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On Clone as Genetic Copy: Critique of a Metaphor

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Abstract A common feature of scientific and ethical debates is that clones are generally described and understood as "copies" or, more specifically defined, as "genetic copies." The attempt of this paper is to question this widespread definition. It first argues that the terminology of "clone as copy" can only be understood as a metaphor, and therefore, a clone is not a "genetic copy" in a strict literal sense, but in a figurative one. Second, the copy metaphor has a normative component that is problematic in the context of descriptive science and may support or indicate the ethically relevant phenomenon of objectification of animals. In order to support the argument against the common conception of a clone as a copy, the biotechnological principles of somatic cell nuclear transfer (SCNT) cloning will be examined. On this basis, it will be shown that the metaphor is valid because of similarities between the phenotype, the genotype, or the nuclear DNA sequence of the clone and its progenitor by using three prominent levels of comparison (clone as phenotypical, genotypical, and nuclear copy). Focusing on the process of SCNT, it will be shown that cloning as copying or doubling has to be redefined for scientific purposes because it is neither necessary nor does it fit to the biotechnological principles of cloning. It is more accurate to understand SCNT cloning as a process of splitting rather than of doubling or copying. In the second part, a deconstructivist analysis based on Jacques Derrida's description in *Positions* (1981) will reveal the normative potential of the original–copy dichotomy. I will be showing that it includes an asymmetrical power structure between the original (progenitor) and the copy (clone) and that this structure can be reversed or at least considered unstable. Therefore, arguments that build on that metaphor must be reconsidered. Moreover, the analysis reveals that applying a terminology to humans and animals that is commonly used for things becomes the language of objectification. Two selected examples, fungibility and violability, based on Martha Nussbaum's notion of objectification will support the thesis of objectification, display its normative consequences, and put the clone as a copy metaphor in a broader range of ethically questionable research tendencies.

Keywords Animal ethics · Clone · Deconstruction · Human animal studies · Metaphor · Objectification · Somatic cell nuclear transfer (SCNT)

Introduction

February 14th, 2013 was the 10th anniversary of the death of Dolly the sheep. She was the first mammal that was cloned out of an adult body cell by somatic cell nuclear transfer (SCNT) [75].[1] At the time, the public

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[1] If not otherwise stated, I will refer to cloning as SCNT with adult cells.

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and academic debate triggered by the birth of Dolly mainly focused on questions concerning the technological possibility and ethical permissibility of cloning humans (e.g., McGee [56]). Since the official risk assessments by the *US Food and Drug Administration* (FDA) [71] and the *European Food and Safety Authority* (EFSA) [32], the question of food quality and the safety of products from cloned animals and their offspring have been dominating the cloning debate. Rather than continue existing discussions about food safety and labeling products from cloned animals and their offspring, this paper instead steps back to reconsidering the ontological status of a clone and its relation to its origin. Proper definition and understanding of a clone and the performance and limits of cloning as biotechnology are important because they form a basic premise for applications and ethical investigations concerning human and nonhuman animals.

A common feature of scientific and ethical debates is that clones are generally described and understood as "copies" or more specifically as "genetic copies." In a report on cloning human beings, the *National Bioethics Advisory Commission* (NBAC) defined "clone" as follows: "The word clone is used in many different contexts in biological research but in its most simple and strict sense, it refers to a precise genetic copy of a molecule, cell, plant, animal, or human being" ([57]: 29). Another example, found in the *Stanford Encyclopedia of Philosophy*, states that "Strictly speaking, cloning is the creation of a genetic copy of a sequence of DNA or of the entire genome of an organism" [27].[2]

