LINGUISTICA BIDGOSTIANA
Bydgoszcz 2007

Anna Bączkowska

Conceptual universals and linguistic relativity: the perception and conception of space by infants and the acquisition of *in* and *on* by children across languages

Introduction

The aim of the present paper is to discuss how conceptual universals and linguistic relativity determine the acquisition and use of the mother tongue. To illustrate the concept of language acquisition, the first part of this article will be devoted to a brief description of developmental sequences in space perception by infants. While this part will be concerned largely with language universals, the second part of the discussion will demonstrate linguistic relativity by focusing on cross-linguistic differences in space perception encoded by selected prepositions of space. The material examined is based on research into language used by children. The paper will round off with a brief section on possible implications of the cross-linguistic analysis for Polish-English translation, and in particular, problems with equivalence of the English prepositions *in* and *on* and the Polish prepositions *w* and *na* will constitute the core of the last section.

Developmental sequences in space perception by infants

Described from the perspective of developmental psychology, emergence of the awareness of space in an infant will be presented by discussing such categories of description as horizontality and verticality, volume, physical properties of objects (shape, size), relations held between objects (gravity and support, causality, containment, functionalism), and some processes connected with object perception (e.g. separation, conceptual opposites and maximal contrast), as well as primitive concepts of conceptual schemas. Before moving on to the development of the concept of space in neonatals, some introductory remarks about prenatal sensory experience will be briefly presented.

It is claimed that basic senses whereby a child can orient in space, such as cutaneous (relating to skin) and gustatory organs, are already well developed in a newborn (Akhundov 1986: 17). Although an infant is fully conscious of space well after birth, and the process of becoming aware of space is believed to occur gradually, it must be noted that the human being becomes acquainted with the concept of space also well before birth – through the confinement of the womb in the prenatal life. The first argument speaking for the development of primitive spatial concepts in prenatals stems from the fact that around the seventh week the sense of touch develops and the sensitivity of this sense increases with the growing foetus as it experiences direct contact with the uterine walls while moving. By experiencing limitations of its movements, i.e. by first bouncing against the cushion-like uterine membranes and next by rubbing against them with its back, head and hands as well as kicking them, a prenatal, in fact, experiences the sense of confinement, i.e. a closed space. As the immediate environment of the womb is dark, the sense of sight does not develop until late in the second trimester and, thus, a greater role in sensory experience, along with touch, is ascribed to the sense of hearing. The womb membranes are permeated with the voice of the mother as well as other sounds, in particular of mid- and low-frequency, relatively early (Pallas 2005: 7). The auditory signals which reach the foetus are distorted (as the human ear is designed to operate in air rather than in fluid, which fills the ear *in utero*), and not all of them are sufficiently strong to penetrate the uterine membranes, affect the cerebral cortex and trigger stimulus recognition (synaptic circuitry). This deficiency in sound recognition can possibly create the sense of the existence of two independent 'spaces' (places?), here, i.e. in the womb, and there, i.e. outside the womb (in infants known as the schema 'here-there' and in adults known as 'center-periphery'). Egocentrism in the cognitive development of space, put forward by Piaget and Inhelder, is well illustrated by this experience.

Before the proper consciousness of space emerges in an infant, it is perhaps the concept of volume that seems to be more natural for a child. Volume is sensed by an infant (as well as a prenatal) when his stomach is full or empty, due to contractions and distensions of muscles, or when he inflates his lungs with air while breathing (Tuan 1977: 21). Also instinctive actions performed by a child, such as kicking a blanket, according to Tuan (1977: 21), allow a child at several weeks to experience the freedom of open space. Some primitive awareness of the existence of space and the nature of objects, however, occurs at birth (Spelke 1991), and it is manifested in the recognition of simple geometrical shapes extending in space, such as curved and straight lines (Elman et al. 1996: 107).

Interestingly, the concept of straight line is different in an infant than one conceptualized by an adult. For a baby the first topological relations are realized in the form of shapes with coordinates imposed on a non-euclidean plane. As claimed by Piaget (chap. VI in Piaget and Inhelder 1967) "topological relations such as closure, two-dimensional surrounding, or overlapping or boundaries" embodied by figures, although seem to be relatively more complex than geometrical shapes (squares, rectangles, straight line) are in fact acquired earlier. This may be due to the fact that figures are reconstructed by a child in his imagination as elements of non-euclidean space, while geometrical shapes are elements of Euclidean space, the latter being an abstract concept, "a notion far from elementary" (Piaget and Inhelder 1967: 155). The concept of a straight line requires that a baby be aware of continuity, which develops around the age of three and a half months (Boysson-Bardies 1999: 130). Around this time the concept of solidity also arises.

As the awareness of space is largely dependent on sight (Tuan 1977: 6), it seems that infants cannot develop a proper sense of space before their eyes achieve the stage of development which allows them to fix their eyes on an object. As infants' eye fixation at birth is improper and binocular fixation with convergence arises around two months, the perception of rectilinear shapes is imperfect (Bing-chung 1942, Scaife and Bruner 1975, in Tuan 1977: 20).

Once a child develops binocular vision, due to frequent and repetitive actions performed by parents, such as leaving a baby prone and raising him, e.g. to feed, to allow a child to burp after feeding, to console or play with him, a child also develops a sense of verticality and horizontality. The preference for verticality in infants seeks explanation in the general preference of infants for maximal contour density, i.e. for objects which have "the clearest and the most contour per unit area" (Salapatek 1975: 213).

Horizontality is supported by actions performed by the child himself when he starts crawling and explores objects existing in the immediate environment 'moving' along horizontal trajectories in his egocentrically framed world. Full contact of the body with the supporting floor experienced while crawling provides a child with a sense of stability, permanence and security. Interestingly, within horizontally located objects an eight-month-old child is able to recognise a familiar object, say a bottle, only when it is not presented in the usual way (i.e. with the teat upwards), and he is unable to identify it with the familiar object of a bottle when it is displayed upside down (Tuan 1977: 22).

