

**This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.**

**Author(s):** Kallio, Eeva; Marchand, Helena

**Title:** An overview of the concepts of change and development - from the premodern to modern era

**Year:** 2012

**Version:**

**Copyright:** © Springer Science-Business Media B.V. 2012

**Rights:** In Copyright

**Rights url:** <http://rightsstatements.org/page/InC/1.0/?language=en>

**Please cite the original version:**

Kallio, E., & Marchand, H. (2012). An overview of the concepts of change and development - from the premodern to modern era. In P. Tynjälä, M.L. Stenström & M. Saarnivaara (Eds) *Transitions and transformations in learning and education*. (pp. 21-50). Springer.  
[https://doi.org/10.1007/978-94-007-2312-2\\_3](https://doi.org/10.1007/978-94-007-2312-2_3)

In P. Tynjälä, M.L. Stenström & M. Saarnivaara (Eds) Transitions and Transformations in Learning and Education. Springer 2012.

LAST DRAFT

**An overview of the concepts of change and development – from the pre-modern to modern era**

Eeva Kallio & Helena Marchand

Abstract

This chapter focuses on the concepts of change and progress: on one hand, it approaches this topic from the point of view of the history of science; on the other hand, from the point of view of modern developmental psychology. The section on the history of science focuses on the historical period of the pre-modern Hellenistic era to the Enlightenment. This period is long, and it therefore includes several, different world views and cultural trends. In this chapter culturally significant trends of thought within the Ptolemaic-Aristotelic tradition are described. The section on the modern developmental psychology approach analyses the following questions: (1) which characteristics must changes – namely cognitive changes – have in order to be considered “developmental”, (2) how developmental and learning theories, grounded in different philosophical frameworks, view the concepts of change and development, and (3) how change and development are currently studied by developmental scholars. Weak and strong conceptions of development in particular are emphasised. In the conclusion, the concepts of progress, change, and development are discussed using classification of world hypotheses and unit-ideas (family resemblances) in the history of Ideas.

Key words: change, development, progress, pre-modern and modern time, developmental theories, learning theories, history of Ideas

## 1 Conceptual background

### The concepts of change, progress, and development

What do we mean by the widely used concepts of change, progress, and development? In the everyday language of the media and commonplace discussion, these words are often used without clear definitions and boundaries. For example, we may speak of our change over time as a change from some state, phase or stage to another, suggesting that there is some kind of development involved. Change may also refer to a phenomenon without any profound qualitative transformation, such as inconstancy or instability. In addition, one has to comprehend how these concepts are understood within the framework of the history of Ideas: is there anything new in the fashionable modern rhetoric of constant change?

This article focuses on the concepts of change and progress: on one hand, it approaches this topic from the point of view of the history of science; on the other hand, from the point of view of modern developmental psychology. The similarities between these eras are discussed. The section on the history of science focuses on the historical period in Western culture of the pre-modern Hellenistic era to the Enlightenment. This period is long and it therefore includes several, different world views and cultural trends. In this article, the discussion will be limited to the most important and most culturally significant trends of thought.

The three selected concepts –change, progress, and development – are closely related. As previously mentioned, we can talk about change, and development as one of its special cases. In addition, progress as a concept is closely tied to change because it, too, presupposes that something qualitatively new will emerge. The notion of evolution is closely tied to the concepts of change, development, and progress. It has a significant

role in the assessment of the modern notion of development, especially in developmental psychology (e.g. Piaget & Inhelder, 1966/1971).

As a concept, change includes the paradoxical thought of something that changes and yet remains the same, and therefore includes similar elements with the original state of affairs. Thus, change also includes an element of un-changeability, which to say the least, seems to be a paradox. In this chapter, change is defined as a metamorphosis of any phenomenon in time. Hence it is a philosophical issue: whether we can talk about a phenomenon as remaining the same or as being different, consistent or inconsistent (Mortensen, 2006). The inherent properties of the phenomenon (assuming that the phenomenon has some kind of essence or that it at least has some kind of special characteristics which distinguish it from other phenomena) must be retained in order for us to be able to talk about a phenomenon with a similar identity.

One possible way of defining the concept of change is as follows:

‘There is change if and only if there is a subject S that persists and retains its identity along from  $x_1$  to  $x_2$ , and there is a difference that is exhibited by a property, state or part properly predicated of S, from  $x_1$  to  $x_2$ ’ (Hussey 2009, 105).

S means here anything that can change (e.g. person, theory), and  $x_1$  and  $x_2$  are distinct locations or suitable dimensions (e.g. time) (Hussey, *ibid.*).

However, change can refer to a sense that does not include the emergence of something qualitatively new. Change can be the reorganization of the existing elements, into a new form, without any new components emerging as a result of the reorganization. If we include the emergence of something new in the concept of change, we are then dealing with progress or development. These concepts presuppose, in a value-loaded sense, a change towards something better: something that has developed later is more valuable than something that had existed before (Dodd, 2003). In addition, Hussey (2002) distinguishes among different forms of change, such as revolutionary, repetitive, cyclic, chaotic and random, as well as evolutionary change. The opposite of change is stability, i.e. an assumption that everything will stay the same forever.

Parallel to change is progress. For its definition, we can take Dodd's (2003) following formulation: as a concept progress requires a goal or a direction (for the action), and what comes later in time must be further developed than what came first. What kind of yardstick of values do we use to measure progress: what is the yardstick for progress? Can we use the pace of technological development and new innovations as a yardstick? This method of measurement could prove unreliable for humans may not have grown more morally progressive throughout time, as evidenced by the continuation of global wars.

In developmental psychology the concept of progress refers to maturing and change and transformations that are organized, consequential and principle-like in nature (Hoare, 2006). Thus, change does not merely refer to quantitative development, in which something increases cumulatively. Change requires a qualitative leap, during which the earlier form of the phenomenon structurally stays the same, but simultaneously changes to an extent and thus includes a new element. This definition is developmental-psychological in character; however, as pointed out before, philosophically this definition is problematic. How can a phenomenon considered similar to another phenomenon include different characteristics and change into something qualitatively new: is it any longer a similar phenomenon or is it a different phenomenon? (Mortensen, 2006). Is there logical similarity in this development such that it could be called the same phenomenon? Secondly, the problem may lie in the criteria used to define the concept of development. Development does not necessarily need to be unilinear; it can be multilinear, travelling along various routes. In addition, development to one person may well be regression to another. The assumption of the similarity of universal development is not necessarily easily argued for (Gruber, 1986), even if it is a tempting model of explanation.

In our modern and post-modern eras we argue that everything is in a continuous state of change, which can be concerned with several different matters, such as technological development, the development from national states to larger alliances, the change from localization to globalization, or the overall perception of continuous change. We often point out that the pace and the speed of modern change is something special, unique and unforeseen. Also, our time is characterized by the belief in development and progress: we believe not merely in change, but also in the emergence of something qualitatively new during the process of change. In addition, we seem to believe that

whatever emerges as something qualitatively new is also always better and more progressive than what was before.

## 2 Pre-modern era

### Aristotelian-Ptolemaic world view: change and un-changeability

The three people with the most significant impact on our Western world view during the Hellenistic era and until the pre-modern era were philosophers Plato (c. 427-347 BC) and Aristotle (384–322 BC), and astronomer Ptolemy (c. 100-178 AD). However, some other trends of thought, to be discussed later in this article, also existed simultaneously with the world views proposed by these three men.

Aristotle can be considered the founding father of scientific thought based on observing external objects, as well as the first ever empirical scientist. He claimed that we can obtain reliable information on the surrounding reality through perception only, as the imperfect and changing world can be understood by paying attention to and observing its regularities. According to Aristotle, we can gain relatively reliable information on the ever ever-changing reality by categorizing its phenomena and by searching for the connections between these phenomena and the various reasons behind them (Aristotle, 1971). Thus, change is characterized by certain regularity, principles, and it can therefore be understood (Bakalis, 2005). Aristotle must, then, be considered the first empirical scientist, who believed that gaining systematic information on the external reality is possible. In fact, he is considered the first representative of several pre-modern fields of science (e.g. anatomy, astronomy, geology, meteorology, physics and also psychology), or at least he can be defined as the philosopher of natural sciences (Aristotle, 1971). Also, what has emerged as an important contribution from Aristotle is his model of causes and causality. He claims that there are four causes in understanding deterministic relations between cause and effect: material, formal, efficient and final causes (the last also called '*telos*').

Ptolemy was also a philosopher of natural sciences, and one of the most significant Hellenistic thinkers: he was a mathematician, an astronomer, and a geographer. Ptolemy's systematic cosmological model was combined with Aristotelian philosophy, and the result was a world view, marked by traces of the medieval Catholic Church as well, that dominated philosophical studies for nearly two thousand years. This paradigm was the prevailing world view during the Hellenistic era, the Middle Ages and even during the Renaissance; it only crumbled during the Enlightenment and the scientific revolution of the modern era (Kuhn, 1962).

To a great extent, this Ptolemaic world view also determined how change and unchangeability were defined. On one hand, the concept of change was tied to concrete, observed reality. The cosmological model was earth-centric: Earth was the centre of everything, with, based on the speed of their circulations when viewed from Earth, the Moon, Mercury, Venus, Sun, Mars, Jupiter and Saturn – planets known and observed during the Hellenistic era – orbiting around it. As the centre, Earth was stable, and the planets orbited around it. One could observe the (seemingly) regular revolutions of the planets and the starry sky around Earth (Thorndike, 1923-1958). Some of the basic assumptions about the nature of reality are here defined through cosmology. The holistic *macrocosm – microcosm* dogma described the reflection of the cosmos on life on Earth. It was a dogma based on equivalence, sympathy, correspondence, reflection and signification (Boas, 2003; Levy, 1967; Thorndike, 1923-1958). According to this dogma, a part reflects the entity. Thus, life on Earth was a reflection of a larger unity. Human beings were considered to reflect this larger context themselves.<sup>1</sup> Thus, changes in the circle of life were reflections of the larger cosmic sphere and its movements (Burrow, 2008). In terms of modern developmental psychology, a human being's circle of life was a reflection of a wholesome cosmological dogma and the observed cosmic rhythms (Sears, 1986). In other words, it implied a holistic world view and interdependency of

---

<sup>1</sup> This was the case at the anatomical and psychological levels: the human heart was the equivalent of the Sun; as the Sun was the greatest of the 'planets', so the human heart is the greatest organ in a microcosm, directing the bodily functions of the human body. Colors were categorized according to the heavens (the Sun = yellow) and according to the metals (the Sun = gold). According to a similar analogy, the yellow sunflower was associated with a phenomenon dependent on the Sun's sphere of planets. These elements, seen through modern eyes to be completely unrelated, were connected through a shared principle and denominator (cf. Thorndike, 1923-1958; see also e.g. Levi-D'Ancona, 1983 of the continuation of this tradition until the Renaissance).

terrestrial and cosmic phenomena. Briefly, it is a question of a holistic assumption of reality: everything lower in the hierarchy depends on every other thing higher in the hierarchy, and they mirror each other (Gonger, 1922).

