

Embryo Experimentation and Sorites Paradoxes

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ABSTRACT

The most influential opponents of the embryo research and embryo experimentation claim that a person with the rights to life begins to exist at the moment of fertilization. They argue that such a scientific practices are tantamount to murder and, therefore, that they are absolutely morally and legally impermissible. The advocates of such a viewpoint appealed most frequently to three arguments with the purpose of supporting the stance that fertilization should be nominated as the time at which full moral status is acquired: (i) Genetical Argument – at the “moment” of fertilization a genetically human being is created, (ii) Continuity Argument – in the post-fertilization period a continuum of developmental changes is such that it is impossible to isolate any stage to which we could attribute the attainment of moral status, (iii) Individuality Argument – it is the same individual right through from the moment of fertilization until the end. This article considers exclusively the question whether the Continuity Argument really supports the approach according to which fertilization is a determinant of moral status. I will try to show that from the most persuasive interpretation of Continuity Argument does not follow: (1) that the fertilization is necessary determinant of moral status; (2) that the fertilization is the most reasonable determinant of moral status. In short, I will try to show that this very argument does not entail the stance that embryo research and embryo experimentation are morally impermissible.

The development of biotechnology imposed to us numerous extremely complex ethical dilemmas. One of the most important question relevant for the wide spectrum of scientific and medical procedures such as, for instance, embryo research and experimentation, assisted reproductions practices, cloning to abortion are: When does a person begin to exist? In other words, is there, at some time during prenatal development, a crucial “marker event” before which there is no being to whom we have a moral obligation, and after which, there is? Is there any determinant of the moral status of person (prenatal or postnatal) and is it attainable by our cognitive capacities? It is far beyond the purpose of this article to consider all these questions and all these medical procedures. However, I will try to contribute to this important debate by discussing one rather precise question: should we nominate fertilization as a marker event on the basis of the Continuity Argument?

The main aim of this article is to analyse the Continuity Argument, one of the arguments on which is grounded the moral condemnation of embryo research and

experimentation. In the first part, I will give a very brief account of the approach that attributes the status of marker event to fertilisation. I will focus in this paper exclusively on the Continuity Argument in favour of fertilization approach, offering three possible interpretation of it. Finally, I will just register certain scientific facts that may call into question the first two interpretations. In the second part, I will isolate and analyze the third and the most persuasive interpretation of Continuity Argument. However, I will try to show that from this scientifically and philosophically well grounded interpretation of Continuity Argument does not follow: (1) that the fertilization is necessary determinant of moral status; (2) that the fertilization is the most reasonable determinant of moral status. In short, I will try to show that this very argument does not entail the stance that embryo experimentation and research are morally impermissible. It has to be stressed that I will not argue here that such a conclusion implies that fertilization could not be a marker event or that more convincing arguments in favour of fertilization approach could not be offered.

I

Embryo Experimentation and Fertilization as a Marker Event

In what follows, I shall concentrate exclusively on the problem of moral justification of early embryo research and experimentation (what is closely connected with the justification of the medical practice of in vitro fertilization or therapeutic cloning). In other words, I will refer primarily to the problem of embryo experimentation in its earliest stage before the appearance of the primitive streak. Namely, at least in the last decade the majority of polemics about the moral and legal permissibility of embryo research is focused on this period of the first fourteen days after fertilization and before the formation of the primitive streak. Limiting my discussion on this early period of embryo development, I do not want to suggest that the day 14 is the definitive borderline after which any research is forbidden, but only that there are some good arguments against the moral impermissibility of embryo experimentation before this term [\(1\)](#).

The moral judgment about the permissibility of a research or experimentation on an embryo requires an answer to the question when does a person with a right to life and the other moral rights begin to exist. Consequently, the debate is focused on the searching for the marker event or the event that determinate the moral status [\(2\)](#). Various landmarks in prenatal development are nominated as this marker event that determines a full moral status such as fertilization, segmentation, viability, capacity to have an experience, the sentiments of adults, social visibility, the constitution of large multiple connected cerebral cortex, the ability for rational reasoning, consciousness, self-motivated activity, etc [\(3\)](#).

The main opponents of the embryo research and experimentation claim that conception or fertilization is a crucial moment in prenatal development [\(4\)](#). According to this very influential viewpoint that a person with the rights to life of an adult begins to exist at the moment of fertilization, the practices of embryo experimentation and

embryo research are tantamount to murder and, therefore, absolutely impermissible. Fertilization is not exactly a moment but a complex process (lasting about 24 hours) initiated by the incorporation of the sperm in the egg, after which the egg completes maturation, the genetic material of each condenses into chromosomes, and finally the male and the female contributions come together *to form the new genotype* (5). Historically, the opponents of practices such as embryo experimentation have appealed most frequently to this fact about the formation of a new genetic code. It is concluded that fertilization marks the beginning of a genetically unique human life and therefore the beginning of a new individual, a person with all the rights of an adult and that it is wrong to destroy such an individual life because of what it currently is (6). However, in more recent discussions this general argument is divided into three arguments with the purpose of supporting the stance that fertilization should be nominated as the time at which full moral status is acquired: (i) Genetical Argument – at the “moment” of fertilization a genetically human being is created; (ii) Continuity Argument – in the post-fertilization period a continuum of developmental changes is such that it is impossible to isolate any stage to which we could attribute the attainment of moral status, (iii) Individuality Argument – it is the same individual right through from the moment of fertilization until the end (7).