Besides common images of clones presented in science fiction (see below), both authors use the word "strict" to emphasize what a clone really is. Originally, the scientific term clone was coined by biologist Herbert Webber simply to describe asexual reproduction by plants (see [76]: 503). As already noted in the early 1980s, clone has left the scientific discourse and entered common vocabulary in a variety of metaphoric uses (e.g., [45, 46]). Science historian Christina Brandt [12] delineates the shift in the meaning of clone from a technical term to a widespread metaphor during the 1960s and 1970s of the last century. Tracing different dynamic and entangled "layers of time,"[3] Brandt shows how clone unites ancient motives and literary sources such as "doppelganger," artificial creation, actual biotechnological achievements,[4] and the future vision of eugenics of that time. The sovereignty over the semantics of the term clone did not lie with science anymore but with the popular media (see [70]: 21; [45]: 61). Although it should be mentioned that concerning the term clone, the distinction between science and public was not sharp. First of all, John B. S. Haldane's utopian (or dystopian) visions in *Biological Possibilities for the Human Species in the Next 10,000 Years* [43] referred explicitly to cloning humans as it was known from Aldous Huxley's *Brave New World*[5] (1932). Second, Haldane presented his ideas at the Ciba[6] Foundation Symposium *Man and his Future* in London 1962, which, according to Brandt ([11]: 261), had a huge impact on the popular discourse of biotechnological visions. Third, Alvin Toffler's international bestseller *Future Shock* (1970) and *In His Image. The Cloning of a Man* (1978) from scientific journalist Michael Rorvik was based on the scientific concept of cloning. The latter was followed by an article in the journal *Science* [23] that discussed the possibilities of human clones and denied the achievement of the first cloned human being as it was portrayed in the book.

Those examples give an impression of how scientific and public discourses on cloning overlapped and were connected in different ways. Moreover, numerous books, recent films like Michael Bay's *The Island* (2005) and Georg Lucas' *Star Wars*: *The Attack of the Clones* (2002), or the television series *Orphan Black* (2013), created by Graeme Manson and John Fawcett, are possible sources for its negative connotation and its mysterious aura[7]—"[i]n film the dream of cloning is always a nightmare" ([51]: xvii).

[2] Similar definitions can be found by many other authors. Cf. Klotzko ([51]: 20): "She [Dolly] was virtually an exact genetic copy of the 6-year-old sheep that provided the nucleus;" "Animal cloning is intended to produce virtually identical genetic copies of the donor animal to yield identical phenotypes" ([33]: 5). Ian Wilmut, the leader of the group that produced Dolly uses the terms "copy" and "copying" too (e.g., Wilmut qtd. in [50]: 24; see also [51]: 148).

[3] "*Zeitschichten*" after [52].

[4] E.g. successful SCNT experiments with frogs by John B. Gurdon [41] or achievements in in vitro fertilization.

[5] Although Aldous Huxley's *Brave New World* (1932) counts as a prime example for a technological dystopia in the literature about cloning, the word "clone" is not mentioned there (see [55]: 25). Peter N. Poon states that Huxley used the term "Bokanovsky's Process" as an asexual reproduction technique instead of cloning, because it was already reserved in botany (see [64]: 162).

[6] Today pharmaceutical company *Novartis* Switzerland.

[7] *The Island* describes the misuse of cloning, using the cloned humans as organ farms. In *The Attack of the Clones*, the clones are by default faceless and nameless soldiers. Taking the psychological, sociological, and ethical challenges of human cloning into account, *Orphan Black* tells the story about a group of clones revealing the secret of their origin.

To date, science seems to struggle against these dystopian images and promote their demystification. On the one hand, counter pictures are created, showing Dolly not as a monster in a laboratory, but as a normal sheep in a (family) portrait situation in a natural environment.[8] On the other hand, authors emphasize that cloning (as general phenomena, not understood as SCNT) is in fact a natural reproduction strategy found in plants, invertebrates, and even in mammals in the form of identical twins (e.g., [59]:1ff., [51]: xxif.). As stated above, it is claimed that a clone is nothing more and nothing less than a "genetic copy."[9] But is a clone indeed a genetic copy of its progenitor in a *strict sense*? What exactly is *duplicated* during the nuclear transfer of a somatic cell? Is it possible that certain unintended figurative and even normative aspects of cloning have been established in the scientific world?[10]

Against the widespread definition of a clone as a genetic copy, I aim to show two things: (a) that the terminology of "clone as copy" can only be understood as a metaphor and, therefore, a clone is not a genetic copy in a strict literal sense, but in a figurative one; and (b) the copy metaphor has a normative component that is problematic in the context of descriptive science and may support or indicate the ethically relevant phenomenon of objectification of animals.