The aforementioned spheres of planets, i.e. heavens, were located hierarchically above Earth. Reality was divided into the sub-lunar, i.e. earthly, and the super-lunar, i.e. the world of the planets and the stars. The sub-lunar, changing reality consisted of four elements: earth, water, air and fire. Out of these elements, earth and water were heavy and therefore at the centre of the world; air and fire were lighter and therefore further away from the earth. The changing earthly reality was composed of different combinations of these four elements. In addition, the fifth element was ether. It was an element of the heavenly spheres and therefore eternal and immortal in character, non-earthly and un-changeable. The natural form of motion of the fifth element was circular: the orbits of the planets were perfect circles. The sub-lunar world with its four changing elements formed a world that was imperfect and random; a chain of births, growth, maturity and death. Above these spheres was the world of planets and stars, and above that, according to Aristotle, the “Immovable Mover”, which was later, during the Middle Ages, identified as the God of Christianity (Thorndike, 1923-1958).

The relationship between the sub- and the super-lunar realities could be understood as a reflection or an analogy, but not as a direct, causal relation (although some thinkers also supposed that there is causal connection, as tides occurred in accordance with the Moon; see Ptolemy, 1940). Thus, the heavenly, unchangeable and eternal were intertwined with the earthly changing existence. The changing reflects analogically the unchangeable and the eternal, but is in itself a dissolving entity. We must notice that the motion of the circular motion of the planets – the concrete observed reality of the moving planets – was naturally changing reality. In this sense the planets were changing as in a continuous motion in their orbits, but otherwise they were eternal, created as such by the divine principle.

Change and un-changeability in other philosophical traditions



Some other trends of thought, with different assumptions about change and un-changeability, existed simultaneously with the Aristotelian-Ptolemaic world view. The most radical notion of change was presented by Greek philosopher Heraclitus. According to him, all that exists is in a constant state of change, even to the extent that nothing permanent exists. *“You cannot step twice into the same river; for other waters are ever flowing on to you”* is said to be his famous phrase, though the authenticity of it has been questioned [another famous quotation from Heraclitus, though again not definitively an original of his: *“We both step and do not step into the same rivers. We are and are not”*]. In any case, he has been a strong advocate of instability. There is nothing permanent about the basic nature of material reality, it is in constant motion and changes its shape (Graham, 2007). Simultaneously, the underlying energy of change is contradiction, an important concept in Western dialectical thinking. Dialectical thinking assumes that the existence of contradiction leads to change; this mode of thinking emerged later in the writings of Hegel and of Marx (Marx, 2000; Taylor, 2008). Change was then either the development of the spirit that formed the core of reality, or the logic of contradiction that functioned in material reality.<sup>2</sup> Thinking that emphasizes change is dynamic in nature, but it does not necessarily include the emergence of something new. However, both Hegel and Marx assumed that in global development, dialectical contradiction will inevitably lead to the emergence of new, qualitatively more sophisticated forms. Thus, the concepts of change, progress, and development go hand in hand, at least in some dialectical schools of thought.

The notion of un-changeability is in complete opposition to the dialectical notion and thinking based on belief in progress. The concept of the unchangeable emerges in Plato’s theory of Ideas (1971) – or at least in interpreting Plato’s ideas. According to this theory, a world of Ideas exists behind the empirical reality, and it is unchangeable and eternal, conceptual and abstract. The observed, material reality is a reflection of it. The purest forms of Ideas include mathematical reality and its general concepts: for

---

<sup>2</sup> The concept of dialectical thinking has later been used and is still being used in modern developmental and clinical psychology. It is an established term for describing, e.g. the development of thinking in adulthood and the inner dynamics of social relationships (Basseches, 2003). It is also important in modern world views which underline current major theories of psychology, which will be discussed later (see Pepper, 1942).

example, a mathematical truth cannot be observed, and yet it is conceptually true, a timeless and universal truth. Mathematical truths are true independent of time and place, and they have no existence in time or space.

In comparison, the observable reality is subject to change and varies accordingly: we can notice, for example, that the human life-cycle includes a change from childhood to old age and death. The observed reality is an unreliable source of information, because it contains instability and variation. The unchangeable nature of the world of Ideas is perfection, which simultaneously is implicitly more valuable than the observed, material reality. Plato does not deny the existence of change, but he argues that it is an imperfect shadow of the unchangeable, which is the only true being.

In its purest forms Platonism thus denies the existence of change, which it considers nothing but a reflection of the unchangeable Idea. In fact, no new invention is truly new, because it pre-exists in the world of Ideas. Therefore, any new idea has existed primarily as a potential Idea, and it merely becomes actualized through invention, and therefore is no longer new or a change. The influence of Platonism along with Aristotelian thought has been significant: Platonic streams of thinking have existed until modern times, as have different Neo-platonic trends of thought (Remes, 2008). The different variations of Neo-platonic thinking are coloured with the same underlying thought: existence in time-space is secondary in relation to the non-visible, spiritual reality, independent of the concept used for describing it. To complicate this issue further, neo-Platonism and Aristotelism have been integrated more or less in history, and it is sometimes difficult to differentiate “pure” forms of them.

It has to be noted however, that Plato cannot be interpreted straightforwardly. It is very difficult to come to concrete conclusions from his texts, which were written as ambiguous dialogues. He presents some claims in his writings (like his theory of Ideas), but he also contradicts them in others (Kraut, 2009). Kraut states that Plato’s works are like puzzles – not easily solved.

In addition to Platonism, the Hellenistic Stoic school of philosophy assumed that there is no real change or development. Most of the Stoic philosophers believed in the repetition of history, based on the notion of a cyclic or circular timeline, i.e., the beginning and the end of time come together, and a new round begins. Therefore, it is

impossible to assume the existence of something radically new, because everything merely repeats what has already occurred: what is happening now is identical with the events of the previous time-cycle. Therefore, change and anything new that comes with it are actually always only seemingly new and in fact are nothing more than a repetition of the old (Guthrie, 1991). The third Hellenistic School of Thought that denied change was composed of the Eleatics, with Parmenides and Zeno as their leading figures. Zeno's famous paradox "*the flying arrow is static*", refers to the fact that at any given moment an observed object is in static position, even if it seems to be and is observed as being in motion. In fact, the apparent motion consists simply of the partial moments of the static position. Those who support the idea of the un-changeable simultaneously deny the notions of development. If there is no change, then there is no emergence of something radically new (Guthrie, *ibid.*).

#### Cyclical, linear, and spiral time vs. change and un-changeability

The concept of time is also tied to the notion of change, as well as the notions of progress and development. The first foundations upon which the notion of time has been based seem to include observations of the regular cycle of day and night and seasons. The observations of this cosmic repetition of the same also served as the starting point for various calendar systems.

At least two different conceptions of time and its variations are essential from the point of view of change and development: linear and cyclical time. Cyclical time is about the circular repetition. Cyclical time includes an assumption, according to which no radical new changes can take place, because any given moment in time is a repetition of something that has already been, has happened in the previous cycle of time. This trend of thought had followers during the Hellenistic era, and also some in the Modern era, for example within Chinese culture (Shaughnessy, 2005). Within this theory, change exists, but it is about the repetition of earlier instances, and therefore not about something radically new existing. Needham (1981) has estimated that the notion of cyclical time is a typical feature of Hellenistic Greek culture, and has tied the attribute of "regressive time"

to it. According to him, linear time is a notion typical of Western culture and Christianity; he has defined it as “progressive time”. Needham has also categorized the Chinese perception of time as a notion belonging to the latter category, unlike Shaughnessy (2005) who considers time to be cyclic, and Chang (2009) who considers it spiral. Unlike cyclical time, spiral time does not repeat itself in identical circles, but rather produces something evolutionarily new from the old, through its circular orbit.

Linear time has a beginning and an end, separate from each other and irreversible one another. Linear time includes a passage from point A to point B in a moment in time. Change, progress, and development take place during time, between two points on a timeline. These points have no connection between them, unlike in the cyclical (or spiral) understanding of time. Needham (1981) considers linear time to be a characteristic of the Judeo-Christian tradition. The world is considered to begin and end, and it contains a teleological meaning, a goal.

#### Basic historical assumptions of human change and development

Major philosophers in pre-modern times also made psychological claims – these claims can be called “philosophical psychology”, to differentiate them from modern psychological scientific jargon. What is analyzed above was situated on the general level of world views and philosophical schools. In the following, the concepts of change and development will be analysed, as they have also been included in scholarly psychological assumptions.

Lerner (2002) has analysed briefly some major philosophical psychological assumptions in the pre-modern era. He claims that the major boundary line divides the *nature vs. nurture* issue, which is of importance for the question of change. With the emphasis of *nature* as a determining factor in change and development, it can be claimed that inherent factors categorise change as genetic or hereditary, inborn, innate, instinctive or preformed factors. The *nurture* side of the debate claim environment, learning, experience, socialisation and education as major factors in change and development.

Thinkers from pre-modern to modern eras have been proponents of either side, or, in a complex way, of both.

Plato's principle contribution to the issue of nature vs. nurture is, according to Lerner (2002), the notion that human beings innately possess a layered soul. The most known is his division of the psyche into three parts (tripartite conception of soul)<sup>3</sup>. Human desires and appetites reside on the lowest layer, and on the second, the spirit. On the third, the highest, layer is the true soul, which is immortal and it is partly joined to the eternal world of Ideas. Lerner (2002) claims that Plato sees learning as an important point in "training" this highest layer of soul. Socratic discussion is the method by which the highest capacities of reason are engendered. Thus, at least implicitly, Plato sees that the ability to make certain changes is possible through social interaction and debate. Still, it remains problematic to interpret Plato's texts straightforwardly, as has been already stated: there seem to be many alternative possibilities for interpreting them (Kraut, 2009).