Contrary to safe horizontal experiences, **vertical actions** and objects are recognised by children as potential danger. As reported by Tuan (1977, chapter III), vertical slides extending over a glass plate create in a child a sense of danger so intense that he will not explore this terrain, despite strong encouragement from his mother. Verticality is experienced intensively when a child starts to walk. With the still fresh concepts of a prone baby that verticality equals danger, when a child rises to keep an upright position of his body and starts to walk, he tends to stay close to his mother, straying away on the whole very seldom and for very short periods, and with the distance rarely exceeding twenty feet away from his mother in European culture (Tuan 1977: 25). A child's cautious behaviour can be accounted for by common sense explanations: a child does not only want to feel the presence of his mother, a situation which guarantees security, but also he wants to remain erect and avoid the unpleasant experience of falling down on the ground.

Let us notice in passing that closely allied with verticality are concepts of **gravity and support**, which are claimed to develop in a child in small increments. At 4.5 months, as proved by Needham and Baillargeon (1993), infants expect an object to fall when its supporting element is taken away. At seven months, an infant is believed to have 'emerging knowledge of gravity' (Coventry and Garrod, 2004: 151-153) which is discernible in a well known experiment wherein a seven-month-old baby expects a ball rolling down a slope to accelerate and to decelerate when it goes upwards (Elman et al. 1996: 107). Another experiment shows that when displayed in mid-air, an object evokes surprise in an eight-month-old infant due to the lack of support under the presented object (Elman et al. 1996: 107). Interestingly, gravitational judgements are claimed to supersede judgements based on physical observation (cf. report on this issue in Coventry and Garrod 2004: 151). This hypothesis seems to be substantiated by an experiment conducted by Spelke et al. (1992, reported in Coventry and Garrod 2004: 152) which strongly suggests that infants' reactions to impossible support configurations encode surprise, which, in turn, on a more general note, indicates that infants create expectations about where a falling ball is going to drop (on which shelf – the upper or lower – in the case of the above mentioned experiment) *before* they can actually observe it in reality.

Returning to the concept of verticality, the first symptoms of emerging awareness of possible vertical directions in space can be detected before a child is one year old. It is visible, for example, in an **'up gesture'**, when a child raises his arms upwards to encourage an adult to pick him up. Experiments conducted by Quinn (1994) seem to suggest that a three- and four-month-old child is able to create a sense of vertical order by being familiarised with an object (such as a diamond shape) placed above some point of reference (a horizontal bar in this particular experiment) and in a novel position (below a horizontal bar).

Both vertical and horizontal dislocations entail changes in **distance** between an observer and an object observed. At first, an infant is interested only in the immediate environment surrounding him, i.e. in what is visible. Later, at eight months, he is also interested in events which are not within the range of his eyes, such as noises in another room (Tuan 1977: 23). Strangely enough, for an infant only extreme distances seem to be of interest – objects located very far and very close – ignoring the mid-ground (Tuan 1977: 24), which probably results from the fact that infants categorize the environment on the basis of **maximal contrasts and opposites**.

For example, for a toddler there exist two 'spaces' – 'home' and 'outside'. For a two-year-old, then, a typical answer to the question 'where do you live?' would be 'home', although the understanding of the concept 'where', according to Gasell (1950: 121), arises around the age of two and a half years, and therefore at three, the answer to the same question would be different – it is likely to be much more specific, with the name of the street and even numbers of the house and flat as well as, although less frequently, the name of the town (Ames and Learned 1948: 72, 75 reported in Tuan 1977: 25-30). Before understanding the concept 'where', the answer 'home' is suggestive of early development of the sense of security which home, as opposed to 'outside', can provide.

Infants make a distinction between animate and inanimate things and divide people into familiar and unfamiliar. Again, this primitive division based on conceptual opposites probably springs from the need to satisfy basic needs of a defenceless infant, such as a sense of security and hunger. It is no wonder, then, that for a six- to eight-month-old baby a familiar face approaching him induces a soothing reaction and calmness. At two to two and a half a child is able to discriminate between basic spatial opposites, such as empty vs. full (stomach), here vs. there, close vs. far, top vs. bottom, front vs. back, on vs. under, left vs. right, up vs. down (Behl-Chadho and Eimas 1995, Gesell et al. 1950: 102-116, and Ames and Learned 1948). Along with spatial contrasts, infants are also able to discriminate between contrasting objects located in space. Thus, two solid objects put seemingly in the same physical location will evoke surprise in a three-month-old infant (Elman et al. 1996: 107).

In the first months of life objects are perceived as separate entities which exist **independent of one another**. For example (examples from Piaget and

Inhelder 1967: 20, 68, 49, 155, 379, 389), when asked to draw a picture of a cowboy with a hat on sitting on a horse, a child is likely to draw these objects as separate, i.e. with no contiguity points between them. When asked to draw a glass with water, the level of the liquid is likely to be perpendicular to the walls of the glass, even when the glass is tilted; similarly a chimney on a sloping roof will be at right angles relative to the roof rather than the ground. At six months, an infant is capable of recognising and discriminating between basic geometrical shapes, such as a triangle and a square, yet it does not mean that he understands the concepts they represent. This knowledge will develop much later, around the age of four, when a child is able to draw these shapes himself. These observations evince that a child perceives single objects without noticing spatial relations in which they are enmeshed, which, as Piaget claims, speaks for the thesis that child's sensomotor development precedes his conceptual development.

We shall now return to the issue mentioned earlier, namely the perception of object boundaries. It is assumed that an infant is capable of discriminating between overlapping objects, juxtaposed objects or objects as entities separate from the background when he is about four-and-a-half months old (Spelke et al. 1995: 305-306). The evidence which supports the claim that an infant can identify boundaries stems from experiments wherein infants were encouraged to reach for an object which required directing their hands to the borders of the displayed object, and, strangely enough, this reaching move tends to persist even in the dark (Spelke et al. 1995: 307). In determining object boundaries, the main discriminating criterion is believed to be motion: objects move as one unit against other objects or a stationary background, and the edges and surfaces function as indicators in the figure-ground organization which allow infants to conceive object boundaries. It seems then that the whole process of the development of object perception, in particular the identification of parameters of continuity and motion are crucial in object (figure) perception in early infancy and this is suggestive that the concept of motion develops (and develops in the mind as a concept) prior to object boundaries. In might be interesting to mention in passing that because it seems that movement plays an important role in object perception in early infancy, it is believed (Mandler 1996: 373) that the image-schema involving a path (trajectory) in space can be one of the first schemas developed in infants[1].