(a) According to Aristotle's definition ([4]: 1457b), a metaphor links two unlike things by transference. A metaphor creates a common space—the *tertium comparationis* (Latin for "the third part of the comparison")—where two strange terms meet. For example, the metaphor "table leg" unites two unlike things, a wooden stick and a human leg. A transfer from the latter to the former is possible because they share a similar function (*tertium comparationis*) of basing either a plate or a body. In our case, the validity of the metaphor lies in the clone being a result of SCNT as a phenotypical, genetic, or nuclear image of the cell donor, e.g., the clone looks and behaves in a similar way compared to its origin. But the metaphorical language of copying neglects biotechnological principles of SCNT cloning. Against the common sense conception of cloning, it will be shown that it is more accurate to describe SCNT cloning as a process of splitting than of doubling.

In order to support the argument against the common conception of a clone as a copy, the biotechnological principles of SCNT cloning will be examined. On this basis, it will be shown by using three levels of comparison (clone as phenotypical, genotypical, and nuclear copy) that the metaphor is valid in certain aspects. Focusing on the process of cloning, it will be shown that cloning as copying or doubling has to be redefined for scientific purposes because it is neither necessary nor does it fit the biotechnological principles of cloning.

(b) In the second part, a deconstructivist analysis based on Jacques Derrida's description in *Positions* (1981)[11] will show that the binary opposition original–copy includes an asymmetrical power structure between the original (progenitor) and the copy (clone) and that this structure can be reversed or at least considered unstable. Therefore, arguments that build on that metaphor must be reconsidered. Moreover, the analysis uncovers that the application of a terminology used commonly for things to humans and animals becomes the language of objectification. Understood simply as a metaphor, this would be unproblematic. But two selected examples based on Martha Nussbaum's ([58]: 218) seven notions of objectification will support the thesis of objectification, display its normative consequences, and put the clone as copy metaphor in a broader range of ethically questionable research tendencies.

[8] According to Roman Marek ([55]: 33), this is rather astonishing because Dolly must have been one of the medically best investigated sheep in the world.

[9] It is important to acknowledge that animals cloned by SCNT are not to be confused with genetically modified organisms (GMOs). But Dolly was one step on the way to find a more efficient technique to generate GMOs like the transgenic sheep Polly (see [67] and [10]), and therefore, a strong link between SCNT and the production of GMOs is still given.

[10] The role of metaphors in science has already been investigated in general, e.g., Keller [48], Brown [14], Giles [39], and Pauwels [60] among a large body of scientific literature.

[11] The main reason why it is fruitful to rely on Derrida is his approach of deconstruction. But other connections between Derrida and cloning can be made. The dispute between Jürgen Habermas and Derrida will be continued in a deconstruction of Habermas' argument against reproductive human cloning in the last paragraph. Furthermore, as a critic of all forms of equalization and standardization (see [30]: 18), Derrida seems to be the right proponent for challenging a biotechnology like SCNT cloning, which has been related with standardization, genetic identity, and mass production (see [12]) since its beginnings.

The Concept of Clone as Copy

Biotechnological Principles of SCNT Cloning

The aim of cloning in general is to create an animal that has the same features as an already existing animal. Equality is here understood as a three-digit relation that includes two entities and a *tertium comparationis* (Latin for "the third part of the comparison"). Two entities are identical in a strict sense if they share all features. They are similar or identical in a loose sense if they share some features.[12] Strictly speaking, the relation between a clone and its origin is never a relation of strict identity, but loose identity or likeness.[13]

Currently, reproductive cloning by SCNT has only been established in nonhuman animals. Considering these circumstances, it is surprising that an ethical investigation of animal cloning has been widely neglected (see [35, 51]: xxiv), especially when compared to human cloning, which has been under debate since the birth of Dolly.[14] [15] Reproductive cloning by SCNT has been applied in the fields of livestock breeding, biomedical research, xenotransplantation, species conservation,[16] and pet breeding (see [51], 45ff.). To date, about 15 species have been successfully cloned, including sheep, mouse, cow, pig, mouflon, rabbit, cat, goat, horse, wild cat, deer, dog, swamp buffalo, wolf, and camel (see [16], 18f.).