According to Lerner (2002), Aristotle seems to favour nature, innate and inborn faculties of mind, briefly named as plant-, animal-, and human-like layers of soul. It is also question of tripartite conception of soul. The highest level or layer is connected to reasoning, similar to the "true soul" of the highest layer, as Plato claimed. Aristotle also tells us that there are different phases in one's life span, such as boyhood and manhood. Thus, he claims that there is change during the life span. Ptolemy, who systematized the Ptolemaic-Aristotelic world view, made clear-cut definitions of the phases of life in his major work *Tetrabiblos* (Ptolemy, 1980): he considered both four phases of life (p. 61) and seven phases of life (referred to as the "*Ages of Man*") (p. 441-447). These life phases were connected to the Aristotelian-Ptolemaic cosmological system, as the phases were "governed" by each of the seven planets (the Moon governs childhood and Saturn old age, as examples) (Burrow, 2008; Sears, 1986).

Descartes (1596-1650 AD) is famous for his model of dualism of soul and matter. Descartes believed in inner Ideas, much like Plato. The two entities of body and mind are separate, but capable of an interactive relationship (Lerner, *ibid.*). In the 17<sup>th</sup> century, Locke (1632-1704 AD) went even further and claimed that there are no innate ideas;

---

<sup>3</sup> Plato's tripartite conception of soul has been claimed by some scholars to be very close to Freud's psychodynamic conception of soul (see e.g. Knuuttila, 2006).

rather, the human mind is a *tabula rasa* at birth. Thus it is learning and the external environment that make the difference. Experience is the ultimate tool in the development and change in a human being. Locke was thus clearly advocating the importance of nurture and learning in human development and change.

However, in the transition from the Enlightenment to after, the conception of innate Ideas was still very prominent in Immanuel Kant's (1724- 1804 AD) philosophy, who claims that there are inborn ideas or categories of understanding in the human mind. They are not based on experience because they are an inborn capacity of a human's mind. Mathematical and logical ideas are examples of these kinds of inner categories. For example, basic mathematical operations are not empirical facts, but exist ontologically and conceptually, non-empirically. Kant is thus strongly in favour of "nature" in the nature-nurture debate.

The scientific revolution and Modernity dismantled the old Aristotelian-Ptolemaic cosmology, and also the included assumption of cosmo-theological holism in reality (involving planetary spheres, cosmos and life on Earth, including human beings). The changing nature of the sub-lunar world and the eternal nature and un-changeability of the super-lunar world were questioned, not least because the underlying geocentric world view collapsed due to increased sophistication and accuracy of empirical research ("Copernican revolution"). The dogmatic microcosm -macrocosm analogy was questioned, and hypothetical-deductive reasoning, based on causal thinking, gained ground particularly in natural sciences and later also in human sciences (Kuhn, 1957).

The mechanistic, Galileistic world view was established at the beginning of the Modern era, and became the dominating system of interpretation in different scientific fields (von Wright, 1990). It has to be noted, however, that a mechanistic world view in itself is not a new phenomenon. Its roots lie in Classical Antiquity. The first so-called atomists were Leucippus and Democritus (about 460- 370 BC), who claimed, stated briefly: nature is fully mechanistic in that every phenomenon is understood to be a product of the materialistic atomic collisions (Berryman, 2005). Similar thought patterns have been also expressed later in the history of science, and lastly, through a mechanistic world view of modern time.

Biology, in particular, had enduring consequences for the natural sciences through its impact on the notions of development and change: the theory of evolution and Darwinism form the basis for the model of continuous change and development. Evolution in its modern sense refers to a gradual chain of events, during which different species develop over time. It enables the emergence of new and ever more multifarious species, as well as the perpetual emergence of further developed species in the struggle for survival, in which only those who adapt the best survive. The basic difference regarding a pre-modern understanding of time is the notion that evolution is unpredictable and cannot be controlled. Biology has had a definitive impact on developmental psychological theories, as in Piaget's theory (see e.g. Kallio, 1998).

### 3 The concepts of change and development in modern developmental and learning theories

Understanding change and elaborating theories and models of change over time are two fundamental activities in scientific innovation. These are not properties particular to developmental psychology; the notions of change and development are central to genetic psychology and epistemology, as the main objective of these disciplines is to examine psychological progress (Montangero & Vonèche, 1993). The issues of change and development are also fundamental to learning theories. So these two concepts will be analysed in light of both approaches.

#### Change and development according to developmental psychology

The focus of developmental psychology is the study of psychological changes – perceptual, intellectual, emotional, and social, among others – that take place over time. This analysis requires (1) seeing the differences and identities of behaviours at successive moments, and (2) describing and explaining the process of change (i.e. the organization of changes, the order of succession of changes, the direction of changes).

What emerges over the course of psychological development? What are the causes of development? What are the differences between cognitive development,

knowledge acquisition and conceptual change, three expressions often used interchangeably (Carey, 1999)?

The responses to these questions vary according to the author's theoretical, epistemological and methodological affiliations. For example, for Stanley Hall (1844-1924) development is seen from a "nature" point of view; i.e. as deriving above all from innate, maturational and hereditary factors. This "nature" conception of development influenced several of Hall's students, such as Terman (1925) who states that intelligence is a mostly innate characteristic and Gesell (1931) who proposes a nature-based theory in which sensorimotor and cognitive abilities are maturationally determined.

In defending the "nurture" view of development, Watson (1878-1958) stressed that behaviours are acquired and, by implication, developed due to environmental stimuli combined under certain conditions. In Watson's behaviouristic learning theory and the ulterior variations and extensions (e.g. Hull, 1929; Skinner, 1938), observable development is seen as a cumulative acquisition of objective and empirical stimuli-responses relation (Lerner, 2002).

With a view of development involving nature-nurture interactions, Baldwin (1886-1934) introduced several notions – such as developmental stages, accommodation and assimilation, and social interaction – which exerted a decisive influence on Piaget and Vygostky. Within a life span framework Baltes and colleagues (Baltes, 1987), and also Lerner (Lerner, 1991; 2002), proposed a multidirectional, multidimensional, and contextual approach of development. Finally, within a dialectical framework in which periods of crisis are emphasised more than periods of stability, Riegel (1973) defends that development results from a dialectic between internal dimensions (i.e., biological and psychological) and external reality (i.e., cultural and material dimensions) (see Marchand, 2001; 2002; 2008).

The meaning of psychological development

Psychological development is not an empirical concept (Lerner, 2002). Psychological development is a postulation (Kaplan, 1983). Debates among scientists concerning the



meaning of psychological development arise because scientists are committed to distinct theoretical beliefs about the nature of the world and the human being (Lerner, 2002). The different conceptions of development explain why, in the face of the same data, theorists can agree or disagree about whether development has occurred.

Despite the differences, there is some agreement about the minimal components of the concept of psychological development. In a general sense, psychological development refers to change (Lerner, 2002). While development always involves change, not all changes are developmental, as previously discussed in the introduction. In order to be labelled developmental, changes have to occur in sequential, chronological order. However, not all of the changes associated with time are developmental. According to several authors (see Chapman, 1988; Kaplan, 1983; Kohlberg, 1990; Lerner, 2002; Lourenço, 1997; Marti, 1991; Piaget, 1983; Overton, 1993; Tappan, 1992; Vonèche, 1993; Werner, 1957), to be developmental, changes should manifest larger differentiation, adaptation, integration, organization, and balance. It is not a cumulative process (as in acquiring more knowledge, for example) but rather an integrated process towards a final stage (*telos*) defined by the criteria of differentiation, complexity, integration, abstraction, and equilibrium (Lourenço, 1997). From this perspective, development is an axiological or normative notion in the sense that it always refers to an ideal goal, endpoint, or *telos* (Tappan, 1992).

This conception of psychological development – which grounds grand stage theories such as those of Piaget or Kohlberg – reflects, according to Kohlberg (see Kohlberg & Armon, 1984), a *strong conception of development*. A strong conception of development supposes logical priority given to a whole over its parts (holism); the irreducibility to inferior of the superior; the generality of principles of differentiation and integration; and advocates a spiral form of development (Vonèche, 1993).

Acknowledging that not all changes are developmental, how can the distinction between developmental and non-developmental changes be made? According to Flavell (1971; 1982), developmental changes: (1) manifest magnitude (i.e. express deep restructuring), (2) are directional (i.e. occur in a certain direction or *telos*), (3) are uniform and universal (i.e. occur in the same direction on every subject) (4) are

irreversible (i.e. under normal conditions subjects do not lose them or regress), and (5) are inevitable (i.e. it is impossible to prevent its emergence).

This conception of development is not, however, agreed upon by all scholars. Some authors, namely the behaviourists as will be explained later, defend that development is cumulative, continuous, and quantitative. This conception is according to Kohlberg & Armon (1984) a reduced or *weak conception of development* (i.e., a conception in which changes do not manifest magnitude, are not necessary directional, are not universal, are not irreversible and inevitable).

The conception of cognitive development varies, as previously noted, in accordance with the author's beliefs about the nature of the world and the human being. Some scholars view the world as analogous to a machine (e.g. Watson); others (e.g. Piaget) view it as analogous to an organism; and still others (e.g. Vygotsky) as organisms in context. In other words, theories of development are grounded in world views or philosophical models, the most important of which are the mechanistic, the organismic and the contextual models (see Reese and Overton, 1970).

#### The mechanistic world view

The basic metaphor for the mechanistic world view is the machine (see Reese & Overton, 1970). According to this world view the organism, like the machine, does not create its own output but rather only responds to the input of data or external stimuli. Thus, according to the mechanistic world view, the organism is passive by nature. In addition, this view assumes that the whole is equal to the sum of the parts; through the study of the individual parts, the individual as a whole can be understood.

The mechanistic world view has influenced a conception of development in which, first the individual is conceptualized and explained by understanding the parts which make up the whole. Second, the individual is described as a passive-reactive being. Development does not occur from within the individual but rather is in response to external forces. The individual is as Newton describes, a "*tabula rasa*" (cited in Reese & Overton, 1970).

Third, change is quantitative (i.e. changes in behaviour are viewed as differences in

degree as opposed to differences in kind and as such can be operationally defined and measured). Finally, individuals as passive beings, there is no overall purpose to human activity - no teleology. Thus, development and change are not directed towards some end point or goal.