I will focus in this paper only on the second, Continuity Argument, and try to show that there are serious scientific and philosophical obstacles to inferring from the assumptions of this Argument the stance that fertilization is a determinant of moral status.

Continuity Argument

What is exactly argued by this argument? The proponents of this argument view post-fertilization development as a continuous process in which there is no any event to which it is possible to attribute the nomination of a marker event. In contrast to this post-fertilization continuity, fertilization is seen as a crucial discontinuity or “transformation” in development (8).

It has to be noticed that in the literature there are certain terminological ambiguities concerning this argument that provokes further confusion. Namely, three interpretations of various strengths can be detected: (i) the strongest claim is that continuity implies the denial of any genetic and numerical developmental changes in the post-fertilization process; (ii) the moderate claim does not exclude some developmental changes, but it is argued that the continuity means that there are no crucial changes in the sense of discontinuity or relevant “transformation” in development; (iii) the weakest version is the claim that the post-fertilization process is continuous in the sense that there is no one single moment identifiable as a marker event, but that development after fertilization is a gradual process. In short, according to the first interpretation of the Continuity Argument, after fertilization there are no genetical and numerical changes; according to the second interpretation, there are some changes, but these changes are not crucial discontinuity events in comparison with fertilization; and according to the third interpretation, it is allowed that there are

developmental changes, perhaps some of them could be crucial, but it is not possible to isolate one single moment to which the attribution of discontinuity could be ascribed. Regardless of these different versions of the Continuity Argument, the conclusion is the same: the continuity of post-fertilization development is the reason why we have to ascribe to fertilization a status of marker event.

If we tend to a systematic elaboration of the foundation for the moral condemnation of embryo research based on Continuity Argument, each of these three interpretations has to be considered apart from each other.

1. CONTINUITY WITHOUT ANY CHANGES. According to the first, initial and most demanding interpretation of Continuity Argument, any variations during or subsequent to fertilization is not allowed. This interpretation of the continuity of post-fertilization development is understood as a natural implication of the stance that the genotype is definitely formed at the moment of fertilization and can be found primarily at the proponents of genetical argument (9). However, two standard forms of such an interpretation Continuity Argument have to be distinguished: (i) *genetical Continuity Argument* and (ii) *numerical Continuity Argument*. On the one hand, the notion of genetical continuity means that in the post-fertilization period there are no developmental changes in the genotype, i.e. that there is genetical continuity between embryo and me. On the other hand, it is claimed that there is no numerical discontinuity in the post-fertilization period, that is, that fertilization results with the final formation of a single entity. This means that there is a numerical continuity between the embryo and me. I will briefly register some scientific facts that could call into question such an interpretation of both genetical and numerical continuity.

On the one side, scientific research does not support the conclusion about the lack of genetic changes after fertilization. In spite of a certain terminological indeterminacy concerning the notion of genetic change, such a Continuity Argument, in principle, assumes that genetic make-up is something static and constant from the moment of fertilization that crucially determines all further prenatal and postnatal development. Scientists stress a certain overemphasizing of the role of genetics in directing the course of events after fertilization. The dependence on the fidelity of a new genotype formed at fertilization throughout all subsequent development is limited. Scientific research suggests that differentiation is a dynamic process and that the environment contributes to subtle continuous changes throughout a whole lifetime. The genotype of any individual may not be that which is formed at fertilization. Environment is a potential force in the course of development both pre-natally and post-natally. Successful completion of fertilization in no way assures development through to birth or even the commencement of embryo development (10).

On the other side, scientists have generally dismissed the numerical Continuity Argument based on the equation: 1 egg + 1 sperm = 1 embryo = 1 individual. The formation of a single zygote or early embryo in the fertilization may be the forerunner of the development of multiple identical individuals. It is not necessary that an early embryo marks the beginning of a human entity that is numerically continuous throughout all subsequent development. For instance, identical twins arise from a

single embryo that splits around 14 days in about one out of every 270 pregnancies coming to term. It is worth noticing that it has been estimated that a significant proportion of identical twins are lost either through spontaneous abortion, or the loss of one foetus which results in singleton development and birth. Consequently, scientists suggest that the twinning is not a rare phenomenon at all that can be interpreted as a kind of deformation in post-fertilization period. Early embryonic cells are totipotent what means that an early human embryo has the potential to become one or more different individuals (11). There is also an opposite phenomenon when two eggs are fertilized, two embryos (or zygotes) and two genetic codes exist, but around the 6th day two embryos combine forming a chimera and continue to develop as a single organism.

