that the umwelt objects are being *established*.

We can somewhat fairly approach the umwelt of the very young human infant in light of what Uexküll (1956[1940]: 160, here in my translation) remarked in the introduction to *Bedeutungslehre*, where he recounts an encounter with a colour-blind acquaintance and criticizes the zoologist Max Hartmann (1876–1962):

If he [the acquaintance] was colour-blind, then Hartmann is meaning-blind. He studies the face of nature in the same way as a chemist studies the Sistine Madonna. He sees the colours, but not the image. Surely, a chemist can get very far with the colour analysis, but it has nothing to do with the image.<sup>21</sup>

In a similar way, the infant can, from the adult's perspective, be said to be meaning-blind in its dealings with objects that do have a function for the adult but not yet for the child. The focus of the infant often lies in simple sensations, shadings, remarkable details, and so on, rather than in gestalt-like wholes (except for faces, which is a notable exception to this rule).<sup>22</sup>

---

have a reality that is separate from the material dynamics of first-order languaging behaviour. Infants are induced to repeat the verbal pattern qua word and to ignore the behavioural flow of facial, vocal and bodily expression in which this pattern is embedded. [...] This reification of verbal patterns leads to the idea that meanings are transmitted from one person to another and that they exist independently of the behavioural and experiential flux of coordinated inter-individual languaging activity.”

In a sense learning to speak implies learning to forget, or neglect, non-verbal aspects of human experience. Vocabulary, grammar and style thus scaffold phenomenological (i.e. umwelt) experience. While anything that appears (or appears to appear) to the speechless infant exists qua (diffuse) umwelt object, the mature human being's umwelt consists for the most part only of those objects that can be named.

<sup>21</sup> The original reads: “*War dieser farbenblind, so ist Hartmann bedeutungsblind. Er steht dem Antlitz der Natur gegenüber da wie ein Chemiker vor der Sixtinischen Madonna. Er sieht wohl die Farben, aber nicht das Bild. Gewiß kann ein Chemiker bei der Farbenanalyse sehr weit kommen, mit dem Bilde hat es nichts zu tun.*” Uexküll's introduction is unfortunately not included in the most recent translation into English, Uexküll 2010.

<sup>22</sup> At this stage face recognition appears to be distinctively human. Face recognition might have evolved as language evolved, since paying attention to facial expressions significantly improves communicative skills, particularly the ability to understand the intentions and emotions of another person. It is conceivable that those individuals who were (genetically)

To summarize this very last point, while from an adult's perspective the young child is part meaning-blind and part naive, from the infant's own experiential perspective what occurs is that a range of new objects acquire meanings and functions (in other words, for all practical purposes, what the infant experiences is that a range of new objects *emerge*).<sup>23</sup> It is these that the infant explores, and as the infant strolls or totters on, its world keeps growing in range and in depth.<sup>24</sup>

## References

- Abram, David 2010. *Becoming Animal: An Earthly Cosmology*. New York: Pantheon Books.
- Baer, Karl Ernst von 1828. *Über die Entwicklungsgeschichte der Thiere*. Königsberg: Bornträger.
- Barbieri, Marcello 2012. Organic codes and the origin of language. In: Swan, Liz; Gordon, Richard; Sechbach, Robert (eds.) 2012: *Origin(s) of Design in Nature* [= Cellular Origin, Life in Extreme Habitats and Astrobiology 23]. Dordrecht: Springer: 445–473.
- *forthcoming*. Evolving the embryos. In: Barbieri, Marcello, *forthcoming*. *Code Biology*. Manuscript draft.
- Bråten, Stein 2009. *The Intersubjective Mirror in Infant Learning and Evolution of Speech* [Advances in Consciousness Research 76]. Amsterdam, Philadelphia: John Benjamins Publishing Company.
- Brentari, Carlo, *forthcoming*. *The Discovery of the Umwelt. Jakob von Uexküll between Biosemiotics and Theoretical Biology* (Book series *Biosemiotics*). Dordrecht: Springer.
- Buber, Martin 1970[1923]. *I and Thou*. [Kaufmann, Walter, trans.] New York: Scribner's Sons.

---

inclined to pay greater attention to faces and facial expressions overall had lower mortality than those who rather neglected faces and facial expressions, and/or that such attentiveness resulted in them being regarded as more attractive and thus in a reproductive advantage.

<sup>23</sup> This includes animals. A limitation with this article is that it has not addressed animals as umwelt objects in the infant human umwelt. As Lestel (2002: 61) observes, “[i]t is illusory to oppose human and animal societies because every human society is also a society made up of animals”.