Although the nature of the machine used as metaphor has changed with technological advances, categories generated by the mechanistic model remained essentially the same; that is, uniformity, stability, and linearity. Of this, Overton writes, “in meta-theoretical terms, when a person is represented by this metaphor, the individual is understood either as the outward manifestation (e.g. “responses”, “behaviours”, “declarative and procedural knowledge”, “representations”) of additive historical contingencies (“reinforcements”, “stimuli”, “information”), or as a list of mechanisms that constitute the machine itself (“input systems”, “central processing systems”, “storage systems”, “output systems”)” (1993, p. 164).

This conception of development, shared by behaviourists and most information processing scholars, in which experience has a major role (Marti, 1991) is, when compared with the strong conception of development previously described, a very reduced and weak one (see Kohlberg & Armon, 1984; Lourenço, 1997).

### The organismic world view

The metaphor of the organismic world view is the biological organism (Reese and Overton, 1970). According to this metaphor, organisms, active by nature, are composed of interconnected parts which constitute a complex organized system – only understood as a whole – and changes come from within rather than in response to environmental or external influences. Adherents of this model reject the reductionism of the mechanism model and defend the developmental process, in which goal-directedness is indicated by the emergence of new phenomena which cannot be reduced to lower levels of organisation (see Lerner, 2002; Vonèche, 1993). The “grand theories of change and development” (see Renninger & Amsel, 1997) – such as those put forth by Piaget, Freud and Erikson – are grounded in this model. For example, in Piaget’s theory, development

is seen as the outcome of subject-object (organism-environment) interactions and, hence, as an active process, in which disequilibrium provides the moving force. Cognitive development, organised into developmental stages, is characterised by a structure in reference to which individual behaviours can be explained and by a constant and integrative order of succession (Piaget & Inhelder, 1966/1973). This conception of development is considered, as previously demonstrated, to be strong (Kohlberg & Armon, 1984).

Several authors claim that despite rejecting the reductionism of the mechanistic model in favor of the organismic model – which explains psychological development as analogous to biological development – the organismic model is itself prone to reductionism (Gillieron, 1980; Lerner, 2002; Marti, 1991). It is thus inappropriate for studying, for example, development in adulthood and beyond. According to Lerner (2002), viewed from this model, adulthood and beyond are primarily periods of decline. However, data yielded from age-change studies show important differences among subjects, multidirectional trajectories and greater influence of factors such as generation or cohort and historical experiences than of chronological age (see Baltes, Reese, & Lipsitt, 1980; Lerner, 2002). In the words of Brim and Kagan (1980), “growth is more individualist than was thought and it is difficult to find general patterns” (in Lerner, *op. cit.*, p.71). These facts led some scholars to propose a new model both receptive to the danger of biological reduction and more useful for understanding the role of non age-related variables in development (see Baltes, Lindenberger, & Staudinger 1998) – the contextual (dialectical) model.

#### The contextual (dialectical) world view

The main metaphor of the contextual world view is the historical event (Pepper, 1942/70). According to this world view, reality is an ongoing and dynamic event, and organisms can only be understood by examining their parts within the context of their origin of emergence. Adherents to this world view assume a holistic conception of development, in which the interaction of biological, psychological, historical, and sociological factors plays a fundamental role. According to this perspective, individuals are seen as both

active and reactive; that is, while development comes from within the individual, it is also responsive to environmental influences. Changes are seen as both quantitative and qualitative, and development manifests multidirectional and multidimensional trajectories and a strong interpersonal variation.

Although life-span theories such as those of Baltes and Lerner stress the role of the context in cognitive development, the importance of this factor is also assumed by other widely differing approaches, such as: (1) the ecological approach (Bronfenbrenner, 1993), in which development is seen as a process of gradual accommodation of an always changing body to changing contexts; (2) the dialectical approach (e.g. Riegel, 1973) in which periods of crisis are emphasised more than periods of stability, and which upholds that development results from a dialectic between internal dimensions (biological and psychological) and external reality (cultural and material dimensions); (3) the sociocultural theory of Vygotsky, in which human action is always mediated by tools and symbols – chiefly language – and any mental function appears twice, first in the interpersonal or social plane, then at the psychological or intrapersonal plane; and finally, (4) the post-modernist theories (e.g. Bruner, 1992; Gilligan et al., 1990; Kvale, 1992) which proposed that “universalism be replaced by relativism, legitimacy by contextualism, rationality by narrative, and commensurability by incommensurability” (Lourenço, 1997, p.84).

For different reasons, none of the contextual approaches reveals a strong conception of development (Lourenço, 1997). For example, life-span theories show a weaker conception of development than the theories grounded on organismic model (Lourenço, 1996) because of weaknesses such as the following: (1) highlighting the importance of the interplay of various factors without taking into account the specificity of internal mechanisms of development; (2) reducing individual variability to variations in content or context; and (3) lacking a strong theoretical line which permits to distinction between development and behavioural change (see Baltes, 1983, in Marti, op.cit.).

Although very general– and as such not taking into consideration some fundamental differences between their respective authors – these philosophical models

had the advantage of identifying the epistemological principles, the “more or less strong” conceptions of development and the nature of subject-object interactions of the so-called grand theories emerged during the twentieth century.

With the death of Erik H. Erikson in 1994, the era of the grand theorist came to an end; currently research and publication on change and development are sparse with little regard for theory (Meacham, 1997; Renninger & Amsel, 1997). A glance at the programs of meetings and at journals within the field reveals that developmental scholars are divided into many conceptual, linguistic, and methodological sub-cultures. In the words of Renninger & Amsel (1997, p. x), “the waning of the grand theories also may have resulted in an increasing autonomy of theory, method, and application, due in part to the loss of a shared language and theoretical context for communication and mutual influence”. As such, several authors claim there is a necessity for a common language and conceptual background for explaining, assessing and promoting change and development. For Meacham (1997), theory is necessary not only to provide a framework for communication but also to create, maintain, and enrich the sense felt by developmental scholars of belonging to a scientific community.

#### Change and development according to learning theories

The question of change and development can also be analysed from the perspective of the theories of learning and of psychological development theories which, though not learning theories, have implications for the comprehension of the learning process (such as the theories of Piaget, Inhelder and neo-Piagetians). What follows is a short historical account of some of these theories.

In general, learning is seen as a relatively permanent change in behaviour and knowledge due to practice or experience. For years a clear distinction between learning and development was made. Although scientists see both learning and development as involving change, development usually has been identified with deep, fundamental and irreversible processes somewhat independent of learning, and learning, namely empirical learning has been associated with less deep processes. In other words, development has been associated with changes relatively global, uniform, and inevitable; and learning to

changes relatively specific, particular, and cotangential (Harford, 1995; Kohlberg, 1969; Piaget, 1947/1967; Zimmerman, 1995, quoted by Granott, 1998).

Has this view changed during the 20th century? In other words, can the learning process reveal developmental attributes? The responses to these questions vary according to the learning theories which, like developmental psychology, are grounded in different world views and propose different conceptions of change and development.

Usually the expression *learning theories* refers to the traditional or “classical” behavioural learning approaches (i.e., the classical approaches of Watson (1913) and Skinner (1938); the more systematic approaches of Gagné (1968) and Bijou and Baer (1965)); the approaches which inspired by behavioural assumptions integrate aspects of cognitive theories such as the approach of Bandura (1986)); and the latest learning theories such as of Canfield and Ceci (1992) whose central concern is the integration of development and learning.

Classical theories of learning, commonly known as behavioural theories, were the first to analyse learning in a systematic way. Rooted in the belief that the main laws of learning were common to all living beings, numerous laboratorial researches were carried out with animals with the aim of studying behavioural changes. According to these learning theories, changes – whatever they are, and whatever the age at which they are displayed – are acquired, maintained, and modified by the basic mechanisms of learning (reinforcement, punishment, extinction, etc.). With more systematic approaches, Bijou and Baer (1961) carried on viewing learning as continuous, cumulative, and without qualitative leaps; and Gagné (1968) considers qualitative changes as resulting from the cumulative effects of learning.

Despite their diversity, classical theories of learning share principles of the mechanistic model and empiricist epistemology. From the mechanistic model they retained the idea that any learning is an accumulation of more simple learning; from empiricism they retained the idea that an infant’s mind is a *tabula rasa*, devoid of innate ideas and waiting for experience to give it form and meaning (Canfield & Ceci, 1992).

According to several authors (see Harford, 1995; Kohlberg, 1969; Piaget, 1947/1967; Zimmerman, 1995, quoted by Granott, 1998), classical behaviourist scholars, defend a non-developmental conception of learning.

Sharing the distinctive features of classical theories, Bandura's social learning theory points out the importance of models and of cognitive and motivational processes in the acquisition, maintenance, and modification of behaviour. According to Bandura (1986), children become progressively more competent in controlling cognitive and motivational processes, as well as in controlling basic capacities such as the symbolic capacity, the vicarious capacity, the capacity for anticipation, the capacity for self-regulation and the capacity for self-reflection. The importance attributed to cognitive processes in the act of learning makes the concept of development advocated by Bandura less weak than that advocated by classical behaviour theorists. However, because development does not have an orientation (*telos*), this approach, in the words of Lourenço (1997), "confounds change with development and so moves away from a strong conception of development" (p. 97).

In the second half of the twentieth century, behavioural approaches of learning became less dominant thanks to the emergence of information processing theory. More than a systematic theory of development, information processing theory is a set of approaches concerning the analysis of different dimensions – attention, memory, problem solving, mental representations – that share some theoretical and methodological aspects, such as the description of cognition in terms of information flow (e.g. production systems, rules, decision trees) (Marti, 1991).

The classical models of information processing (e.g. the model of Sternberg, 1969, in Marti, 1991), in which development was no more than the subject's capacity to process information, were non-developmental. Although interested in what happened between the input of the information and the output (that is, the production of an answer), changes were analysed in a much reduced dimension. Information processing scholars were more interested in examining what kind of knowledge or strategies were used to solve certain tasks than in studying the genesis of different ways of thinking (Lourenço, 1997). According to these scholars, changes do not emerge from the basic processing structures but from procedures and strategies; in other words, what changes is how to use



information – strategies, procedures, metacognition, levels of processing – which grows gradually more elaborate. For example, to Klahr (1984), differences in processing information between adults and children are explained not through basic structures of information processing, but by positing a deficiency in children's use of procedures and strategies, and of monitoring and using memory. Moreover, research indicates that experts differ from novices in that the experts they have more elaborate networks of information, more memory nodes and interconnections, and better hierarchical organization than the novices (Santrock, 2006).