In short, in spite of fact that these scientific comments have been only sketched here, it seems that there are serious scientific challenges to the viewpoint or even the myth of genetic determinism and numerical continuity.

2. CONTINUITY WITHOUT CRUCIAL DEVELOPMENTAL DISCONTINUITIES.

According to the second interpretation, the theses about continuity allow certain developmental changes, but not a crucial discontinuity or “transformation” in development to which we can ascribe the attribute of marker event (12). In spite of the lack of a precise meaning of “discontinuity” or what it has to be seen as a discontinuity or developmental transformation, it can be concluded, that, as well as the first interpretation, scientific research does not unambiguously support this interpretation.

At the beginning, it has to be stressed that fertilization may not necessarily result with the formation of embryo. Namely, in the case of dispermy, in spite of fertilization, the embryo is not formed. Also, it is worthwhile noting that for up to 78% of human fertilizations the endpoint is loss rather than progression to the next developmental stage (13). The fact is that any other event or process after fertilization taken by theoreticians as a marker event has a better statistics of further development. These scientific findings absolutely do not prove that fertilization is not marker event, but in the light of these facts, the claim about fertilization as the crucial and unique discontinuity event in development of a human being probably loses some initial intuitive strength.

Furthermore, there are no convincing scientific and ethical arguments from the proponents of fertilization approach against the possibilities that some other events or processes could be taken as the crucial developmental transformations. For instance, at least two processes in the post-fertilization development are proposed by scientists as the processes that mark some important transformation in the development of a human being: (i) segmentation and (ii) the formation of a functioning cortex.

Segmentation may be considered as the splitting of the embryo to form multiple identical individuals, or the recombining of twins or triplets to form a single individual. Twinning and chimera formation are complete at about 13 or 14 days after fertilization, in the case of in vivo development, when the primitive streak begins to form in the embryonic disc. Many philosophers defend the stance that segmentation is the determinant of moral status or marker event because at the completion of this stage

there is no longer any possibility of segmentation occurring and the single being becomes twins, triplets, etc (14). Some others do not hold that segmentation is the determinant of moral status or the beginning of an individual life with full moral status, but argue in favour of segmentation as a beginning of particular human life (15). Also, some committees' reports about human (pre-)embryo experimentation have recommended that research using in vitro human prelates should not be permitted beyond 14 days after fertilization (16). Such stances coincide with segmentation as the crucial discontinuity moment in the post-fertilization period. In any case, the approach that defends the moderate kind of continuity after fertilization overlooks the possibility that either twinning or recombination may occur in the normal course of events, disrupting the continuum of development and marking the important discontinuity event. It has to be noticed that I will not here discuss the question whether segmentation is beginning of a particular or individual life or it is not. I only want to stress that the process of segmentation is in various scientific and philosophical contexts recognized as an important discontinuity in developmental process.

The second event or process that could deserve a special status in the post-fertilization period is the formation of a functioning cortex. The starting crude scientific fact is that the existence of a large multiply connected cerebral cortex distinguishes human beings both structurally and functionally from other forms of life. Some scientists have made a further, perhaps more metaphysical step, recommending the stance to philosophers that, therefore, our species acquire humanness when the enlarged cortex has developed, and that the individual human foetus becomes a person with the rights of an adult when the cortex begins to function (17). However, such a metaphysical claim is beyond this kind of debate. My aim here is only to stress the fact that scientists find that this change in post-fertilization development is important discontinuity. Namely, science teaches us that up to the end of the second trimester (or 24th week) of pregnancy, nerve cells accumulate in the brain and differentiate, but until that time a significant number of connections between those cells are not formed. A pile of nerve cells is not a functioning cortex. It becomes a functioning cortex when the system is "wired up" by synaptic connections, and this process starts at around twenty-four weeks of gestation and continues into childhood. Before the wiring up of the cortex, the foetus is simply incapable of feeling anything, including pain. The signals may be sent by the nerves earlier, but there is nothing to receive them. Once the synapses start forming, however, this sort of categorical statement can no longer be made. Undoubtedly, regardless of the question of personhood, such an event that marks the beginning of feeling, or "wiring up" of the cortex, has to be a prime candidate for the nomination of the discontinuity event in the development of a human being.

It is worthwhile to stress once more that in this case as well as in the previous of segmentation, I do not argue in favour of any positions, but I only try to stress that such events or processes, according to scientists, marks the important discontinuities in the development. Therefore, the proponents of the second interpretation should take into account that there are significant scientific recommendations that in the post-fertilization process there are crucial discontinuity events or processes and important developmental transformations.

