The Smartphone. Digital Reverse Transcriptase of Child Development. The New Inner World of the Outer World of the Inner World

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593 A major cause of philosophical malady—one-sided diet: you feed your thinking with only one kind of examples.
—Ludwig Wittgenstein, Philosophische Untersuchungen, 1953

Abstract The Smartphone, the Digital Reverse Transcriptase of child development in the beginning of the twenty-first century is transferred to a discourse of understanding seen as fundamental bio-philosophical thinking dealing with ongoing rapid worldwide changes. The available (and even for toddlers simple to use) digital, and especially smart phone technology, is already measurably influencing children's pre-lingual brain and hand motor skills. It seems that human brain and smart phone are mutually influencing their individual development in an almost co-evolutionary sense. Therefore, both technological development and medical research require accompanying philosophical-ethical considerations of how these modified brain activity eventually influences a child's (and later adult's) perception of itself and the connection to its surrounding environment.

Keywords Digitalization · Child development · Smart phone · Physiological fitting · Hand motor function

1 Introduction

We can understand the world only in the context of human development, not without, not against development. Development is childhood. Development and childhood are being neglected in Philosophy so far, not included in our thinking, not included in our view of the world. The essence of human being, of the human brain: An inner world of an outer world developmentally bridged by pre-lingual hand motor function.

This fitting of pre-lingual human hand motor activity and technically simplified availability is new, but matches physiologically the development of the child's brain

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and hand motor skills, also in the sense of abstract and at the same time biologic-mental grasping. In consequence, this fitting has a fascination, distribution, and dynamic that is 'fitting' with all early as well as late developmental phases of man, especially children and adolescents. This fitting is perceived as socially irreversible. It could have the potential to define newly the directions that individual developments may take, not (yet) foreseeable, not unidirectional. This fitting gave rise to a quantum leap in possibilities and in turn, to a new evolutionary step of adaptation. Unquestionably, positive constructive possibilities as well as negative destructive possibilities are conceivable. There is a high priority for further understanding and drawing the right conclusions from the 'smartphone phenomenon.' We are only at the beginning.

2 The Outer World Appears Clear-Cut

Since Steve Jobs introduced the iPhone in 2007, the smartphone has become an unprecedented success story within an unmatched short time. Indeed, the smartphone became 'viral,' spread out, everywhere. It transformed a whole corporation (Apple), rescued it, and made it to the most valuable business in the world—philosophically irrelevant—led to new industries that are typically networking globally—philosophically already a bit more relevant—and as a tangible object always at hand, it has globally changed every day's world—indeed relevant.

Using the smartphone, more or less 'everyone' in nearly 'every' culture is able to communicate, mirror, photograph, film, experience, attend to, and design nearly 'everything.'

The smartphone functions globally viral, in the countryside of East Africa as well as in the financial districts of New York, London, or Hong Kong, in the East and West just as well as in the North and South.

This development in its unparalleled innovation provokes new questions due to a newly conceived interaction of the human hand, technical device, human brain, and transfer of knowledge.

Here, we are considering the question, whether and at which point child development in its specifically human course, its biological complexity, its healthy variable normality, and its underlying natural principles could provide an important key to our understanding of this technology that we no longer perceive as new because it is already so well embedded in everyday life. We concern ourselves with this question, because we are convinced that this 'fitting of man and smartphone,' this obvious phenomenon of 'fitting together,' is our current social reality and that we should strive for a better understanding of this phenomenon, regardless how society might judge this phenomenon, approval, critic and rejection, and quite independent of the powerful 'attention value' that presents a new gold mine for seemingly unlimited commercial exploitation.

3 The Inner World is Not So Clear

Why is the smartphone so attractive for all age groups, why obviously for all people independent of the world region, type of government, or religion? Why has it sustained unbroken attraction? Why are there no signs of a slowing down in attention and of wearing off in fascination with the smartphone?

Considering this background, it is clear that there should be intensive discussion regarding potential risks and undesirable side effects of the smartphone for children and adolescents. However, we decided not to enter into this discussion here at this stage. Not because we are afraid of misunderstandings, inappropriate approval or rejection, but rather we feel it necessary to first understand the biological, physiological 'fitting' phenomenon before turning our attention to developing an 'educational fitting.'

The (unclarified) inner world of a (seemingly) clear outer world of the smartphone therefore requires an excursion and discourse on the fundamentals of child development, which we present below in the form of theses. We hope our theses will provoke a thought process that gives rise to antitheses and syntheses, which in turn may again become theses, ultimately improving our understanding.[1]

4 Discourse on Childhood and Smartphone, Presented in 36 Theses

The development of the child may be described as 'shaping of the inner world in direct relation to the changing outer world' involving the biological age-related and constituent perception and reaction principles applicable to the individual inner world [1].