The information processing approach, focused more on functional than on structural aspects, manifests a relatively deep conception of development (see Kohlberg, 1969; Lourenço, 1997; Piaget, 1947/1967).

Some basic assumptions of information processing namely the analysis of strategies, interested developmental researchers (e.g., Fischer, 1980; Klahr & Wallace, 1976, among others). For developmental scholars the detailed functional description of cognition, the attention to the particularities and demands of tasks, and the explanation of gradual changes during the development complemented the Piagetian approach. As such, the information processing approach provided the impetus for new research in the field of the constructivist approach (Flavell, 1985); for new models inspired by Piaget's theory (e.g. Case, 1992; Fischer, 1980; Halford, 1995; Pascual-Leone, 1988; 2004, among others); and for microgenetic researches led by Inhelder and a team of assistants (see Inhelder, Cellérier *et al.*, 1992).

The most eminent defender of the constructivist view, Piaget refuted empiricist positions and instead emphasised that cognitive development is an interactive subject-environmental process in which cognitive structures, representative of a particular stage, are actively constructed. According to Piaget it is impossible to explain new acquisitions without recourse to equilibration, an inner regulatory process (Goustard *et al.*, 1959) which plays a central role in all acquisitions, even those brought about through experience.

Piaget's constructivism played a very important role in the re-examination of school learning. Thanks to Piaget's work, children were seen as cognitively active beings with theories about the world as well as their minds. Thanks to him, an architecture of

knowledge with the developmental routes for its constitution was built (Inhelder & De Caprona, 1987). Thanks to his theory debates and discussions concerning the nature and significations of logical-mathematical structures in children's cognitive development, the means for measuring the structures, the experimental designs for training them, the appropriate practices for teachers to promote them were organised (Renninger & Amsel, 1997).

This invaluable body of information that has given rise to a new way of viewing education showed, from the beginning, inherent difficulties when transferred to the educational context (Marti, 1996). Several reasons have been proposed to explain such difficulties. The most important concerned the nature of Piaget's theory, which underestimates the role of environmental factors – the logical structures emerge as a result of auto-regulative processes – and taking no account of individual differences in developmental processes; ignoring factors such as affect; undervaluing spatial, time and linguistic constraints on knowledge and learning processes, and giving no explanation of developmental reasoning changes that take place within different cultures (see Carey & Spelke, 1994; Case, 1992; Dasen & de Ribaupierre, 1988; Demetriou, Shayer & Efklides, 1992; Halford, 1995; Hirschfeld & Gelman, 1994; Fischer & Farrar, 1988; Pascual-Leone, 1984).

In the last two decades of the twentieth century much research on cognitive psychology was carried out, which refuted Piaget's general conception of development and highlighted the importance of domain-specific constraints on the construction of knowledge (e.g. Carey & Spelke, 1994; Hirschfeld & Gelman, 1994; Karmiloff-Smith, 1992). Several theories, aimed at preserving the strengths of Piaget's theory and eliminating its weaknesses, were proposed (the so-called "neo-Piagetian" theories), and micro-genetic researches were conducted by Inhelder and co-workers. Some other models, grounded in different epistemological traditions, such the sociohistorical tradition, were also seen as alternative to the Piagetian theory.

The main attempts of neo-Piagetian scholars (see Case, 1992) were: (1) to retain some aspects of Piaget's theory; (2) to settle some aspects of his work that seemed incomplete; and (3) to alter aspects of the theory difficult to analyze empirically or that underestimated the influence of physical or cultural environment.

Although claiming different points of view, neo-Piagetian scholars share some postulates with the classical Piagetian theory, such as the importance of cognitive structures, the role of the child's activity in creating these structures; the universality of the structures; the inclusion of earlier structures into later ones; and the typical ages for acquisition of structures. Some expanded upon classical Piagetian concepts, such as the distinction between development and learning, the hypothesis that developmental restructuring is local in nature, the notion of cyclic recapitulation of structural sequences, and the relation of affective and cognitive structures. Finally, others modified some classical Piagetian ideas, such as the redefinition of cognitive structures; the upper limit on complexity of cognitive structures; the role of maturation in determining upper limit; and the importance of individual differences and of context in children's intellectual development (see Case, 1992).

From the information processing approach, neo-Piagetian scholars retained the hypothesis for an individual's capacity to process an increasing quantity of information with age and the need for detailed descriptions of functional aspects of cognition. Among other ideas, they retained the focus on the particularities and requirements of the tasks and the claim that changes flow from the experience of the participants and their ongoing ability to use new strategies.

Contrarily to Piaget - more interested in the epistemic subject than in the psychological subject, in the general constructions than in the interindividual differences in the acquisition of these structures - neo-Piagetian scholars were generally very much concerned with individual differences in the process of structural construction and with the way they apply the existing structures to particular domains.

For instance, Pascual-Leone's model (1984) contrasts universal and differential constructs: the M-operator is seen as universal construct (i.e. for all subjects of a given age), the other operators are at the origin of individual differences (i.e. although present in all individuals, the force of activation differs among subjects). Case's theory assumes the possibility of different structural sequences between domains or within a domain (Case, 1992). Fischer and Farrar (1988) distinguish relative/ universal developmental sequences, which are not in opposition but their differences are more a matter of scale

(i.e., universal changes are seen as large scale, i.e. macro-developmental, and individual differences are seen in small scale , i.e. micro-developmental).

The studies of neo-Piagetian scholars provided important information concerning how reasoning is organized; the role of internal and social constraints in the process of development; individual differences; the importance of domain-specific restrictions in the understanding of how knowledge is constructed within each of these domains; and the role of the social and affective domains in knowledge development. This new information provides an important frame to organize curricula, to choose instructional methods and assessment (see Biggs, 1992).

In an innovative micro-genetic study of children's spontaneous action sequences, Inhelder and others (see Inhelder & Cellérier, 1992) attempted to acquire a better understanding of the mechanisms of change which, until then, had been analysed only in very general terms of reflexive abstraction, or of increasing equilibration, or in terms of fine, intermediate steps and of cognitive conflict (cf. Inhelder, Sinclair & Bovet, 1974).

In Inhelder's study the focus shifted from the atemporal structures of the epistemic subject to the finalized procedures of the psychological subject; in other words, from macro-development to the changes which occur in the spontaneous action sequences of micro-formation (Karmiloff-Smith & Inhelder, 1975). The main goal was to analyse how functional-pragmatic aspects (expressed in changes) are integrated into structural-constructivist aspects. This innovative synthesis introduced new elements to the classical Piagetian theory, and also to the information processing theory. In effect, observations of children's procedures when solving tasks broadened several aspects of knowledge processes (cf. Inhelder & Cellérier, 1992; Saada-Robert & Brun, 1996); namely the two essential concepts of Piaget's theory: constructivism and interactionism. With constructivism, they emphasised that knowledge is not simply applied to a situation; rather it is reconstructed in accordance with the situation (Saada-Robert & Brun, 1996). As for interactionism they underscored the role of the situation and attributed a greater importance to accommodation in the relations that subjects establish with the environment. According to Saada-Robert and Brun (1996) it is up to the object, with its properties and constraints, to indicate the direction that the subject should follow in knowledge construction.

Observations have yielded two important results: (1) that cognitive progress does not derive from success or lack of success, but rather from the successive accommodations that seem to play a greater role in micro-genetic sequences than in macro-genetic construction; and (2) that familiar schemes can both help and hinder problem-solving. Although these data have important implications on the learning comprehension process, there are very few studies in which these results were transposed to school learning (Saada-Robert & Brun, 1996).

Despite their diversity, both neo-Piagetian approaches and micro-genetic approach which share principles of the organismic model, defend, to various degrees, a strong conception of development.

Because knowledge within the school context requires cultural and social dimensions be taken into account (dimensions not analysed in Piaget's theory) other models, grounded on different epistemological traditions such the sociocultural model, were seen as alternative to Piagetian theory. According to Vygotsky (1978): (1) higher mental functioning, such as thinking and voluntary attention, has its origins in social life; (2) human action is mediated by tools and signs, like language; and (3) psychological processes are formed at two separate levels: first at the social level and secondly at the individual level. That is, internalization, which cannot be understood without the input of semiotic mediation (Marti, 1991), transforms social phenomena into psychological phenomena, wherein the latter guard the main characteristics of the former. The social origins of mental functioning are linked to the concept of the "zone of proximal development" (i.e. the distance between a child's actual developmental level, as determined by independent problem solving, and the higher level of potential development, as determined by problem solving under adult guidance or in collaboration with more capable peers). According to Vygotsky (1978), instruction should create a zone of proximal development: i.e., instruction should proceed ahead of development (Wertsch & Kanner, 1992).

Although it assigns an eventually overly prominent role to socialization during the development process – which can lead to a reduction of the latter to the previous – Vygotsky's conception of development is relatively strong (Lourenço, 1997; Marti, 1992).

#### 4 Final considerations

The aim of this chapter was to analyse change, development and progress from the pre-modern to modern historical eras. In the first part, the concepts of change, development and progress were defined at the general philosophical level. Some major pre-modern assumptions about change were described. Plato and Aristotle are the big names in western philosophy, and their impact as well as differences and similarities were broadened. Basic assumptions of non-change and continuous change were debatable topics in Hellenistic Greece. After the Hellenistic period, the most prominent world view was Aristotelic-Ptolemaic until the Scientific Revolution, after which change was then viewed as being linked to the terrestrial world. In Aristotelic-Ptolemaic world view a holistic microcosm-macrocosm claim was made, in which human beings were seen as part of a larger whole, a cosmic system.

It would seem that concepts of development, progress and change, also in addition to the notion of un-changeability, are historical phenomena, and that they have been debated for a long time. In the following, they are discussed from two viewpoints: the viewpoint of Pepper's world view hypothesis, and from the viewpoint of historian Lovejoy's claim of continuous "unit-ideas" in the history of Ideas and intellectual history.

#### World view hypotheses of modern theories

From the end of the nineteenth century to the present, the meaning of human development, progress and change has varied according to the implicit or explicit epistemological assumptions of scientists; that is, according to their philosophical models. These models – whose roots can also be traced to pre-modern philosophers – are frameworks which help guide the selection of hypotheses, methods and data analysis procedures (Lerner, 2002). The interest of philosophical models such as Pepper's (1942/1970) is to assist scholars, educators, and practitioners in (a) understanding the

underlying assumptions (whether implicit or explicit) of family theories<sup>4</sup>; (b) seeing the logical relations among various family theories; and (c) determining which family theories, if any, can be logically combined (i.e. eclecticism) for either theoretical or practical purposes. In addition, Pepper's model allows scholars to identify for themselves, and transmit to the academic community, their epistemological positions (Rose, 2003). According to Liddle (1982, quoted by Rose, 2003), it is critical that researchers, practitioners, and educators determine and be able to articulate epistemological positions with respect to theory.