3. CONTINUITY AS A GRADUAL PROCESS. According to the third and less demanding interpretation, the notion of continuity means that post-fertilization is a certain gradual process, that is, that we are incapable of identifying one single moment as a marker event. This third interpretation is the most usual interpretation of the Continuity Argument. In contrast to the previous interpretations, it has to be noticed that this interpretation is generally accepted both by scientists and by the majority of philosophers from Aristotle and Thomas Aquinas until today. Scientists have strong reasons to believe that all biology is a matter of gradual change. Consequently, the development of a human being is also gradual. Such a widespread consensual viewpoint implies that in the post-fertilization development there is no one single identifiable moment to which we could attribute the mark of marker event. However, we will try to show that from this generally acceptable formulation of Continuity Argument does not follow that the fertilization - the beginning of the continuous process - is neither necessary nor the most reasonable marker event. It could be argued that there are other morally relevant reasons for the nomination of fertilization as a marker event. We hope we will show here only that from this most convincing interpretation of Continuity Argument does not follow that fertilization has to be ascribed with such a nomination.

II

Sorites series and the problem of the arbitrary precisification

At the beginning, let us consider in a more detailed manner why, from the thesis about the continuity of post-fertilization development, it follows that we cannot isolate one single moment as actually being a discontinuity event. It can be useful to recall here the ancient notion of continuum. For instance, according to Aristotle, continuum is a kind of coherence where coherence is defined as that which touches when it is in sequence. Continuum is a species of coherence, such as that both terms by which it is contained are one and the same, and, as its name signifies, they are contained; but this cannot be when there are two terms. Commenting on this passage of Aristotle, Thomas Aquinas says: “For when the ends of two things which touch are made one the same, that is said to be a continuum. Continuum is derived from contained (continendum). When therefore many parts are contained in one, that is, hold together as it were at the same time, then there is continuum. (...) From this it follows further that there cannot be continuation except in those things, from which a unity is made naturally by contact.” (18) According to this interpretation of continuity, the requirement for the identification of one single moment as a certain borderline even contradicts the notion of continuous process as unity or wholeness.

There is also a certain weaker position according to which in continuous processes any demarcation is arbitrary. Namely, it has to be noticed that in various areas where we deal with the continuous processes or scales - in biology as well as in any other domain- we deal with the sorites series. The requirement to identify a single moment in

sorites sequence leads to the sorites paradoxes (19) or to “the problem of arbitrary precisification” (20). Sorites paradoxes seem to have been introduced by the logician Eubulides of Miletus, a contemporary of Aristotle. The most famous puzzles are Bald Mann (i.e. the original Falakros) and Heap (i.e. originally Sorites). In antiquity they were usually formulated as series of questions.

Let us see the Heap: Does one grain of wheat make a heap? Do two grains of wheat make a heap? Do three grains of wheat make a heap? Etc. Do ten thousand grains of wheat make a heap? If someone admits that one grain does not make a heap, and are unwilling to make a fuss about the addition of any single grain, he is eventually forced to admit that ten thousand grains do not make a heap. Namely, when someone at first denies that one grain makes a heap – which is the only reasonable answer - he should later decide between two equally unacceptable answers: that one grain makes a heap from a non-heap at some arbitrary point, or to deny that ten thousand grains make a heap (21). As well as in the case of the heap, the non-arbitrary identification of one single point as a marker event is not possible in many other cases of continuous or gradual processes: for instance, in the cases of tallness, baldness, strong wind, a mountain, a city, the open sea, when an orange colour in a spectrum becomes red, etc. The non-arbitrary isolation of the centimetre at which someone becomes tall or the hair when someone becomes bald seems to be hopeless.

Similarly, if we assume with the majority of scientists that post-fertilisation is a continuous process, that is, a certain sorites sequence, the isolation of any moment as a marker event would be arbitrary and it would lead us to the sorites paradox. Since, we are not principally able to make a non-arbitrary precisification of a crucial moment, we cannot isolate a single moment both in prenatal and postnatal development as a marker event as well as we cannot find out the moment that determines when childhood finishes and puberty begins, when adolescence or maturity begins, etc (22). It can be objected here that such an analogy between the cases of baldness or heap and the issues about the beginning of the life of a person is ungrounded for two reasons: 1.) the paradox is restricted only to quantitative processes like baldness, tallness or the like, but not qualitative like post-fertilization development; 2.) there is a great difference between baldness and personhood in terms of moral importance.

However, it seems to us that the paradox is not restricted exclusively to quantitative processes. Any continuous process, “including those that refer to qualities such as loudness or to stages of temporal development, are susceptible to the sorites paradox” (23). For instance, let us see how L.F. Kerckhove and S.Waller illustrate the applicability of the sorites paradox to one qualitative process:

- “1. An egg cooked for one second is not a hard boiled egg.
2. Cooking the egg one second longer will not affect its doneness.
3. Therefore, an egg cooked for two seconds will not be hard boiled.
4. Repeat steps (2)-(3).” (24)

Consequently, any continuous or gradual biological process presents sorites series like baldness, tallness but also loudness, red-orange continuum of colour patches, temporal development, etc.

Secondly, we are deeply aware of the difference in moral importance between the debate about baldness and post-fertilization development, but we are here limited to no other analogy except in the aspect of continuity. More precisely, while the applicability of possible solutions of sorites paradox in the case of personhood could be an object of moral concern, it seems that the mere identification of the analogy between the different cases of continuous processes cannot (25). The problem of moral evaluation will be actualised later with a proposal we will offer.