<sup>24</sup> **Acknowledgements:** Some of what I have written here I have learned from books and articles, but the most important knowledge is derived from my experience as a father of Matias Laurits da Silva-Tønnessen (born October 10th, 2012), in the company of his mother, my wife, Helena da Silva-Tønnessen. I owe them both gratitude for what they have taught me about life, including the life of the very young human. From Matias in particular I am learning (imperfectly) to discover the world anew. Rather than “having done research” on him, I feel that I have been subjected to an experience of co-learning. And besides, how could I ever *teach* him anything, even as a role model, without again and again *learning* (from him) to know him? – This study has been conducted as part of the research project “Animals in changing environments: Cultural mediation and semiotic analysis” (EEA Norway Grants – EMP151). I want to thank participants at the conference NASS VIII (Aarhus, May 2013) and in the research seminar of Lund University's Centre for Cognitive Semiotics (October 24th 2013), plus two anonymous reviewers, for feedback on earlier drafts of this paper.



- Cobley, Paul, *forthcoming*. *Narrative*. [Second edition.] London, New York: Routledge.
- Cowley, Stephen J. 2008. The codes of language: Turtles all the way up? In: Barbieri, Marcello (ed.): *The Codes of Life: The Rules of Macroevolution*. Berlin: Springer, 319–345.
- Hodges, Bert H. 2007. Good prospects: Ecological and social perspectives on conforming, creating, and caring in conversation. *Language Sciences* 29: 584–604.
- Hrdy, Sarah Blaffer 2009a. Meet the alloparents: Shared child care may be the secret of human evolutionary success. *Natural History Magazine* 04 (April 2009).
- 2009b. *The Evolutionary Origins of Mutual Understanding*. Cambridge: Harvard University Press.
- Kleinsner, Karel 2008. The semantic morphology of Adolf Portmann: A starting point for the biosemiotics of organic form? *Biosemiotics* 1(1): 207–219.
- Lenninger, Sara 2012. *When similarity qualifies as a sign: A study in picture understanding and semiotic development in young children*. [Doctoral thesis.] Lund: Lund University.
- Lestel, Dominique 2002. The biosemiotics and phylogenesis of culture. *Social Science Information* 41(1): 35–68.
- 2011. What capabilities for the animal? *Biosemiotics* 4(1): 83–102.
- Magnus, Riin 2011. Time-plans of the organisms: Jakob von Uexküll's explorations into the temporal constitution of living beings. *Sign Systems Studies* 39(2/4): 37–57.
- Malloch, Stephen; Trevarthen, Colwyn 2009. Musicality: Communicating the vitality and interests of life. In: Malloch, Stephen; Trevarthen, Colwyn (eds.), *Communicative Musicality*. Oxford: Oxford University Press, 1–11.
- Martin, Robert 2013. *How We Do It: The Evolution and Future of Human Reproduction*. New York: Basic Books.
- Maturana, Humberto R. 1978. Biology of language: The epistemology of reality. In: Miller, Georg A.; Lenneberg, Elizabeth (eds.), *Psychology and Biology of Language and Thought: Essays in Honor of Eric Lenneberg*. New York: Academic Press, 27–63.
- Neumann, Martin; Cowley, Stephen J. 2013. Human agency and the resources of reason. In: Cowley, Stephen J.; Vallée-Tourangeau, Frédéric (eds.), *Cognition beyond the Brain: Computation, Interactivity and Human Artifice*. Dordrecht: Springer, 13–30.
- Portmann, Adolf 1941. Die Tragzeiten der Primaten und die Dauer der Schwangerschaft beim Menschen: Ein Problem der vergleichenden Biologie. *Rev. Suisse Zool.* 48: 511–518.
- 1945. Die Ontogenese des Menschen als Problem der Evolutionsforschung. *Verh. Schweiz. Naturf. Ges.* 125: 44–53.
- 1990. *Essays in Philosophical Zoology: The Living Form and the Seeing Eye*. [Carter, Richard Burnett, trans.]. Leviston: E. Mellen Press.
- Sears, William 2003. *Becoming a Father: How to Nurture & Enjoy Your Family*. [Revised edition.] Schaumburg: La Leche League International.
- Starck, J. Matthias; Ricklefs, Robert E. 1998. Patterns of development: The altricial–precocial spectrum. In: Starck, J. Matthias; Ricklefs, Robert E. (eds.), *Avian Growth and Development: Evolution within the Altricial-Precocial Spectrum*. New York: Oxford University Press, 3–30.
- Stuart, Susan 2010. Enkinaesthesia, biosemiotics, and the ethiosphere. In: Cowley, Stephen; Major, João C.; Steffensen, Sune V.; Dinis, Alfredo (eds.), *Signifying Bodies: Biosemiosis, Interaction and Health*. Braga, Portugal: Portuguese Catholic University, 305–330.
- Thibault, Paul 2000. The dialogical integration of the brain in social semiosis: Edelman and the case for downward causation. *Mind, Culture, and Activity* 7(4): 291–311.