As explained earlier, three major world views influenced modern-era developmental psychology and learning theories: the organismic, the mechanistic, and the contextual world views (Pepper, 1942), each of them defending a specific conception of change and development. In synthesis, the organismic world view sees changes as qualitative or structural, discontinuous and unidirectional, towards some end point or goal (*telos*). In the mechanistic world view, changes are responses to external stimuli (and thus the existence of internal structures is ignored), which are quantitative and continuous. Finally, in the contextual world view, changes in behaviour are quantitative and qualitative, multidirectional or unidirectional, depending on the change, and resulting from an interaction of the individual with the context. As the context is continuously changing, structural stages are not considered.

The distinctive feature of the twentieth century is the existence of several "grand theories", such as the behaviourist learning theories, the information-processing theories, the structuralist theories and the contextualist theories in connection with life-span theories. Each grand theory, in accordance to its underlying world view, defends a particular conception of psychological change and development. For behaviourist learning – and also information processing theories – changes occur in response to external forces and not as a reflex of modifications in internal structure. Changes are

---

<sup>4</sup> Family theories are groups of theories which share similar epistemological principles. For example, Piaget and Kohlberg belong to the same family theory (i.e., both defend a constructivist perspective grounded in the organismic world view); Watson and Skinner belong to the same family theory (i.e., a behaviourist learning perspective grounded in the mechanistic world view); and finally Riegel's and Baltes's theories are consistent with the contextualist family theory, grounded in the contextual world view.

viewed as quantitative, continuous, and multidirectional responses to external stimuli – thus no change in structure is theorized – and development is considered gradual and cumulative. For structuralist and constructivist theories, development is seen as changes in the structure rather than behaviour. Developmental changes come from within and are discontinuous – the stages are qualitatively different – and goal-directed. Finally, for the contextualist theories, changes are neither due to modifications in structure nor to external forces; they result from the interactions of the individual and the context. Changes are both qualitative and quantitative, and both continuous and discontinuous. Development is characterized by its regularity, multi-directionality, multidimensionality, and inter-individual differences. No universal stages are defined, as the interaction of individual and context continuously changes.

Despite epistemological principles that express different world views, and despite different conceptions of development and change, the grand theories offered (1) a solid ground for interpreting and understanding change and development (Renninger & Amsel, 1997); (2) a solid connections between theory, method and applications; and (3) a shared language. In the context of the grand theories, Piaget's theory was, given this strong conception of development, the one with the greatest impact both in developmental psychology and in education. The 80s and 90s saw a waning of Piaget's theory, as well as other grand theories, and an increase of more focused research. If such more-specialized researches allow for a deeper and more clarified analysis of some theoretical and methodological aspects of grand theories, if such researches provide a good foundation for considering the importance of the individual's context and variability, they are sparse, most of them with little regard for theory. The understanding of human development can hardly be obtained from a catalogue of empirical facts (Lerner, 2002); the understanding of human development presupposes scholars made an effort to integrate theory, method and applications. In others words, understanding human development presupposes scholars made an effort to recreate or – even better – to create new grand theories in which, by analogy with the strong conception of development, previous theories will be integrated.

Continuity of ideas across historical periods?



Historian Lovejoy (1936) has used the concept *unit-idea* in his model, which refers to relatively unchanged ideas throughout intellectual history<sup>5</sup>. Thus, he claims, the unit-ideas persist, but in various forms in different cultures and in different times. Thus, there is continuity in intellectual history: the same thought-patterns and assumptions have emerged in various forms throughout time. Lovejoy aims to explain that there are actually very few novel ideas in history; rather, the ideas that emerge are simply modifications to the pre-existing unit-idea; a rearrangement and modification of the basic elements into “new” order and structure. Lovejoy’s analysis is thus focused on the persistent ideas: meanings of the concepts may change across historical eras and different cultures, but the unit-idea does not.

There is a difference between “concept” and “term”: the former is non-verbal and latter verbal. The concepts can be the same across histories and cultures, but the meanings behind the terms may vary. According to Lovejoy, the concepts are eternal and unchanging; in this sentiment, he comes close to the Platonic view of Ideas. There is also the post-Lovejoyan tradition, which is not as strict in using unit-ideas and continuity as basic forms of historical ideas, but instead merely uses the “Wittgensteinian” concept of *family-resemblance* (Wittgenstein, 2009) as an alternative expression (Gram & Martin, 1980). According to this modified version, there can be continuation and discontinuation in the history of Ideas. There can be a core of similarity and continuity between the concepts of different historical eras, but it is not necessary; there can be also progress and change of ideas at the same time.

If one follows either the Lovejoyan idea of continuity, or post-Lovejoyan idea of family-resemblance, is it possible to specify continuity or discontinuity in the conceptions of change, progress and development, as described in this article? In the following, three major recurrent ideas are discussed, namely claims about the *telos* of human development, the idea of dialectical progress and the holism-atomism debate, and, finally, assumption of hierarchies.

---

<sup>5</sup> The concepts of history of Ideas and intellectual history are used here and subsequently interchangeably; though in strict theoretical analysis they are often used as similar, but not identical, terms.

The teleology claim seems to have had proponents in both the pre-modern and modern eras. The question of *telos* is definitely important in connection with change and development, progress and development. Previously Aristotle named *telos* as one of the major causes of events. It refers to a future goal, a direction in which one aims to move. During the pre-modern, medieval and renaissance worlds, as seen through the Aristotelian-Ptolemaic world view *telos* was very important. It was the God (the Immovable Mover in Aristotelian Christianized thought) who ordained *telos* of everything existing in the super- and sub-lunar worlds. Using *telos* to explain motive has not disappeared in the modern era – on the contrary. As shown above, it is particularly connected to the concept of development in many modern psychological models (Flavell, 1982; Lourenco, 1997); but in the modern scientific world view any theological connotations have naturally been ignored. Grand theories of Piaget, Freud and Erikson share the idea that development is goal-directed and teleological, and according to the modern scientific world view it is biologically motivated or even partly determined. Teleological thought is not, however, so prominent in learning theories, which do not posit any special goal in processes of change. This notion can be one of the major differences between developmental and learning theories.

The holism-atomism debate has also endured throughout the history, and it has also impacted the fields of psychology and education. Clearly there are resemblances between pre-modern conceptions of the human being as part of a larger whole, the cosmos, and modern conceptions of contextualism. In pre-modern times, the holistic world view with Aristotelism and Ptolemy's cosmology determined man's place in the world. The human being as a microcosm was part of a totality, a macrocosm; the pair was analogous to a smaller world incorporated into a bigger world. There is a certain similarity between this notion and the modern assumption that there is some relationship between the human being and environment, though the contexts have been understood differently within different historical eras. In both world-views, the organism (human being) is seen to be composed of interconnected and interrelated parts, constituting a complex, organized system. As previously stated, perspective is holistic, systemic, teleological and architectonic. It is a question of different world views, but the main

theme is the same: the human being is connected to a larger system. The same idea of contextuality can be found in many modern developmental theories.

Also it is possible to claim that the concept of dialecticism has re-emerged throughout history in its many variants. As has been shown, it has emerged in Western culture in one form already present in Classical Antiquity. It was the major component in the philosophies of Hegel and Marx, and it has had advocates in various psychological fields, especially in the field of adult cognitive development (Kallio, 2010, in press). Proponents of a contextual world view in psychology have favoured this; in fact Riegel (1973) and Basseches (2003) are advocates of it. They claim that thinking of progress as a process of thesis, antithesis and synthesis is linked closely to contradictions, which forces development to emerge as a result. Another manifestation of a similar idea throughout history is that of a mechanistic model of change – it also has its roots in Classical Antiquity. Mechanistic-materialistic models in recent history have been capable tools in trying to describe how change is possible, both in psychological developmental theories and theories of learning.

In developmental psychology in particular, there is a tendency to understand phenomena hierarchically; i.e. to assume that development is constructed into qualitatively different stages, organized into lower and higher levels compared with each other (for discussion of this within Piaget's theory, cf. Kallio & Helkama, 1991; Kallio, 1995; Kallio, 1998 to define stages by empirical research). Notions of hierarchical levels have, however, already existed in pre-modern times. Assumption of a hierarchy in the "great chain of being" has been ultimate fundamental part of a pre-modern world view (Boas, 2003), as has already been clarified in the beginning of this chapter. In it, i.e. in the Aristotelian-Ptolemaic world view, hierarchies existed: in the first stance is a sub-lunar hierarchy of four elements (wherein the lowest is earth and the highest fire) and above them, super-lunar planetary spheres (wherein the lowest is the Moon and the highest Saturn and even higher than them, a sphere of fixed stars) and above all existed God (Boas, 2003; Gonger, 1922; Thorndike, 1923-1958). If the Lovejoyan thought-pattern is followed, this may be one indication of a similar *unit-idea* manifesting itself in history, in various forms. But at the same time it must be acknowledged that not all

psychological theories are based on biological evolution and hierarchical thinking, as has been demonstrated with learning theories mentioned previously.

As stated in the beginning of this chapter, there seems to be an assumption in modern culture that everything is in a state of constant change and progress. New innovations are always arriving and everything should be done rapidly, as soon as possible. According to Lovejoy (1936), the *unit-idea* or at least a *family resemblance* to this kind of thinking must have already existed sometime in the history of Ideas. Stated in its most extreme form, nothing remains same, everything changes all the time, according to Heraclitos during Classical Antiquity. Paradoxically, the idea of constant change in the course of history has been stated as an absolute truth; but at least one thing has stayed the same: the idea of change.