Consequently, for the sake of our present debate, we hold that the following reasoning is legitimate:

In the continuous processes or in the sorites series it is not possible to non-arbitrarily isolate any single moment as a marker event.

Post-fertilization development is continuous process.

Therefore, in the post-fertilization process it is not possible to non-arbitrarily isolate any single moment as the marker event (26).

Our question will be now whether we should, therefore, with the proponents of Continuity Argument, nominate fertilization - the beginning of the continuous developmental process - as the marker event.

Non-sequitur

Should we conclude with the advocates of the Continuity Argument that fertilization is necessary marker event because in the continuous process such as prenatal and postnatal development the non-arbitrary precisification of one single moment is impossible? It seems to us that Continuity Argument failed to support the fertilization approach. More precisely, from the fact of the continuous post-fertilization process it does not follow that fertilization itself must be the marker event.

1. SORITES PARADOX. When someone claims the Continuity Argument, or from the continuous nature of post-fertilization development derives a conclusion that fertilization – the very beginning of this continuous process - has to be the marker event, they fall into a certain absurd conclusion or in the sorites paradox. L.F. Kerckhove & S. Waller construed the following argument, which illustrates the applicability of the sorites paradox in the case of a person:

“ 1. X is a person at age T, where T is twenty-one years old.

2.If X is a person at age T, then X is person at T-1 second.

3.Therefore, X is a person at T-1.

4.Repeat steps (2)- (3).

Using iterated modus ponens, we can eventually slide from the intuitively plausible claim that a twenty-one year old human being is a person to the much stronger claim that a newly fertilized ovum is a person.” (27)

To nominate fertilization as the marker event would be absurd, like claiming that someone becomes bald with the first hair he loses because we cannot isolate one single moment or a hair when the baldness starts. In spite of the impossibility that we non-arbitrarily isolate a moment when someone becomes bald, nobody can seriously claim

that a person becomes bald with the first hair he loses. Similarly, to derive a claim about fertilization as a marker event from the fact of continuity is like deriving that the first grain makes a heap, that adolescence begins at conception or that the first drop makes an ocean. In short, the inference according to which from the fact of continuous process follows that the beginning of a process is the marker event, presents a clear case of deficient and unacceptable inference.

2. CONTINUITY DOES NOT IMPLY IDENTITY. It seems that the proponents of Continuity Argument assume that if we have a person at some point in the continuous process, due to continuity, we have to have a person also at the beginning of this process. Let us consider such reasoning in a bit different way. What we know is that twenty-one year old (perfectly physically and mentally healthy) Mary is undoubtedly a person. There is no single participant in the discussion about personhood who would say that twenty-one year old Mary is not a person. Probably, when Mary was ten years old, she was a person as well. Perhaps she was a person in her seventh year. Whatever we decide, twenty-one year old Mary is an adult with all the rights of a person. Mary, who is twenty-one years old, is physically continuous from the egg that was fertilized more than twenty-one years ago, and from which she developed. However, it does not follow that she became a person when the egg was fertilized. The mere physical continuity does not imply necessary identity. For instance, Robert Lane who argues that physical continuity does not imply even a numerical identity, wrote:

“(...) an early-term PBH (pre-born-human) is not sufficiently similar, either anatomically, physiologically, or psychologically, to the late term PBH, infant, or adult with which it is physically continuous, to be one and the same thing as any of them.”

(28)

Accordingly, it could be justifiable to say that in spite of the physical continuity of process, things could be of one kind at some point in development and another at the beginning because they can change their identity during this developmental process. The continuity of process does not necessarily imply identity during the whole process. Someone can hold that a person who is named Mary began to live from conception for some other reasons. However, a mere physical continuity is surely not the reason to give that we say that a twenty-one year old person was necessarily a person also at the moment of fertilization.

In short, from the facts that a twenty-one year old human being is a person and that the process from fertilization to being a twenty-one year old person is continuous, to derive that fertilization is the moment when this person began to exist – is an obvious non sequitur. The continuous process can be conceived as the process of gradual change during which - in spite of the impossibility identifying any single moment as a marker event - something that is not a person could become a person (as well as during other sorites series a non-bald person becomes bald, orange colour becomes red, etc.). It can be perfectly justified to say that, in spite of the continuity of prenatal and postnatal development, Mary over time gradually became a person from a non-person.

Fertilisation as the most reasonable marker event

However, it can be objected that such an interpretation of Continuity Argument – that continuity necessary implies that fertilization is the marker event – is a certain argument of a straw man. Namely, it could be said that in Continuity Argument it is only assumed that it is **most reasonably** to take fertilization as a marker event.

The two lines of argumentation in favour of such reasoning could be offered.

1. Since there is an impossibility to identify non-arbitrarily one single moment as a marker event, it would be the most reasonable in terms of moral concerns to nominate the fertilisation as a marker event. Namely, in the situation when the marker event is principally unattainable, attributing fertilization as the marker event we could prevent possible murders (29).