The inner world of the outer world reflects the mirror-inverted relationship with the outside world, with its own dynamics, potential, and a relatively long time of decided child development, continually and flexibly pursued for a life-long human development and change.

The development of the child is neurobiological sculpturing and neurobiologically sculptured—not simply additive—plasticity of the human brain [2].

In the child's early development, understanding is principally pre-lingual—with emphasis on pre-lingual hand motor function.

Intentional pointing with the index finger is a necessary milestone in the child's development, comparable to free walking, and both are a *conditio sine qua non* in the context of health.

[1] Cf. the dialectic approach formulated by Plato, further developed by the Plato-Augustine intellectual arc into the Christian middle age philosophy and the German philosophy of idealism by Fichte, Schelling, and Hegel.

Hand motor skills represent one of the most human aspects of voluntary motor function. They are especially closely associated with cortical activity of the brain and when considering the whole evolution 'exclusively human' [3, 4].

Hand motor function between thumb (D1) and index finger (D2), such as the thumb–index pincer grip, biologically achieves the fastest conduction times (cortico-spino-muscular) and the most direct (monosynaptic) spinal connections between brain and periphery.

Hand motor function is represented within the motor cortex with cortical pyramidal cells embedded in central neuronal networks: Layers 2 and 3 interneurons and Layer 5 first motor neurons. L2 and L3 neurons perform, besides the known regulatory effect by the cell soma, also axonal excitation and inhibition, exclusively attributable to the human cortex.

Hand motor function with emphasis on 'pointing with the index finger' and on the radial pincers grip (between thumb and index finger) shows a system-physiological early structural basic maturity of the brain (assessed with the already present 'adult like' characteristics during the 1–3 years of life), as well as years later available functional 'adult-like' performance maturity (assessed with the 'adult-like' characteristics during the 10–16 year of life).

For hand motor function applies: conduction proceeds skill [5–11].

We may consider hand motor function paradigmatically as the development of the inner world of the brain in response to the primarily egocentric outer world 'hand' that secondarily is grasping onto the next, increasingly allocentric outer world, the contemporary world.

Considering and accepting that hand motor skills play a paradigmatic role in special aspects of child development, learning, cognition, and abstraction—and in the fitting of brain, hand motor function and smartphone that bring about cultural changes—it would be a mistake to reason that pathologic development with pathologic or absent hand motor function would make the developmental process as such impossible. Development is always possible, also with existing disabilities, also with impaired hand motor function (which may have various causes such as disease, syndrome, or traumatic loss. These are exactly the type of patients that form part of the author's clinical routine as a developmental and child neurologist). This development is possible because of the child's basic, naturally existing 'inner direction and unfolding,' which finds alternative ways and surprises with variability, plasticity, and creative compensation. By no means, of course, can human development be reduced to hand motor function alone. However, development involves the hand and its function as a very fundamental human tool.

This is new: between inner world and outer world, we say since 2007, a new all-in-one go-between world or all-in-one new world or all-in-one handheld, the smartphone, is squeezing in.

This new world is a kind of intermediate world in the form of 'physically lying in the palm of the hand' and a non-physical 'unlimited availability' of plenty if not 'everything' (including information, music, social networks, and orientation in space).

This type of new world—all-in-one—in the hand and thus in the physiological world of the growing child, is the smartphone.

The smartphone is an irreversible reality also in childhood, also in the developing brain.

Using the smartphone means digital processes: 'everything is available' (in digital format).

As the smartphone involves manual handling, pointing, swiping, drop and drag, or pre-lingual use, it may be considered as a kind of digital reverse transcriptase of child development and culture. That is a knowledge or information device that not only builds up—by unidirectional adding—on increasing linguistic competence, but with its haptic (innovation iPhone) and with its increasing accessibility by voice (and/or face/eye interaction) introduces and allows bi-directionality exactly where previously only unidirectional usage—towards an ever more complex language—was possible.

First, the smartphone accomplishes by convergence the pre-lingual simplification 'on the way to pointing,' but then it also achieves by divergence a simplification 'towards language,' 'towards voice control,' and 'towards face/eye control.'

Using the smartphone means digital procedures: From the moment in childhood development when the child begins to use its hands, the child will be able to digitally enter an intermediate world, access it by pointing/touching, change it, and monitor it.

However, it also means that the child itself becomes digitally socially commensurable, or is made to be so, or is traceable. The child leaves the un-reflected trace of a child's interests and playful activities, constituting for the first time an unprotected and highly vulnerable field of human behavior and condition outside the protected family environment to a powerful industry.