**REFERENCES**

- Aristotle. (1971). *Complete Works of Aristotle* (J. Barnes, editor). New Jersey: The Princeton University Press.
- Baer, D. (1970). An age-related concept of development. *Merrill-Palmer Quarterly: Behaviour and Development*, 61, 239-245.
- Bakalis, N. (2005). *Handbook of Greek Philosophy: From Thales to the Stoics. Analysis and Fragments*. Bloomington: Trafford Publishing.
- Baltes, P. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology*, 23, 611-626.
- Baltes, P., Lindenberger, U., & Staudinger, U. (1998). Life-span theory in developmental psychology. In W. Damon (Series Ed.) & R. Lerner (Vol. Ed.), *Handbook of child psychology: Vol.1.Theoretical models of human development* (pp.1029-1144). New York: Wiley.
- Baltes, P.B., Reese, H.W., & Lipsitt, L.P. (1980). Life-span developmental psychology. *Annual Review of Psychology*, 31, 65-110.
- Bandura, A. (1986). *Social foundation of thought and action: a social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Basseches, M. (2003). Adult Development and the Practice of Psychotherapy. In J. Demick and C. Andreoletti (Eds.) *The Handbook of Adult Development*. New York: Plenum Press.

Biggs, J. B. (1992). Returning to school: review and discussion. In A. Demetriou, M. Shayer & A. Efklides, (1992). *Neo-Piagetian theories of cognitive development* (p. 11-30). London, New York : Routledge.

Bijou, S. (1992). Behavior analysis. In R. Vasta (Ed.), *Six theories of child development* (pp.61-83). London: Jessica Kingsley Publishers.

Bijou,S. & Baer, D. (1961). *Child development: a systematic and empirical theory*. Englewood Cliffs, NJ: Prentice-Hall.

Boas, George. "The Microcosm." In *The History of Ideas: An Introduction*, 212–238. New York: Scribners, 1969.

Berryman, S. (2005). *Ancient atomism*. Stanford Encyclopedia of Philosophy. Retrieved 2010-09-06 from <http://plato.stanford.edu/entries/atomism-ancient/>

Brim, O. Jr. & Kagan, J. (1980). Constancy and change: A view of the issues. In O. Brim, Jr. & J. Kagan (Eds.) *Constancy and change in human development* (pp. 1-25). Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1993). The ecology of cognitive development: research models and fugitive findings. In R. Wozniak & K. Fischer (Eds.), *Development in context* (pp. 3-44). Hillsdale, NJ: Erlbaum.

Bronckart, J.P. (1985). Vygotsky, une oeuvre en devenir. In B. Schneuwly & J.P. Bronckart (Eds), *Vygotsky aujourd'hui* (pp.7-21). Neuchâtel/Paris, Delachaux et Niestlé.

Bruner, J. (1965). The growth of mind. *American Psychologist*, 20, 1007-1017.

- Bruner, J. (1992). The narrative construction of reality. In H. Beilin & P. Pufall (Eds.), *Piaget's theory: Prospects and possibilities* (pp.229-248). Hillsdale, NJ: Erlbaum.
- Burrow, J. (2008). *The Ages of Man*. Gloucestershire: Clarendon.
- Canfield, R. & Ceci, S. (1992). Learning and intellectual development. In R. Sternberg & C. Berg (Eds.) *Intellectual Development* (pp. 278-300). Cambridge: Cambridge University Press.
- Carey, S. (1999). Sources of conceptual change. In E. Skolnick, K. Nelson, S. Gelman and P. Miller (Eds.), *Conceptual Development: Piaget's Legacy* (pp. 293-326). Mahwah, NJ, London. Lawrence Erlbaum.
- Carey, S. & Spelke, E. (1994). Domain-specific knowledge and conceptual change. In L. Hirschfeld & S. Gelman (Eds.) *Mapping the mind: domain specificity in cognition and culture* (pp.169-200). Cambridge: University Press.
- Case, R. (1992). Neo-Piagetian theories of child development. In R. Sternberg & C. Berg (Eds.), *Intellectual development* (pp. 161-196). Cambridge: Cambridge University Press.
- Chapman, M. (1988). Contextuality and directionality of cognitive development. *Human Development*, 31, 92-106.
- Chang, W. (2009). Reflections on time and related ideas in the Yijing. *Philosophy East & West*, 59, 2, 216-229.
- Dasen, P.R. & de Ribaupierre, A. (1988). Neo-Piagetian theories: cross-cultural and

differential perspectives. In A. Demetriou (Ed.), *The neo-Piagetian theories of cognitive development: Toward an integration* (pp. 287-326). North-Holland: Elsevier Science Publishers.

Demetriou, A., Shayer, M. & Efklides, A. (Eds.) (1992). Introduction. In A. Demetriou, M. Shayer, & A. Efklides (Eds.), *Neo-Piagetian theories of cognitive development: Implications and applications to education* (pp. 1-7). London: Routledge.

Fischer, K.W (1980). A theory of cognitive development: the control and construction of hierarchies of skills. *Psychological Review*, 87,477-531.

Fischer, K.W. & Farrar, M. (1988). Generalization about generalization: how theory of skill development explains both generality and specificity. In A. Demetriou (Ed.), *The neo-Piagetian theories of cognitive development: Toward an integration* (pp.137-171). North-Holland : Elsevier Science Publishers.

Flavell, J. (1971). Stage-related properties of cognitive development. *Cognitive Psychology*, 2, 421-453.

Flavell, J. (1982). Structures, stages, and sequences in cognitive development. In W. Collins (Ed.), *The concept of development* (pp.1-28). Hillsdale, NJ: Erlbaum.

Flavell, J. (1985). *Cognitive Development*. Englewood Cliffs, NJ: Prentice-Hall.

Gagné, R.M. (1968). Contributions of learning to human development. *Psychological Review*,75, 177-191.

Gesell, A. (1931). Maturation and the patterning of behaviour. In C. Murchison (Ed.), *Handbook of child psychology* (pp.209-235). Worcester, MA: Clark University Press.



Gillieron, C. (1980). Gerontologia, psicología del niño y estudio del desarrollo. *Anuario de Psicología*, 23, 2, 59-83.

Gilligan, C., Murphy, J. & Tappan, M. (1990). Moral development beyond adolescence. In C. Alexander & E. Langer (Eds.), *Higher stages of human development* (pp. 208-225). New York: Oxford University Press.

Goustard, M., Gréco, P., Matalon, B. & Piaget, J. (1959). La logique des apprentissages. *Études d'Épistémologie Génétique*, vol X. Paris: Presses Universitaires de France.

Graham, D. (2007). *Heraclitus*. Retrieved from <http://plato.stanford.edu/entries/heraclitus/>

Gongor, G. 1922. *Theories of microcosm and macrocosm in the history of philosophy*. NY: Columbia University Press.

Gram, M.S. & Martin, R. (1980). The perils of plenitude: Hintikka contra Lovejoy. *Journal of History of Ideas*, 41, 497-511.

Grannot, N. (1998). We learn therefore we develop: learning versus development – or developing learning? In M.C. Smith & T. Pourchot (Eds.), *Adult learning and development* (pp.15-34), Mahwah, New Jersey, London: Lawrence Erlbaum.

Gruber, H. (1986). Which Way is Up? A Developmental Question. In R. Mines & K. Kitchener (Eds.) *Adult Cognitive Development: Methods and Models*. Praeger: New York.

Guthrie, W.K. (1991). *History of Greek Philosophy*. Cambridge: Cambridge University Press.

Halford, G.S. (1995). Learning processes in cognitive development: A reassessment with some unexpected implications. *Human Development*, 38, 295-301.

Hall, G.,S. (1904). *Adolescence: its psychology and its relations to physiology, anthropology, sociology, sex, crime, religion and education* (Vols 1 and 2). New York: Appleton.

Hirschfeld, L. & Gelman, S. (Eds) (1994). *Mapping the mind: domain specificity in cognition and culture*. In Halford, G. S. (1993). *Children's understanding: The development of mental models*. Hillsdale, NJ: Erlbaum.

Hoare, C. (2006). Growing a discipline at the borders of thought. In C. Hoare (Ed.) *Handbook of Adult Development and Learning*. Oxford University Press.

Hull, C. (1929). A functional interpretation of the conditioned reflex. *Psychological Review*, 36, 498-511.

Hussey, T. (2009). Thinking about change. *Nursing Philosophy*. Retrieved 2010-09-03 from <http://onlinelibrary.wiley.com/doi/10.1046/j.1466-769X.2002.00096.x/pdf>

Inhelder, B. & Caprona, D. (1987). Introduction. In B. Inhelder, D. de Caprona, A. Cornu-Wells (Eds.), *Piaget today* (pp.1-14). Hove and London: Lawrence Erlbaum.

Inhelder, B. & Cellérier, G.(Ed.) (1992). *Le cheminement des découvertes de l'enfant*. Neuchatel, Paris: Delachaux & Niestlé.

Inhelder, B., Sinclair, H. & Bovet, M. (1974). *Apprentissage et structures de la connaissance*. Paris: Presses Universitaires de France.

Kallio, E. (1995). Systematic reasoning: formal or postformal cognition? *Journal of Adult Development*, 2, 3, 187-192.

Kallio, E. (1998) Training of students' scientific reasoning skills. *Jyväskylä studies in education, psychology and social research* vol. 139. Retrieved 2010-09-06 from <http://selene.lib.jyu.fi:8080/vaitos/studies/studeduc/9513912922.pdf>

Kallio, E. (2010) Integrative Thinking is the Key: an Evaluation of Current Research into the Development of Adult Thinking. *Theory & Psychology* (in press).

Kallio, E. & Helkama, K. (1991). Formal operations and postformal reasoning: A replication. *Scandinavian Journal of Psychology*, 32, 1, 18-21.

Kaplan, B. (1983). A trio of trials. In R. Lerner (Ed.), *Developmental psychology: Historical and philosophical perspective* (pp.185-228). Hillsdale, NJ: Erlbaum.

Karmiloff-Smith, A. (1992). *Beyond modularity: a development perspective on cognitive science*. Cambridge, Massachusetts: MIT Press.

Karmiloff-Smith, A. & Inhelder, B. (1975). If you want to get ahead, get a theory. *Cognition*, 3 (3), 195-212.

Klahr, D. (1984) Modelos de desarrollo intelectual basados en lo processamiento de la información. In M. Carretero & J.A. Garcia Madruga (Eds.), *Lecturas de la psicología del pensamiento* (pp.221-252). Madrid; Allianza.

Klahr, D. & Wallace, J. (1976). *Cognitive development: an information processing view*. Hillsdale, NJ: Erlbaum.

Kohlberg, L. (1969). Stage and sequence. The cognitive developmental approach to socialization. In D.A. Goslin (Ed.), *Handbook of socialization theory and research* (pp.347-480). Chicago: RandMcNally.