2. If we do not nominate fertilization, due to the continuity of the developmental process, it would be impossible to determine any marker event as a basis of moral and legal regulation. Namely, fertilization is the only salient event or the only clearly identifiable event in the developmental process. So, since moral and legal purposes impose on us the need for some event that can be nominated as a marker event, fertilization is not only a suitable marker event, but also – due to continuity - the only possible such event (30).

Let us notice that such reasoning would be justified only under two stronger interpretations of continuity that reject the existence of developmental changes, or at least the existence of crucial changes in the post-fertilization development. If there are no changes, or no crucial changes, any marker event in the post-fertilization period would be unreachable. However, under the third interpretation according to which continuous post-fertilization development is the process of gradual changes, such an argumentation loses its basis. If we are right, under the assumption that the developmental process is a process of gradual changes, fertilization is not the most reasonable marker event.

In the sorites series, from the fact that we cannot identify non-arbitrarily one single point as a demarcation line it does not follow that we cannot know that a person **somewhere during** the process of losing hair becomes bald, or that we cannot know that the life of a person begins **somewhere during** this continuous process. Namely, in spite of the fact that we cannot isolate one single moment, we can isolate the **zone** or **area** where the crucial change happens.

Let me elaborate this stance in more detail. Some scientists claim that we can be perfectly sure that a person begins to live with a functioning cortex, and at the same time that it is impossible to isolate one single moment as the moment when the cortex becomes “wired up”. For instance, H.J. Morowitz and J.S. Trefil claim that (i) the individual human fetus becomes a person with rights when the cortex begins to function; (ii) the cortex becomes functioning when the system is “wired up” by synaptic connections; (iii) this process starts at **around** twenty-four weeks of gestation (31). Such an example illustrates clearly that the continuity - the stance about the

impossibility to isolate non-arbitrarily one single moment as a marker event - does not imply the stance that we don't know when a person begins to live, or what are the features that make a person. In other words, the thesis that it is not possible to identify a non-arbitrary demarcation line as a marker event could be perfectly compatible with the stance that, for instance, there is some **zone** or **area** of the cortex formation (or segmentation, or some other) that can be the determinant of moral status.

In the general philosophical debate about sorites paradoxes, a certain solution that supports previous reasoning about the possibility to determine an area as the marker process has been already offered as certain pragmatical strategies that treat sorites-infected paradoxes (32). In spite of the fact that we cannot say exactly at which point someone becomes tall, bald, when the door is open or when an egg is hard boiled, we can perfectly distinguish a tall person from a small one, a bald person from one who is not bald, when a door is open or when an egg is hard boiled and when is not. In other words, in the sorites series the existence of change from a non-bald person to bald, from a non-heap to heap, from an orange colour in red, non-person to person is unquestionable. This suggests that, in spite of the impossibility to non-arbitrarily isolate a precise one single moment as a marker point, it could be possible to define a **relevant sequence** or simply a **grey area** in which the crucial change happens.

For instance, in spite of the fact that we cannot isolate the centimetre when a person becomes tall, all semantically competent speakers (who understand the notion "tall" and who know how to use this notion) agree that a person of 160 cm is not tall while a person of 190 cm is tall. Terrence Horgan's proposal of relevant sequence can be applied here as a sort of pragmatical solution of the sorites paradoxes because it can provide us with a workable solution concerning the determination of a marker area in the continuous processes (33). Precisely, when scientists and moral philosophers would agree about the features that make a person, there will not be any principal obstacles to the isolation of a relevant sequence, or grey area, to which they can attribute a nomination of marker area (34). The line can be simply drawn in the general area of the appearance of the morally relevant feature. For instance, let us imagine that scientists and philosophers make a consensus that the segmentation is a morally relevant developmental change. As well, as we say that after 190 centimetres a person is tall, we could say that after the day 14, any scientific intervention or research on embryos is forbidden. Neither the 190 centimetres, nor day 14 is an arbitrary line, but the end of the sequence after which the uncertainty disappears. Namely, in the case of segmentation, the grey area finishes for sure at day 14 in in vivo development (and even later in vitro development) when the appearance of the primitive streak precludes the embryo becoming two or more different individuals. Therefore, if the scientists and moral philosophers would agree that segmentation (or the formation of a functioning cortex or some other event) is a morally relevant change in development, the fact about the continuity of developmental process would not be an obstacle to determine one of these processes as a marker area. The line that could be drawn at the end (or in the case of the cortex functioning, at the beginning) of a general or grey area would be also completely reasonable and a non-arbitrary line.