[1] Mandler (1995: 373) describes image-schemas as 'discrete meaning packages' which "retain their continuous analog character while at the same time providing some of the desirable characteristics of prepositional representations".

If two objects, however, are stationary and they are presented against a stationary background then infants tend to perceive them as one object, even if they differ in terms of shape, texture and colour (Spelke et al. 1995: 309-319). For example, being presented with a single picture of a car and an adjacent trailer, an infant seems to identify them as a bounded object – 'a car-trailer' – rather than a car and a trailer which follows it (ibid.), pushing thus the object boundaries to the whole isomorphous picture which consists of two constitutive elements (which are polymorphic). This experiment is in line with the Gestalt school, which insists that observers are inclined to perceive the objects observed as maximally simple (or simplified) and regular arrangements or units. Thus the car and the trailer must be identified as a single object, as the contour comprises both elements. Gestalt theory is consonant with claims voiced by some scholars who believe that since the ability to identify contours of simple two-dimensional figures does not need experiential learning, then it is innate (Gibson 1950: 216-220, Michotte, Thines and Crabble 1964, Bower 1974, all discussed in Salapatek 1975). Although there is a bulk of research which seems to support the Gestalt principles of cognition, it must be stressed that there are experiments that are indicative of conclusions which are completely reverse. Spelke et al. (1995: 310) claim that there are studies which "support the Gestalt thesis that perceivers have an early-developing, general process for organizing arrays into objects" when it comes to the universal rules of cognition but, at the same time, "infants do not appear to perceive object boundaries by organizing visual scenes into units that are maximally homogeneous in color and texture and maximally smooth and regular in shape". It is agreed that the principle parameter against which object grouping is performed is proximity, and that this Gestalt principle precedes form-based grouping or one dependent on the parameter of continuation (discussed by Quinn et al. 2002). This claim has been supported by the experiment with a yellow rubber duck and a red metal toy truck wherein after familiarising ten-month-old infants with two basic toy arrangements (arrangement one: the duck moving back and forth remaining on the surface of the truck; arrangement two: stationary duck on top of the truck), in the second part of the experiment a hand entered the display to, in one arrangement, move the duck and the truck upwards or, in the other arrangement, move only the duck into the air. While infants who were exposed to the first (with moving duck) arrangement looked longer at the first event, which implies that what they saw was contradictory to their expectations as the two objects were identified as one, infants who were first exposed to the stationary arrangement looked longer at the second event, which suggests that they perceived the two objects as separate. This experiment, as Spelke et al. claim, is inconsistent with the Gestalt principle of similarity, according to which "surfaces lie on a single object if they share a common color and texture" (Spelke et al. 1995: 310). Other Gestalt principles as well as their violation in experiments on infant perception are presented in Spelke et al. (1995).

When discussing the issue of object boundary identification it must also be stressed that both sensory-anatomical and attentional perception of object contours in infants are relatively poor and thus they differ from what an adult understands as object boundary. This poor visual acuity in infants stems from underdeveloped peripheral (as compared to focal) processing as well as poor binocular fixation.

In sum, it must be noted that experimental data on object boundaries perception by infants are inconclusive. Although it seems that the ability of an infant to perceive an object as different and as a unified whole which has certain characteristic features (such as texture, shape and colour) requires some experience, i.e. is perceptual, the ability to perceive amorphous objects/figures is not based on experience, therefore it is probably innate, yet there is also evidence which might suggests reverse opinions. Concluding this section on infants, perhaps it is interesting to mention that research on the perception of objects by higher animals, in particular the coding of contours and the reception of shapes, size, motion and colour, provides further support to the claim that these abilities are innate (discussed in Salapatek 1975: 145-146).

From perception to conception (from percepts to concepts)

An interesting problem in connection with infants' perception and concept formation is the relation of a word's conceptual meaning to its ontological status, which is expressed by two competing views on word learning noticed by Tomasello: the so-called constraints approach, represented by e.g. Markman (1992) and Gleitman (1990), and the social-pragmatic approach, convergent with cognitive linguistics (Lakoff and Johnson 2003, Langacker 1987) supported by some psycholinguists (e.g. Tomasello 2001). The first view encounters serious problems when it comes to tackling commonly known issue posed by Quine (1960) of referential indeterminacy, according to which a non-native observer being presented with a situation wherein a native utters a word, say, 'Gavagai!' cannot possibly know what the word refers to – the event, the participant of the event or only a part of the participant's body, etc. The social-pragmatic view stresses the importance of experiential knowledge in matching word meaning with objects in real world and thus it seems to overlap concepts voiced by cognitive linguistics and constructivism.

Let us pause at this point to mention another pressing problem associated with language acquisition which is still left unsolved, namely how, once learned, the conceptual/semantic meaning is *identified* in an object. There are several approaches to this problem (cf. Shallice 1996 for summary of four main perspectives) which boil down to the question of whether we have one or two conceptual/semantic systems which are accessed during word and object recognition. One theory, the organized unitary content hypothesis (OUCH), proposed by Caramazza et al. (1990), maintains that there is one access system which consists of two subsystems – the visually and verbally-based knowledge – and that access to the visual semantics is believed to be easier. A competing approach (advocated by Warrington 1975, Shallice 1987, McCarthy and Warrington 1988) suggests that there are two access systems – visual-based and verbally-based knowledge (and thus verbal and visual semantics) – which are separate, and that assuming the existence of just one conceptual/semantic system is 'too gross a characterization of the subdivisions of the cognitive system involved in semantic processing' (Shallice 1996: 533). Apart from the obvious semantic system, the functional system has been identified by Chertkow and Bub (1990).