Using the smartphone means 'a digital approach to the multifaceted world': Relating to the hand, using the hand, using the human-specific grasp, and pointing functions in their intuitive pre-lingual purpose (including swiping, dragging for enlarging or reducing, and spreading).

The above considerations suggest an evolutionary–revolutionary fitting of human brain and smartphone, a fitting at several different levels such as visual, acoustic, haptic-sensory, motoric, cognitive, emotional, etc.

The fitting of brain and smartphone (also) includes space and time dimensions.

While the space dimension with its 'lying in the hand' micro dimension would seem less critical, the time dimension with its quickly accumulating time also in the sense of consuming is considered a critical parameter.

We are dealing here with a biological–technical fitting and, through this form of pointing, with a new discovery—a product invention (by Steve Jobs) that is changing the world.

This fitting explains the potency when it comes to the globally ubiquitous presence and the individuality.

The accuracy of the fitting regarding the globally ubiquitous presence and the individuality is fascinating in itself.

This fitting allows to critically drawing an analogy to the fitting of alcohol and human brain.

There is fascination for the inner world of the brain as well as for the outer world, such as the society, parents, teachers, politics, and medicine.

Above considerations show that diametrically opposing arguments can be offered for either positive aspects and approval or negative dangers and rejection.

The factor 'development of the brain' and the factor 'development of the hand' and the connective factor 'technical development of a hand-held smartphone' have to be studied newly and more profoundly.

The illustrated complexity needs to be simplified. However, we do not yet understand enough to suggest an effective approach to simplification.

For setting up plausible rules for children and adolescents, it will be necessary though to simplify our understanding and the rules to match the truly active and powerful simplification level of the smartphone.

Basic supportive and protective rules as well as those specifically relating to areas such as medicine, media, family, and school should be developed.

Network strength of the smartphone: This term stands for the smartphone's omnipresence and its powerful possibilities to access readily information and to form and participate in social networks—implying both chances and risks. Such general network strength should be countered with a network strength specifically based on child and adolescent medicine, psychiatry, and educational sciences. All these disciplines should be well prepared with resources, coordinating, differentiating, not dramatizing or catastrophizing. Such efforts should emerge from pediatrics and developmental neurology. The self-proclaimed pseudo-pediatricians and global advisors—painting a dramatic picture but, in fact, only representing themselves—are the opposite of helpful in this discourse.

We are currently in a situation where the Goliath smartphone is progressing in big steps, and we are trying to confront this Goliath with a hardly prepared, not to say limping, David pediatrics.

5 Conclusions

We may consider the smartphone as a new in-between world or as a kind of digital reverse transcriptase of child development and culture.

The new smartphone world is a palmar all-in-one handheld device that makes everything available everywhere, preferably visually, factually, manually. This all-in-one handheld device allows for the first time during evolution such an early access to 'everything.' Access takes place 'in-the-hand' and thus interconnects the 'exclusively human sculpturing hand motor function in the brain' with an 'always immediate availability.'

The term digital has here a threefold connotation: (1) digitalized technical availability, (2) digital (concerning hand and fingers, Latin: *digitus*, the finger) human-specific motor control, and (3) digital reverse transcriptase. Control of hand motor function between thumb and index finger in essence constitutes evolutionary the most

human motor function of the hand, closest to brain and self. Image control, knowledge management, and visual control are thereby linked with hand motor function, while at the same time speeded up. Knowledge management is no longer exclusively tied to rhythm, speed, and understanding of the first written and then read words and language, something that is being attained relatively late in the development of the child and is organized in an additive, linear manner. Instead, knowledge management is linked with the relatively early developing pre-lingual motor activities such as pointing, swiping, spreading, and drag and drop, and thus is pre-additive, not linear, and concurrent.

This fitting of pre-lingual human hand motor activity and technically simplified availability is new, but matches physiologically the development of the child's brain and hand motor skills, also in the sense of abstract and at the same time biologic-mental grasping. In consequence, this fitting has a fascination, distribution, and dynamic that is 'fitting' with all early as well as late developmental phases of man, especially children and adolescents. This fitting is perceived as socially irreversible. It could have the potential to newly define the directions that individual developments may take, not (yet) foreseeable, not unidirectional. This fitting gave rise to a quantum leap in possibilities and in turn, to a new evolutionary step of adaptation. Unquestionably, positive constructive possibilities as well as negative destructive possibilities are conceivable (explicitly also a destructive plasticity with the risk of addiction).

There is a high priority for further understanding and drawing the right conclusions from the smartphone phenomenon. We are only at the beginning.

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