Morally malign and benign arbitrariness

Someone can now reasonably object that our proposal failed and that we have not escaped from the arbitrariness because the lines that determine the beginning or the end of grey areas must be also arbitrary. For instance, we chose the 160 cm and 190 cm as the borderlines of the grey area in which someone becomes tall. Someone could, quite intelligibly, ask why not 159 cm and 188 cm? Moreover, we could have been, and probably should have been more precise and chose the sequence from 170cm-186cm. In the light of such reasoning, a kind of arbitrariness in our proposal is inevitable. However, it seems to me that, in contrast to the malign arbitrariness that characterize sorites paradoxes, such arbitrariness is of the morally benign kind. In our example, it can be taken as granted in the highest possible degree that nobody under 160 cm is tall and anybody over 190 cm is not tall. Such arbitrariness is benign in the comparison of pointing, for instance, 184 cm as the demarcation line when someone becomes tall. There is no reason why 183cm or 186 cm instead of 184 cm are not chosen as demarcation lines. Namely, we cannot conceive or imagine any explanatory basis that would single out some unique candidate over against its competitors. It is definitely much more accurate to say that someone becomes tall in the sequence from 160-190 cm, than at 184 cm. The pragmatic solutions, as well as this way of thinking about benign arbitrariness, is far more appropriate in bioethical discussions where indifference about hypothetical solutions is intolerable and where moral deliberation in each particular case would minimize the possibility of mistakes.

Similarly, under the assumption that the segmentation is the morally relevant developmental change, day 14 can be chosen as the end of the relevant period after which (in the case of in vivo development) there is no any possibility for twinning or chimera formation because the primitive streak definitely begins to form in the embryonic disc. It should be stressed here that the dynamics of in vitro and in vivo development are not identical. The development of the in vitro embryo up until about 7 days after fertilization is roughly equivalent to that in vivo. Beyond this, however, there is no equivalence in development; no primitive streak will be formed in vitro embryos at the stage of 14 days (35). Since in vitro development is much slower than in vivo, such a line is definitely the most secure line before which, for instance, embryo experimentation can be accomplished without any fear that the primitive streak can be formed. Day 14 as the line before which embryo experimentation can be performed is arbitrary in a morally very benign sense, because it, in the highest degree, excludes the possibility that we make a mistake concerning the formation of the primitive streak (and, under the assumption that segmentation is the marker process, to kill a person).

It has to be emphasized at the end that the final decision about whether fertilization or the segmentation or formation of a cortex or some other process has to be determinant of moral status is the question of further scientific research and moral appraisal of scientific facts about these processes. I have only tried to prove that Continuity

Argument failed, that is, that from the more detailed analysis of the notion of continuity it does not follow that that fertilization is both necessary and the most reasonable marker event. Consequently, contrary to the Continuity Argument on which the fertilization approach is based, it can be argued that the post-fertilization process is continuous and gradual, and that fertilization is not the determinant of moral status. In other words, it is possible to accept scientifically and philosophically convincing ideas about the continuity of developmental process, and at the same time to claim that scientific practice of embryo experimentation and research are morally justified.

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Notes

- (1) I will rely here on the several influential documents in which it is assumed the day 14 as a borderline. See, Committee to Consider the Social, Ethical and Legal Issues Arising from In Vitro Fertilization. Report on the Disposition of Embryos Produced by In Vitro Fertilization, (Prof. Louis Waller, chairman). Melbourne: Victorian Government Printer; 1984. para. 3.29.; Report of the Committee of Inquiry into Human Fertilization and Embryology (Mary Warnock, chair). London: HMSO; 1984. para. 11.19-11.22.
- (2) It should be noted here that while such a discussion assumes that moral status of some medical practices depends on the questions of personhood or on the determination of the time, event or process when a full moral status is acquired, there is also an alternative approach. Namely, some authors claim that the determination of marker events or discussion about the status of embryo (or fetus) is not relevant for the moral judgement of these practices. Arguments in favor of this alternative viewpoint can be found on both sides of the debate. For instance, J. J. Thomson claims that abortion could be permissible even if fetus is a person, while D. Marquis holds that abortion would be impermissible even if fetus is not a person. It could be possible to see a promising alternative with R. Dworkin in stance that moral judgements should be based instead on the question of the intrinsic value of life or with L.F. Kerchove & S. Waller in the debate about balancing interest. See J. J. Thomson, 1971; D. Marquis,

1994; R. M. Dworkin, 1993; L. F. Kerchove & S. Waller, 1998. It is however far beyond our purposes to compare these general approaches. We will limit our debate exclusively on the still predominant issue about the marker event.

(3) See, for instance, T. J. Noonan 1970; M. A. Warren 1973; M. Tooley 1983; H. J. Morowitz & J. S. Trefil 1992.

(4) See, for instance, John Paul II 1995; J. Finnis 1973; T. J. Noonan 1970.

(5) R. G. Harison 1978; S. Buckle, K. Dawson, P. Singer 1993.

(6) A number of philosophers, on both sides, think that it is wrong to destroy such an individual life – not (or not only) because of what it currently is – but because of what it has a potential to become. However, this interesting, relevant and extremely important discussion about the potentiality argument is beyond our present interest.

(7) See in K. Dawson, 1993.

(8) G. C. Grisez, 1970; W. Quinn, 1970; T. J. Noonan, 1970; T. Iglesias, 1984.

(9) R. Werner, 1974; R. Wertheimer, 1971; B. Brody, 1978; J. Santamaria, 1982.