Kohlberg, L. (1990). Which postformal levels are stages? In M.L. Commons, C. Armon,

L. Kohlberg, F.A. Richards, T.A. Grozer, & J.D. Sinnott (Eds.), *Adult Development, Vol 2: Models and methods in the study of adolescent and adult thought* (pp.263-268). New York: Praeger.

Kohlberg, L., & Armon, C. (1984). Three types of stage models used in the study of adult development. In M.L. Commons, F.A. Richards, & C. Armon (Eds.), *Beyond formal operations*, (pp. 383-394). New York: Praeger.

Kraut, R. (2009) *Plato*. Stanford Encyclopedia of Philosophy. Retrieved 2010-09-03 from <http://plato.stanford.edu/entries/plato/>

Kuhn, T. S. (1957). *The Copernican Revolution*. Cambridge: Harvard University Press.

Knuuttila, S. (2006). *Emotions in Ancient and Medieval Philosophy*. USA: Oxford University Press.

Kvale, S. (1992). *Psychology and postmodernism*. London: Sage.

Lerner, R. (1991). Changing organism – context relations as the basic process of development: A developmental contextual perspective. *Developmental Psychology*, 27, 27-32.

Lerner, R. (2002). *Concepts and theories of human development*. Mahwah, NJ, London: Lawrence Erlbaum Associates, Publishers.

Levi D'Ancona, M. (1983). *Botticelli's Primavera. A botanical interpretation including astrology, alchemy and the Medici*. Firenze: Olschi Editore.

Levy, D. (1967). Macrocosm and microcosm. In P. Edwards (Ed.), *The encyclopedia of philosophy*, vol.5, pp.121-125. NY: MacMillan.

Liddle, H. A. (1982). On the problems of eclecticism: A call for epistemologic clarification and human-scale theories. *Family Process*, 21, 243-250.

Lourenço, O. (1997). *Psicologia do Desenvolvimento Cognitivo-Teoria, Dados e Implicações* (Psychology of Cognitive Development – Theory, Data and Implications). Coimbra: Livraria Almedina.

Lovejoy, A. (1936). *The great chain of being: A study of the history of an idea*. Cambridge: Harvard University Press.

Marchand, H. (1986). Apprentissage opératoire dans un milieu socio-culturel sous-privilegié. *Archives de Psychologie*. Genève, 54, 2-26.

Marchand, H. (2000). From the diagnostics of reasoning in the mentally disabled to the microgenetic study of the processes of discovery: Bärbel Inhelder's contribution toward a global understanding of the subject. *The Genetic Epistemologist*, 28, 4, 2-8.

Marchand, H. (2001). Some reflections on post-formal thought. *The Genetic Epistemologist*, 29, 2-9.

Marchand, H. (2002). Some reflections on post-formal stage. *Behavioral Development Bulletin*, 1, 39-46.

Marchand, H. (2008). Formal thought and postformal thought: *A critical review*. Oral communication presented at the 38th Annual Meeting of the Jean Piaget Society, *Adolescent Development: Challenges and Opportunities*. Québec.

Marti, E. (1991). *Psicología Evolutiva - teorías y ámbitos de investigación*. Barcelona: Anthropos. Editorial del Hombre.

- Marti, E. (1996). Piaget and school education: a socio-cultural challenge. *Prospects*, XXVI, 1, 141-158.
- Marx, K. (2000). *Selected Writings*. (D. McLellan, editor). Oxford: Oxford University Press.
- Meacham, J. (1997). Autobiography, voice and developmental theory. In E. Amsel & K. Renninger (Eds.), *Change and development: Issues of theory, method and application* (pp.43-60). Mahwah, New Jersey, London: Lawrence Erlbaum Associates, Publishers.
- Montangero, J. & Vonèche, J. (1993). Introduction. In J. Montangero, A. Cornu-Wells, A. Tryphon & J. Vonèche (Eds.), *Conceptions of change over time* (pp.7-13). Genève: Cahiers de la Fondation Archives Jean Piaget. 13.
- Mortensen, C. (2006). *Change*. In Stanford Encyclopedia of Philosophy, retrieved 2009-05-12 from <http://plato.stanford.edu/entries/change/>
- Needham, J. (1981). *Science in Traditional China*. Cambridge: Harvard University Press.
- Overton, W. (1993). The arrow of time and cycles of time: Implications for change in cognitive development. In J. Montangero, A. Cornu-Wells, A. Tryphon & J. Vonèche (Eds.), *Conceptions of change over time* (pp.159-180). Genève: Cahiers de la Fondation Archives Jean Piaget 13.
- Pascual-Leone, J. (1984). Attentional, dialectic, and mental effort: Toward an organismic theory of life stages. In M. Commons, F. Richards, & C. Armon (Eds.), *Beyond formal operations* (pp.182-215). New York: Praeger.

Pascual-Leone, J. (1988). Organismic process for neo-Piagetian theories: a dialectical account of cognitive development. In A. Demetriou (Ed.), *The neo-Piagetian theories of cognitive development* (pp. 25-64). Amsterdam: Elsevier.

Pascual-Leone, J. (2004). Hidden operators of mental attention applying on LTM give the illusion of a separate working memory. *Behavioral and Brain Sciences*, 27 (5), 709-711.

Pepper, S. C. (1942/1970). *World hypotheses: A study in evidence*. Berkeley, CA: University of California Press.

Piaget, J. (1947/1967). *La psychologie de l'intelligence*. Paris : Armand Colin.

Piaget, J. (1983). *Le possible et le nécessaire: l'évolution du nécessaire chez l'enfant*. Paris: Presses Universitaires de France.

Piaget, J. & Inhelder, B. (1966/1973). *La psychologie de l'enfant*. Paris: Presses Universitaires de France.

Plato (1977). *Plato Complete Works*. John M. Cooper & D. S. Hutchinson (Editors). Hackett Publishing Company.

Ptolemy, C. (1940) *Tetrabiblos*. Loeb classical library series, vol. 435. Trans. by F.E. Robbins. Cambridge: Harvard University Press.

Reese, H. & Overton, W. (1970). Models of development and theories of development. In I. Goulet & P. Baltes (Eds.), *Life-span developmental psychology: Research and theory* (pp.115-145). New York: Academic Press.

Remes, P. (2008). *Neoplatonism*. University of California Press.

Renninger, K. & Amsel, E. (1997). Change and Development: An introduction. In E. Amsel & K. Renninger (Eds.), *Change and development: Issues of theory, method and application* (pp. ix-xv). Mahwah, New Jersey, London: Lawrence Erlbaum Associates, Publishers.

Riegel, K. (1973). Dialectic operations: the final period of cognitive development. *Human Development*, 16, 346-370.

Rose, H. A. (2003). *Pepper's world hypotheses: A philosophical rubric for understanding family theories*. Paper presented at the Theory Construction and Research Methodology Pre-conference at the Annual Conference of the National Council on Family Relations. Vancouver, Canada.

Saada-Robert, M. & Brun, J. (1996). Transformations of school knowledge: The contributions and extensions of genetic psychology. *Prospects*, XXVI, 1, 25-36.

Santrock, J. (2006). *Educational Psychology*. Boston: McGraw-Hill.

Sears, E. (1986). *Ages of man*. Princeton: Princeton University Press.

Shaughnessy E. L. (2005). *China*. Duncan Baird Publishers.

Siegler, R.S. (1983). Information processing approaches to development. In P.H. Mussen (Ed), *Handbook of child psychology, vol 1* (pp.129-211). New York, Wiley.

Skinner, B. (1938). *The behaviour of organisms*. New York: Appleton.

Stenberg, S. (1969). Memory-scanning: Mental processes revealed by reaction-time experiments. *American Scientist*, 57, 421-457.



Tappan, M. (1992). Commentary. *Human Development*, 35, 376-383.

Taylor, C. (2008). *Hegel*. Cambridge: Cambridge University Press.

Terman, L. (1925). *Genetic studies of genius, Vol. I: Mental and physical traits of a thousand gifted children*. Stanford, CA: Stanford University Press.

Thorndike, L. (1923-1958). *A history of Magic and Experimental Science*, vols. 1-8. Columbia University Press.

Vonèche, J. (1994). The mirror and the lamp: The opposition between mechanical and organismic explanation in developmental psychology: A response to Harry Beilin and Willis Overton. In J. Montangero, A. Cornu-Wells, A. Tryphon & J. Vonèche, (Eds.), *Conceptions of change over time* (pp.181-194). Genève: Cahiers de la Fondation Archives Jean Piaget, 13.

Von Wright, G.H. (1990). *Explanation and Understanding*. Ithaca, N.Y.: Cornell University Press.

Vygotsky, L. (1978). *Mind in society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Watson, J. (1913). Psychology as the behaviourist views it. *Psychological Review*, 20, 158-177.

Werner, H. (1957). The concept of development from a comparative and organismic point of view. In D. Harris (Ed.). *The concept of development* (pp.125-148). Minneapolis: University of Minnesota Press.

Wertsch, J. & Kanner, B. (1992). A socio cultural approach to intellectual development. In R. Sternberg & C. Berg (Eds.), *Intellectual development* (pp. 328-349). Cambridge: Cambridge University Press.

Wittgenstein, Ludwig (2009). *Philosophical Investigations*, 4th edition, 2009, P.M.S. Hacker and Joachim Schulte (eds. and trans.), Oxford: Wiley-Blackwell.

Zimmerman, B. (1995). Attaining reciprocity between learning and development through self-regulation. *Human Development*, 38, 367-372.

Eeva Kallio

Senior researcher, PhD, Adjunct professor

University of Jyväskylä

Finnish Institute for Educational Research

P.O. Box 35

40014 Jyväskylä

Finland

[eeva.k.kallio@jyu.fi](mailto:eeva.k.kallio@jyu.fi)

int. tel. +358 44507 2428

Helena Marchand, Associate Professor

Institute of Education

University of Lisbon

Alameda da Universidade

1649-013 Lisbon, Portugal

[helenamarchand@hotmail.com](mailto:helenamarchand@hotmail.com)

[helenamarchand@ie.ul.pt](mailto:helenamarchand@ie.ul.pt)

ACKNOWLEDGEMENTS. The authors want to thanks doctoral student Timothy Riggs from the Finnish Academy Unit of Excellence for ‘Philosophical Psychology, Morality and Politics’ from the University of Jyväskylä, Finland, for comments on the historical part of the text.