- 2011a. Linguaging behaviour as catalytic process: Steps towards a theory of living language (Part I). *The Public Journal of Semiotics* 3(2): 2–79.
  - 2011b. Linguaging behaviour as catalytic process: Steps towards a theory of living language (Part II). *The Public Journal of Semiotics* 3(2): 80–151.
- Trevarthen, Colwyn; Delafield-Butt, Jonathan 2013. Biology of shared experience and language development: Regulations for the intersubjective life of narratives. In: Legerstee, Maria Theresia; Halevy, David V; Bornstein, Marc H. (eds.), *The Developing Infant Mind: Integrating Biology and Experience*. New York: Guilford Press, 167–199.
- Tønnessen, Morten 2009a. Umwelt transitions: Uexküll and environmental change. *Biosemiotics* 2(1): 47–64.
- 2009b. Abstraction, cruelty and other aspects of animal play (Exemplified by the playfulness of Muki and Maluca). *Sign Systems Studies* 37(3/4): 558–579.
  - 2011. *Umwelt Transition and Uexküllian Phenomenology – An Ecossemiotic Analysis of Norwegian Wolf Management (Dissertationes Semioticae Universitatis Tartuensis 16.)*. Tartu: Tartu University Press.
  - 2014. Umwelt trajectories. *Semiotica* 198 [Special Issue “Dimensions of Zoosemiotics”; Maran, Timo, ed.]: 159–180.
- Uexküll, Jakob von 1922. Technische und mechanische Biologie. In *Ergebnisse der Physiologie* (XX Band), Munchen and Wiesbaden: Verlag von J. F. Bergmann, 129–161.
- 1924. Mechanik und Formbildung: Ein Gespräch. *Deutsche Rundschau* 201: 51–64.
  - 1956[1934/1940]. *Streifzüge durch die Umwelten von Tieren und Menschen: Ein Bilderbuch unsichtbarer Welten. Bedeutungslehre*. Hamburg: Rowohlt.
  - 1973[1928]. *Theoretische Biologie*. Frankfurt a. M.: Suhrkamp Taschenbuch Wissenschaft.
  - 2010. *A Foray into the Worlds of Animals and Humans with a Theory of Meaning*. [orig. Uexküll 1956[1934{1940}]; O’Neil Joseph, trans.] Minneapolis: University of Minneapolis Press.
- Zlatev, Jordan 2012. Cognitive semiotics: An emerging field for the transdisciplinary study of meaning. *The Public Journal of Semiotics* 4(1): 2–24.

### **Онтогенезис умвельта человека в эмбриональной, зародышевой и детской стадии**

В статье рассматриваются четыре вопроса: В какой момент возникает умвельт человека? Какие переходы умвельта можно опознать в раннем онтогенезе человека? Что характеризует траектории умвельта на разных этапах человеческого развития? Каким образом в человеческом умвельте возникают/кристаллизируются/фиксируются объекты умвельта?

Ранний умвельт человека характеризуется быстрым развитием, радикальными изменениями и постепенным возникновением первых и основных объектов умвельта путем их изучения и обучения. Хотя доказано, что умвельт человека возникает уже в эмбриональной стадии, обогащенный чувствами умвельт появляется в стадии зародыша. В отличие от взрослого, умвельт зародыша и ребенка не является с точки зрения организма полностью функциональным. Социализации людей способствуют общие действия в ранней постэмбриональной стадии.

### **Inimese maailma ontogeneesi embrüonaalses, loote ja lapse staadiumis**

See artikkel, mis hõlmab üksikjuhtumi vaatlust ning arendab edasi maailmateooriat, puudutab nelja uurimisküsimust: Millisel hetkel tekib inimese maailm? Milliseid maailma üleminekuid saab inimomailma varajases ontogeneesis tuvastada? Mis iseloomustab inimembrüote/-loodete/-laste maailmatrajektoore? Kuidas on inimese maailmas moodustunud/kristalliseerunud/fikseerunud maailmaobjektid?

Inimese varajast maailma iseloomustavad kiired muutused, radikaalsed teisenemised ning esimeste ja põhiliste maailmaobjektide järk-järguline moodustumine uurimise ning õppimise kaudu. Kuigi inimese maailm tekib tõestatavalt juba embrüonaalses staadiumis, tekib meeltest küllastunud maailm lootestaadiumis. Erinevalt täiskasvanud inimese maailmast ei ole inimloomade ja lapse maailm organismi kui sellise perspektiivist täiesti funktsionaalne. Inimeste sotsialiseerimist stimuleerivad veelgi ühised ettevõtmised varajases postembrüonaalses elus, mis muudavad meid tegelikkuses mõne konkreetse sotsiaalse süsteemi osaks.