Returning now to the verbal and semantic systems of an infant, evidence to prove that first, still as an infant, children form concepts at the prelinguistic stage and words are mapped onto these conceptual representations available, rather than the other way round, has been presented above, on the basis of research conducted by Piaget and other developmental psychologists working within the Piagetian paradigm. The emergence of spatial topological relations are believed to stem from primitive conceptual representations which, as Mandler (1996: 363) claims, are spatial in nature, and they are supposed to follow the same sequence across languages. The universality of words encoding space, i.e. prepositions, is reflected in the following pattern: first concepts indicating containment are learned (*in*), next the preposition *on* is learned to express support and contiguity, this is followed by the preposition *under* which codes occlusion, and finally words expressing proximity (e.g. *next to*, *between*, *at*) emerge (Bowerman and Choi 2001: 478). The concepts of containment (seen from several angles) and support are believed to be developed by 6 months, and, along with occlusion, in the task of distinguishing containment from support infants rely on other parameters as well (Casasola et al. 2003). Bowerman and Choi notice that the sequence of development of universal schemas encoded by spatial prepositions is consonant with the developmental stages of infants described by Piagetian researchers. It is perhaps also interesting to mention at this stage that in the case of non-universal concepts, children become sensitive to language-specific spatial categorical notions encoded by prepositions as early as before the age of two (Bowerman and Choi 2001: 491), and that the categorical organization in spatial memory arises in early infancy, Quinn (1994) claims that even in infants of three months.

Interestingly, the sequence of the acquisition of prepositions is determined by strategies infants use during their prelinguistic phase. As claimed by Bowerman (1996: 390), experiments conducted in the seventies (Clark 1973) indicate that the preposition *in* is acquired before *on*, and *on* precedes *under* because the nature of spatial perception is such that a baby discovers the possibility of putting one object into another container-shape object (the concept of inclusion encoded by *in*) earlier than of putting one object onto a supporting, flat surface (the concept of support, encoded by *on*). If this is true then this claim is convergent with the contention that the spatial schema of containment probably develops in the pre-natal stage, as because of remaining for nine months in the enclosure of mother's womb it seems more likely that a foetus experiences the sense of containment rather than the concept of support.

Given the claim that concepts arise before words, one could ask how a child passes from the preverbal, conceptual stage to the verbal stage. When we look at this problem more closely it turns out that the assumption we proposed above and to which we wish to adhere – that concepts are formed before words – is far from simple and involves more than just one change – from notion to word. In fact, as Mandler (1996) maintains, after the sensomotor period of basic schemas development analysed by psychologists there is in literature a great leap to the verbal stage taken over by linguists, leaving the stage in between – the nature of concepts (as symbolic representations) and the process of shifting from one stage to another – an almost uncharted terrain. The question Landau and Hoffman (2005) ask themselves in the first sentence of their important paper only proves that the problem is still under investigation: "does the acquisition of spatial language always reflect the characteristics of non-linguistic spatial representation?" Moreover, as noted by Mandler (1996: 366), psychologists do not always agree with linguists as to the nature of preverbal concepts, which makes the problem even more complicated. For example, Piaget assumes that an infant is born with the *tabula rasa* mind and all concepts he develops as a baby result from operations experienced in the immediate environment of the infant, and that these concepts do not have the status of symbolic representations. Linguists, on the other hand, are of the opinion that before a child learns words he must first possess a set of symbolic representations in his mind and they do not always exclude the existence of some primitive conceptual schemas (conceptual domains) already built in a neonatal's mind. As there are some disagreements concerning this crucial stage in child verbal development, in what follows we shall have a closer look at these underdeveloped problems.

First, there is the sensorimotor stage (which lasts one year) scrutinised by Piaget and other Piagetian psychologists when no concepts arise and only sensorimotor experiences are collected. Some scholars maintain, however, that simultaneous to this stage the conceptual domains are said to arise. For example, Mandler (1996: 366-9) makes a point that the concepts of animals and vehicles are formed first (at seven months) and they are followed by the emergence of the domain of plants, furniture and utensils (at eleven months), which may result from the distinction of animate vs. inanimate entities arising at the stage of maximal contrasts and opposites (cf. above). Thus the rich conceptual life of a baby begins before the sensorimotor period terminates.

From this it also transpires that sensorimotor and conceptual accomplishments are two distinct types of knowledge. The former encodes procedural information which permits the identification of actions or objects experienced earlier and, on this basis, the anticipation of what is still to come. It is therefore conditioned and somewhat behavioural, sharing in this respect common ground with Skinner's theory, with the difference to bear in mind that Piagetian constructivism sees a child as an active information constructor, whereas behaviourism requires only passive knowledge storage (Karmiloff-Smith 1992). This conditioned, context-dependent knowledge does not allow a child to use it independently of its original context and, in consequence, it cannot be treated as the foundation for linguistic development, although some communication between the two planes is assumed to be allowed or even necessary (Mandler 1996: 367). As an example of such interdependence Mandler presents a scene wherein a baby is putting a spoon into a bowl. He notices that, on the sensomotor plane, this action requires some dexterity and for a child it comprises 'an intricate sequence of movements'. On the other hand, on the conceptual plane this sequence of movements is considerably simplified to a schema which might be embodied in the notion of containment (encoded by *in*). Mandler maintains that it is due to this simplified conceptual schema that linguistic development can be instigated, rather than to the procedural sensomotor schema itself.

Connected with concept emergence on the basis of perception is also the phenomenon of categorisation, both perceptual and conceptual. It is said that the objects an infant perceives in reality, say a dog, are only exemplars of a superordinate category, although it must be noted that it is also claimed by other scholars, for example by Murphy (2002: 286), that memory storage in infants (similarly to adults) of both exemplars (coordinate representations) and categories (categorical representations) is equally efficient[2]. A successful identification of contrasting properties between two different exemplars of one category (e.g. the broad category of animal), such as a dog and a cat, a horse and a zebra, or a dog and a lion, which takes place at three months, enables a child to accomplish perceptual categories. They are classified as perceptual, rather than conceptual, as they do not allow a child to organize his knowledge immediately into a set of examples at a higher level of cognition, and although they do not maintain and form a purely abstract, schematic concept of the category of animal, their role is crucial in the emergence of conceptual categories, which are built around the kernel properties encoded in perceptual categories. Thus it becomes increasingly probable that between sensorimotor operations and conceptual, abstract representations there is a linking stage of perceptual categories formation. This thesis is supported by experiments conducted by Eimas and Quinn (1994), as well as Mandler and McDonough (1993), and it is also consonant with what we know about the structure of semantic memory. The theory of the semantic memory proposes several approaches to categorization of which two are important for this paper: the prototype and the exemplar approach (cf. Matlin 2005, chap. 8). It must be stressed at this point that the answer to the question about the nature of categorization cannot be sought in only one of the theories and that the debate about which of them explicates the process better has not been resolved as yet.