(10) K. Dawson, 1993.

(11) H. Kuhse & P. Singer, 1993.

(12) T. J. Noonan, 1991.

(13) C. J. Roberts & C.R. Lowe, 1975.

(14) P. Ramsey, 1970; C.E. Curran, 1978.

(15) H. Kuhse & P. Singer, 1993.

(16) Committee to Consider the Social, Ethical and Legal Issue Arising from In Vitro Fertilization. Report on the Disposition of Embryos Produced by In Vitro Fertilization. Report on the Disposition of Embryos Produced by In Vitro Fertilization, (Prof. Louis Waller, chairman). Melbourne: Victorian Government Printer; 1984. para. 3.29.; Report of the Committee of Inquiry into Human Fertilization and Embryology, (Mary Warnock, chair). London: HMSO; 1984. para. 11.19-11.22.

(17) H.J. Morowitz & J.S. Trefil, 1992.

(18) See in R. McKeon, (ed.), 1930, pp. 439-440.

(19) See, for instance, in R.A. Sorensen, 1988; T. Williamson, 1993; L.F. Kerchove and S. Waller, 1998. K. Ludwig and G. Ray, 2002.

(20) See in T. Horgan, 1997.

(21) Sorites paradoxes can be presented also as argument with premises and conclusions. Let us see the puzzle Bald man:

Premise 1: The loss of one hair is too few to nominate a man as bald.

Premise 2: If 1 is few then 2 are few.

Premise 3: If 2 are few then 3 are few.

Etc.

Premise 200 000: If 199 999 are few then 200 000 are few.

Conclusion: The loss of 200 000 hairs is too few to nominate a man as bald.

See in T. Williamson, 1993, p. 39.

(22) According to L.F. Kerckhove and S. Waller, a connection between the debate about personhood and the sorites paradox has been recognized by R. A. Sorensen and R. Shafer Landau. See, L.F. Kerckhove & S. Waller, 1998.

(23) L.F. Kerckhove & S. Waller, 1998, pp. 179-80.

(24) Ibid., p. 180.

(25) For instance, according to certain epistemic solutions to the sorites paradox (R. Sorensen, T. Williamson), boundaries exist out in the mind-independent world, but they are unknown to us. While such a principal ignorance of a demarcation line can be an acceptable solution in the case of baldness, the same indifference about our ignorance is unacceptable when we have to make a moral decision about embryo experimentation or abortion. See R. A. Sorensen, 1984; T. Williamson, 1994.

(26) It is worth noticing that one of the most important philosophical dilemmas concerning this issue is whether (i) we are incapable of identifying one such single point although it really exists, or (ii) we are incapable to nominate non-arbitrarily one single point as a borderline because it does not exist (it is assumed the ontological view according to which the world itself is a fuzzy place). The majority of philosophers who write on vagueness and sorites paradox take it to be a kind of semantic phenomenon. However, the debate about these issues is out of our present task. We will assume what is commonsense view or at least what is evident – that we are incapable non arbitrarily identifying one single point in the continuous process, not considering the possible hypothesis about the ontological, epistemic or semantic reasons for such incapacity.

(27) L.F. Kerckhove & S. Waller, 1998, p. 181.

(28) R. Lane, 2003, p. 69.

(29) John Paul II, 1995.

(30) See in S. Buckle, 1993.

(31) H.J. Morowitz & J.S. Trefil, 1992.

(32) See, for instance, D. Raffman, 1994; R. Manor, 1997.

(33) Concerning the problem of the vagueness, T. Horgan defends a position of transvaluationism. According to him, there are two fundamental claims of transvaluationism: (i) The Incoherence Thesis – vagueness is logically incoherent in a certain way; (ii) The Legitimacy Thesis – vagueness is viable and legitimate nonetheless, even an essential aspect of human thought and speech. He favours the idea of contextual and psychologistic semantics in which operational standards may vary according to the internal (similarly to D. Raffman) and external circumstances at hand (similarly to R. Manor). This means that epistemological and ontological commitments are to be kept as strict as possible, but never add up to ultimate, reductive, absolute or universal ones. Finally, he argues that when we force through a sorites series, the discourse ultimately gets regimented around a “collettivistic” pole (to be compared with Raffman’s pairwise constraint). See in T. Horgan, 1994, 1997, 1998. See also in B. Van Kerckhove, 2000.

(34) Let us notice that in the post-fertilization developmental process, in contrast to other sorites series, there are disagreements about the features that make a person (possession of human DNA, unique genetic code, viability, functioning cortex, consciousness, rationality, etc.). For instance, while it is clear what features make an egg hard boiled or what features characterize puberty, there is no consensus about the properties which define a person. However, when scientists and philosophers would agree what properties define a person, a fact that a developmental process is

continuous would not prevent us from defining a relevant sequence. On the other hand, it is possible to say that it is not possible in principle to define the features that make a person. However, in such a case, the very fact of continuity will not be a reason why we cannot identify a marker event, what it is claimed by Continuity Argument.

(35) R.G. Edwards, 1986.