Although some scholars caution that the idea of conceptual categories being derivable from perceptual categories encounters some empirical difficulties (e.g. Mandler 1996: 368), and some even openly criticize the need to discriminate between perceptual and conceptual ones, it is important to notice that since this problem causes so much discussion, the way from sensorimotor experiencing of objects and thus learning the basic principles of physics,

[2] Interestingly, neuroscience has provided us with new revealing data obtained through PET and fMRI studies which demonstrate that coordinate representations are stored in the right hemisphere while categorical representations reside in the left hemisphere (Baciu et. al 1999). Local prepositions, in particular *in*, *on*, and *around*, are believed to be processed by two regions in the brain: left inferior prefrontal and left inferior parietal region (Tranel and Kemmerer 2004).

to the building of their epistemic representations and next their abstract categories cannot involve a single one-stage mechanistic leap but a complex and largely still unsolved process.

Returning now to the categorical perceptual-conceptual dyad, it is believed that perceptual and conceptual categories evolve in parallel before the age of one year. Evidence that conceptual representations, i.e. symbolic, abstract representations which allow an infant to use them in absence of their original context, are different from perceptual ones (believed to emerge in the beginning as meaningless), has been provided by Mandler and McDonough (1993) who demonstrate that infants have the capability of categorising dissimilar exemplars of one superordinate category while at the same time failing to categorise basic-level exemplars which look alike. Bearing in mind that, as already mentioned, there is evidence (Mandler 1996) which demonstrates that the categories of, say, animals and vehicles are developed at seven months and plant, furniture and utensils represent a separate group of concepts which develop around the age of eleven months, this interesting observation, as Mandler (1996: 369) himself admits, can lead to somewhat controversial conclusions that 'infants distinguish global categories *before* they distinguish the basic-level categories nested within the animal class'. In other words, infants are believed to identify abstract global categories regardless of the properties of their physical manifestations, and this thesis speaks for the development of abstract symbolic representations at a superordinate level in early infancy simultaneously to – if not before – basic-level (subordinate level) representations arise. This statement, however, would be at odds with a bulk of research on child development as well as in sharp contrast with psychological investigations of categorisation conducted by Rosch (1973), which is one of the psychological theorems on which cognitive linguistics was erected.

Acquisition of prepositions *in* and *on* across languages

Crosslinguistic research on language acquisition, with its peak in the 1970s, revealed that regardless of the mother tongue there is a universal set of meanings which are acquired first, and that these meanings are connected with children's bodies as well as defining objects, their possession, attributes and location (Bowerman and Choi 2001: 476). Despite these universal cross--cultural similarities, there is a great deal known about substantial differences in how concepts formed by a child are mapped onto linguistic forms available in a culture- and language-specific context. Before this problem is embarked on, it is perhaps interesting to note that it has not been decided with full certainty what comes first: is it the concept that is first formed and then encoded by a word or is it the word that is chosen prior to the concept it encodes. In other words, it is still unclear which of the following questions posed by Nelson in 1974 should be approached: "how does the child form a concept to fit the word?" or "how does the child match words to his concepts?" (Bowerman and Choi 2001: 476). Recent research seems to favour the problem posed by the second question, as "babies do not wait until the onset of language to start thinking; the problem of packaging meanings into workable units is thus a prelinguistic one" (Mandler 1996: 365).

As children who start to utter their first words are already familiar with the notions established much earlier in the preverbal stage, rapid generalisation occurs at the stage of the single-word period. Thus, having learned the concept of verticality at the age of several months, a two-year-old child starts to use the prepositions *up* and *down* with full comprehension, and being already familiarised with the notion of distance and contrasts (which emerge before the age of one), he starts to use the preposition *out*, *off* and the like. The meanings of the above prepositions, however, are extended onto contexts which bear limited similarity to their prototypical senses. The fact that children are inclined to generalise about the canonical meaning of these concepts speaks for the view that notions emerge before words and that words are mapped into concepts rather than concepts into workable units (Bowerman and Choi 2001: 479).

Interestingly, in the past some of these workable units – early spatial words – were believed to be universal (evidence obtained from research on adult speech), yet this view has been questioned recently by Bowerman and Choi (2001: 505). They claim that children's too broad or too narrow generalizations (i.e. extension patterns) are not aligned to a universal set of semantic categories and that these categories (which are thus language-specific) are not directly moulded by "non-linguistic perceptual and conceptual predispositions for space" (ibid.). This statement speaks for the crucial role of environmental factors in both language and cognitive development and it downgrades the function of hard-wired knowledge[3].

As mentioned before, the two prepositions and their conceptual meanings discovered by babies first are *in* and *on*, and thus in what follows I will give examples of how these concepts emerge in different languages (based on

[3] Some interesting research has been conducted by Norman (1980) in urban and suburban New England and rural Appalachia. His findings seem to prove that cognitive development is strongly influenced by environment factors.

experiments conducted by Bowerman 1996a and b, also cf. Coventry and Garrod 2004, chap. 8). Bowerman compares these prepositions by juxtaposing three situational categories – support and gravity, inclusion, and support without gravity – exemplified by several phrases (see table 1).

Table 1. Concepts, schemas and lexical expressions denoting *in* and *on*

concepts-schemas	**lexical expressions**	**English**	**Finnish**	**Dutch**	**Spanish**	**Japanese**	**Berber**	**Korean**	**Polish**
inclusion	'apple in bowl'	in	in (-ssa)	in (in)	in (en)	naka	di	nehta/ kkita	in (w)
support without gravitation (vertical)	'bandaid on leg'	on	in (-ssa)	on (op)		ue	x or di		on (na)
support with inclusion; encirclement	'ring on finger'	on	in (-ssa)	on (om)					on (na)
support without gravitation (vertical)	'fly on door'	on	in (-ssa)	on (op)					on (na)
support without gravitation (vertical);	'picture on wall'	on	on (-lla)	on (aan)		x or di		on (na)	
support without gravitation (vertical); attachment through projecting or hanging	'handle on cupboard'	on	in (-ssa)	on (ann)	in (en)		di		on (na)
support with gravitation (horizontal)	'cup on table'	on	on (-lla)	on (op)	in (en)	ue	x	nohta/ pwuthita	n (na)

From the information tabulated above it can be noticed that: (1) the English and the Polish concepts encoded by the two prepositions in these particular contexts overlap; (2) in Spanish there is one preposition (*en*) to encode the above concepts; (3) in Finnish inclusion and support without gravitation are encoded by the same postpositional case markers: *-lla* for intimate contact and *-ssa* for loose contact; (4) Dutch uses a number of prepositions of space which encode relations unmarked in English; (5) the preposition *on* in Dutch is used of relations indicative of support without gravitation (*op* or *ann*) as well as with gravitation (*op*) and encirclement (*om*); (6) in Berber two prepositions can designate support without gravitation: *x* and *di*; (7) in Japanese the two prepositions in question roughly correspond to their English equivalents; (8) in Korean inclusion and support are refined and further divided into a configuration wherein tr and lm fit either loosely (*nehta*) or tightly (*kkita*) in terms of containment or are attached loosely (*nohta*) or tightly (*pwuthita*) in the case of support.

Implications for Polish-English translation

In the above analysis the Polish equivalents of the English *on* and *in* do not seem to pose any problems, yet, as described elsewhere (Turewicz 1993, Bączkowska 2004), relying on the equivalence of concepts expressed solely by the configurations presented in Table 1 would lead us astray. It should be stressed that there are a number of cases wherein there is no direct correspondence between Polish and English expressions which encapsulate the above mentioned schemas (table 2, based on Bączkowska 2004).

Table 2. Lack of conceptual and lexical correspondence between English and Polish prepositional phrases

English	**Polish translation**
in a tree – inclusion	*na drzewie* (on a tree) – support
in a desert – inclusion	*na pustyni* (on a desert) – extended flat surface
in a corridor – inclusion	*na korytarzu* (on a corridor) or *w korytarzu* (in a corridor) – inclusion
in a street – inclusion	*na ulicy* (on a street) – support
in a room – inclusion	*w sali* (in a room) or *na sali* (on a room) – inclusion
on TV – exposition (sub-schema of support)	*w TV* (in TV) – inclusion
in the sun/rain – inclusion	*na/w słońcu, na/w deszczu*[4]

[4] On the difference between the Polish phrases *na/w deszczu and na/w słońcu*, cf. Bączkowska (in preparation).

Conclusions based on my own research on the schematic correspondence between English and Polish prepositions can be summarised as follows. First, inclusion is typically expressed in English by one preposition – *in* – and by two prepositions in Polish – *w* or *na*. The English *in* is translated into the Polish *w* if the notion of three-dimensionality (encoded by inclusion) is realized fully, i.e. if both *in* and *w* stress the feature of three-dimensionality as the salient feature of the construed scene. The English *in*, however, can also be rendered into Polish *na* (roughly English *on*) if: (1) the three-dimensional shape of the object which illustrates inclusion (i.e. the landmark) is not ideal (i.e. inclusion is realized through virtual boundaries, cf. Langacker 1987) as in the example ***in** the street* vs. ***na** ulicy*; (2) inclusion is not profiled in a given scene, as in *(a bird)* ***in** a tree* vs. *(ptak)* ***na** drzewie* wherein support, rather than inclusion, is put to the fore; (3) whenever potentially two schemas – inclusion and support – can be encoded by a given scene, there is a tendency to highlight inclusion in English (and thus to use *in*) and to give priority to the concept of support in Polish (and thus to use *na*) as a more typical schema, leaving thus *w* to convey additional, usually more emotional or less usual information. For example, in Polish to say that somebody remains outside when it is raining is typically realized through *na*, while in English it is encoded by *in*: *stand* (and wait) *in the rain* vs. *stać* (i czekać) *na deszczu*. However, it is also possible to say *stać w deszczu*, yet it seems that there is a subtle difference in meaning between the two phrases, which can be summarized as follows: The preposition *na* is suggestive of more static situations and/or open and extending spaces, whereas *in* is used in contexts wherein tr is more dynamic, more involved in the situations described, and the spatial or temporal range is shorter than in the case of contexts encoded by *on/na*. Thus, *na* resembles the canonical conceptual meaning of the English *on* which dictates spatial and temporal extension and is likely to create a motionless picture. On the other hand, *w* shows some similarity to the conceptual meaning of *in* in the sense that both prepositions are implicative of an active tr involved in the scene construed (as indicated in English by the very phrase *be involved in*, in the context of *rain* it might be hinted by emotional states, such as strong irritation and impatience expressed by, say, body movement and facial expression) and, in comparison with *na deszczu*, both are suggestive of shorter actions/states.

To conclude our contrastive study of the two prepositions, my analysis supports the thesis put forward by Turewicz (1993, 2005) who claims that the lack of correspondence between Polish and English conceptual meanings of the prepositions *in*, *on* and *w*, *na* can be sought in differences in the degree of salience found in three-dimensional objects to which the given prepositions refer (i.e. to their landmarks, in the case of prepositional phrases). Thus, if inclusion encoded by the landmark following the English *in* is fully reflected and receives equal (primary) emphasis in its Polish equivalent, than the Polish *w* is used; if, however, the feature of three-dimensionality of the landmark is not salient, then it preserves the preference for inclusion in English expressed by the preposition *in*, yet it lacks this preference in Polish, and, instead, it is mapped onto the conceptual meaning expressed by the Polish *on*. Examples below (from Turewicz 1993: 214) illustrate the problem:

(1) the crack in the cup – pęknięcie na filiżance (3d in English vs. flat surface and support in Polish);
(2) muscles in the leg – mięśnie w nodze (profiled 3d in both languages).

Conclusion

Conceptual universals and linguistic/conceptual relativity have been discussed in the present paper in connection with the acquisition of spatial prepositions. Reasons to think that the conceptualisation of space is central to the development of language are many. Let us mention the thesis most important for the present discussion that the concept of space seems to be the most primitive concept in human cognition, developed most probably well before an infant is born, and, as some scholars claim, the schematic idealization of space is hard-wired and thus it is triggered already in prenatal stage. Because of this, simple image-schemas through which to experience rudimentary relations in space are believed to be universal. The moment a child is born, however, environmental factors gradually start to affect the perception and conception of space by infants and, consequently, the words picked out to map spatial conceptualisation vary across languages and cultures, thus illustrating linguistic relativity.

References

Akhundov M. D., 1986: *Conceptions of Space and Time*, Cambridge: MIT Press.

Ames L. B., Learned J., 1948: *The development of verbalized space in the young child*, "Journal of Genetic Psychology", vol. 72, pp. 63-84.

Baciu M., Koening O., Vernier M-P., Bedoin N., Rubin C. and Segebarth C., 1999: *Categorical and coordinate spatial relations: fMRI evidence for hemispheric specialization*, "NeuroReport", No. 10, pp. 1373-1378.

Bączkowska A., 2004: In *versus* na: *krótkie studium porównawcze*, „JOWS", No. 1, pp. 11-14.

Bączkowska A., 2005: *Analiza przyimka* on *w świetle gramatyki kognitywnej oraz jej implikacje dydaktyczne*, „JOWS", No. 3, pp. 27-32.

Bączkowska A., 2005: *Nauczanie „phrasal verbs": czasowniki z partykułą* on *wyrażające pojęcie TERAZ w schemacie 'illative'*, "JOWS", No. 4, ss. 12-16.

Bączkowska A., (in preparation): *Contrasting English and Polish prepositions: the case of* w/na deszczu *vs.* in the rain *and* w/na słońcu *vs.* in the sun.

Behl-Chadha G., Eimas P. D., 1995: *Infant categorization of left-right spatial relations*, "British Journal of Developmental Psychology" 13, pp. 69-79.

Bing-chung L., 1942: *A genetic study of sustained visual fixation and associated behaviour in the human infant from birth to six months*, "Journal of Genetic Psychology", No. 61, pp. 271-272.

Bower T. G. R., 1974: *Development in Infancy*, San Francisco: Freeman.

Bowerman M., 1996a: *The Origins of Children's Spatial Semantic Categories: Cognitive versus Linguistic Determinants*, In: J. J. Gumperz and S. C. Levinson, *Rethinking Linguistic Relativity*, Cambridge: CUP.

Bowerman M., 1996b: *Learning How to Structure Space for Language: A crosslinguistic Perspective*, In: P. Bloom, M. A. Peterson, L. Nadel and M. F. Garrett (eds), *Language and Space*, Cambridge, Mass.: MIT Press.

Bowerman M., Choi S., 2001: *Shaping Meanings for Language: universal and language-specific in the acquisition of spatial semantic categories*, In: M. Bowerman and S. C. Levinson, *Language Acquisition and Conceptual Development*, Cambridge: CUP.

Boysson-Bardies B. (translated by M. B. DeBevoise), 1999: *How Language Comes to Children: from birth to two years*, Cambridge: Mass.: MIT Press.

Caramazza A., Hillis A. E., Rapp B. C. and Romani C., 1990: *The multiple semantics hypothesis: multiple confusions?*, "Cognitive Neuropsychology" 7, pp. 161-189.

Casasola M., Cohen L. B., Chiarello E., 2003: *Six-Month-Old Infants' Categorization of Containment Spatial Relations*, "Child Development", Vol. 74, No. 3, pp. 679-693.

Chertkow H. and Bub D., 1990: *Semantic memory loss in dementia of Alzheimer's type*, "Brain" 113, pp. 379-417.

Clark E. V., 1973: *What's in a word? On the child's acquisition of semantics in his first language*, In: T. E. Moore (ed.), *Cognitive Development and the Acquisition of Language*, New York: Academic Press, pp. 65-110.

Coventry K. R. and Garrod S. C., 2004: *Saying, Seeing and Acting: The Psychological Semantics of Spatial Prepositions*, Hove: Psychology Press.

Eimas P. D. and Quinn P. C., 1994: *Studies on the formation of perceptually based basic-level categories in young infants*, "Child Development" 65, pp. 903-917.

Elman J. L., Bates E. A., Johnson M. H., Karmiloff-Smith A., Parisi D., Pluntett K., 1996: *Rethinking Innateness: A Connectionist Perspective on Development*. Cambridge, Mass.: MIT Press.

Gesell A., Ilg F. L., Bullie G. E., 1950: *Vision: Its Development in Infant and Child*. New York: Paul B. Hoeber.

Gibson J. J. 1950: *The Perception of the Visual World*. Boston: Houghton Mifflin.

Gleitman L. R. 1990: *The structural sources of verb meanings*, „Language Acquisition" 1, pp. 3-55.

Karmiloff-Smith A., 1992: *Beyond Modularity: A Developmental Perspective on Cognitive Science*, Cambridge, Mass.: MIT Press.

Kemmerer D. and Tranel D., 2000: *A Double Dissociation between Linguistic and Perceptual Representations of Spatial Relationship*, "Cognitive Neuropsychology", Vol. 17, No. 5, pp. 393-414.

Lakoff G., Johnson M., 2003: *Metaphors We Live By*, Chicago: Chicago University Press.

Landau B. and Hoffman J. E., 2005: *Parallels between Spatial Cognition and Spatial Language: Evidence from Williams syndrome*, "Journal of Memory and Language", Vol. 53, Issue 2, pp. 163-186.

Langacker R., 1987: *Foundations of Cognitive Linguistics*, Stanford: Stanford University Press.

Mandler J. M., 1996: *Preverbal representations and language*, In: P. Bloom, M. A. Peterson, L. Nadel, M. F. Garrett (eds), *Language and Space*, Cambridge, Mass.: MIT Press, pp. 365-384.

Mandler J. M., 2000: *Perceptual and Conceptual Processes in Infancy*, "Journal of Cognition and Development", Vol. I. pp. 3-36.

Mandler J. M. and McDonough L., 1993: *Concept formation in infancy*, "Cognitive Development" 8, pp. 291-318.

Markman E. M., 1992: *Categorization and Naming in Children: problems of induction*. Cambridge, Mass.: MIT Press.

Matlin M. W., 2005: *Cognition*. Hoboken, NJ.: John Wiley & Sons.

McCarthy R. A. and Warrington E. K., 1988: *Evidence for modality-specific meaning systems in the brain*, "Nature" 334, pp. 428-430.

Michotte A., Thines G. and Crabble G., 1964: *Les complements amodaux des structures perceptives*. „Studia Psychologica", Louvain: Publications Universitaires de Louvain.

Murphy G. L., 2002: *The Big Book of Concepts*, Cambridge, Mass.: MIT Press.

Needham A. and Baillargeon R., 1993: *Intuitions about support in 4.5-month-old infants*, *„Cognition"* 4, pp. 121-148.

Norman D. K., 1980: *A Comparison of Children's Spatial Reasoning: Rural Appalachia, Suburban, and Urban New England*, "Child Development", Vol. 51, No. 1, pp. 288-291.

Quinn P. C., 1994: *The Categoriztion of* Above *and* Below. *Spatial Relations by Young Infants*, "Child Development", No. 65, pp. 58-69.

Quinn P. C., Bhatt R. S., Brush D., Grimes A. and Sharpnack H., 2002: *Development of Form Similarity as a Gestalt Grouping in Infancy*, "Psychological Science", Vol. 13, No. 4, pp. 320-328.

Pallas S. L., 2005: *Pre- and Postnatal Sensory Experience Shapes Functional Architecture in the Brain*, In: B. Hopkins and S. P. Johnson (eds), *Prenatal Development of Postnatal Functions*. Westport, Connecticut: Praeger.

Piaget J. and Inhelder B., 1967: *The Child's Concept of Space*, New York: Norton Library.

Quine W.: 1960: *Word and Object*. Cambridge, Mass.: MIT Press. Polish translation: 1999, *Słowo i przedmiot*. Warszawa: Aletheia.

Rosch E., 1973: *Natural categories*, "Cognitive Psychology" 4, s. 328-350.

Scaife M. and Bruner J. S., 1975: *The capacity for joint visual attention in the infant*, „Nature", 24, pp. 265-266.

Shallice T., 1987: *Impairments of Semantic Processing: Multiple Dissociations*, In: R. Job, G. Satori, and M. Coltheart (eds): *The Cognitive Neuropsychology of Language*. London: Erlbaum.

Shallice T., 1996: *The language-to-object perception interface: evidence from neuropsychology*, In: P. Bloom, M. A. Peterson, L. Nadel, M. F. Garrett (eds), *Language and Space*, Cambridge, Mass.: MIT Press, pp. 531-552.

Spelke E. S., Breinlinger K., Macomber J., and Jacobson K., 1992: *Origins of knowledge*, „Psychological Revie" 99, pp. 605-632.

Spelke E. S., Gutheil G., and Van de Walle G., 1995: *The Development of Object Perception*, In: S. M. Kosslyn and D. N. Osherson, *Visual Cognition*. Cambridge, Mass.: MIT Press.

Talmy L., 1996: *Fictive motion in language and 'ception'*, In: P. Bloom, M. A. Peterson, L. Nadel, M. F. Garrett (eds), *Language and Space*, Cambridge, Mass.: MIT Press, pp. 211-276.

Tomasello M., 2001: "Perceiving Intentions and Learning Words in the Second Year of Life". In: M. Bowerman and S. C. Levinson (eds). *Language Acquisition and Conceptual Development*. Cambridge: CUP.

Tranel D. and Kemmerer D., 2004: *Neuroanatomical Correlates of Locative Prepositions*, "Cognitive Neuropsychology", Vol. 21, No. 7, pp. 719-749.

Tuan Y-F., 1977: *Space and Place: the Perspective of Experience*. Minneapolis: University of Minnesota Press.

Turewicz K., 1993: *English* in *and* on : *Polish* w *and* na. *A Cognitive Grammar Perspective*, In: E. Gussmann and H. Kardela (eds) *Focus on Language*, Lublin: UMCS Press.

Turewicz K., 2005: *Understanding prepositions through Cognitive Grammar: A case of* in, In: K. Turewicz (ed.), *Cognitive Linguistics: A User-Friendly Approach*, Szczecin: Wydawnictwo Uniwersytetu Szczecińskiego.

Warrington E. K., 1975: *The selective impairments of semantic memory*, „Quarterly Journal of Experimental Psychology" 27, pp. 635-657.

Summary

The aim of the present paper is to discuss how conceptual universals and linguistic relativity determine the acquisition and use of the mother tongue. To illustrate the concept of language acquisition, the first part of this article is devoted to a brief description of developmental sequences in space perception by infants. While this

part is concerned largely with language universals, the second part of the discussion demonstrates linguistic relativity by focusing on cross-linguistic differences in space perception encoded by selected prepositions of space. The material examined is based on research into language used by children. The paper rounds off with a brief section on possible implications of the cross-linguistic analysis for Polish-English translation, and in particular, problems with equivalence of the English prepositions *in* and *on* and the Polish prepositions *w* and *na* constitute the core of the last section.

Anna Bączkowska, dr nauk humanistycznych, specjalista w zakresie językoznawstwa angielskiego. Ukończyła Uniwersytet Adama Mickiewicza w Poznaniu, doktoryzowała się na Uniwersytecie Łódzkim. Jest adiunktem w Katedrze Filologii Angielskiej i zastępcą dyrektora Instytutu Neofilologii i Lingwistyki Stosowanej UKW w Bydgoszczy. Jej zainteresowania naukowe obejmują językoznawstwo kognitywne, filozofię języka, psycholingwistykę, metodykę nauczania języka angielskiego jako obcego, komunikację interpersonalną i interkulturową, translację, juryslingwistykę i języki specjalistyczne (prawny i ekonomiczny).