SCNT cloning mainly consists of five steps (cf. Perry [61]: 28ff.; [59]: 29). The first step to create a clone is to take a cell of the animal to be cloned (cell donor or progenitor). The second step is to extract an oocyte from a female animal of the same species (oocyte donor). The nucleus is removed in both cases. The next step is the transfer of the cell donor's nucleus into the empty oocyte—hence, the name "nuclear transfer." The development of the cell is triggered by a stimulus. The cell starts to divide and grows to a fully developed animal without any human intervention in the surrogate mother.

Given this description, we need to ask: in which way can we now speak of a clone as a copy?

In the context of defining the term clone, I found three prominent levels of comparison which will guide the analysis in the following sections. My analysis refers to a clone as a phenotypical ("Clone as a Phenotypical Copy"), genetic ("Clone as a Genetic Copy"), and nuclear copy ("Clone as a Nuclear Copy"). All levels have in common that they make use of the terminology of clone as copy. The first one refers to the physical appearance of the clone. The phenotypical similarities between the clone and its progenitor are the main source for literature and science fiction. As the phenotype can differ between the clone and its progenitor for various reasons (cf. "Clone as a Genetic Copy"), scientists prefer to define a clone on a genetic level. As mentioned in the "Introduction", the definition of a clone as a genetic copy is well grounded in scientific literature. As we will see in "Clone as a Nuclear Copy," for some scientists, this definition is still not accurate enough. They claim that SCNT clones are only copies of a special part of the genetic traits, the nucleus. By analyzing these three levels, it will be asked whether and in which aspects the clone as a copy metaphor is valid.

Clone as a Phenotypical Copy

If the cloning process is successful, the clone looks and behaves like its progenitor. In an ideal case, the clone can be described not only as a replication of the cell donor but also as a phenotypical copy. The phenotype is defined as the expression of certain physical and psychological features of an organism—such as shape, height, weight, or behavior—that are determined by the genotype.[17] When only looking at the appearance of an organism, it is obvious why the term "copy" is used to describe the clone

[12] Donald L. M. Baxter ([7]) discusses Joseph Butler's distinction between identity in a loose and in a strict sense.

[13] Cloning raises questions about phenotypical, genotypical, and also personal identity. In this article, the first two will be addressed only.

[14] Some exceptions should be mentioned here. Fiester [35] focuses on consequent-based and deontological ethical concerns of animal cloning. The expert's report by the Danish Centre for Bioethics and Risk Assessment ([24]) is of interest as it does not only include a sentientist welfare perspective but is also referring to the integrity of cloned farm animals (for details on the integrity concept, see [65]). Camenzind [16] considers anthropocentric and sentientist approaches as well as the non-sentientist Swiss concept of animal's dignity, stated in the Swiss Constitution (for explanation of animal's dignity, see [6]; [17]).

[15] Because of this neglect, I will refer to animal cloning whenever possible, especially in the last part of the paper.

[16] A sociological study on cloning of endangered animals can be found in Friese [37].

[17] A deeper discussion about the fundamental concepts of genome, genotype, and phenotype is provided by Mahner and Kary [54].

regarding reproductive cloning. The term copy originates from medieval Latin "copia," which means "transcription," "authentic copy," or "replication." On this phenotypical level, the terms "image" and copy seem appropriate to describe the clone resulting from this procedure. When Habermas ([42]: 163) notes "[t]here is a rational kernel to the archaic revulsion provoked by the vision of cloned human replicas [orig.: *Ebenbildern*]," he works with the same semantic field.

Clone as a Genetic Copy

Although successful SCNT cloning experiments with mammals date back to the 1980s (e.g., [74], using embryonic cells) and the achievements of various species cloned out of adult cells after the breakthrough with Dolly, positive results are the exception rather than the rule. The overall efficiency of the technique is still low, and cloning as a reproductive method is still considered risky and uncertain (see [69, 16], 18ff.; [73]). Undesirable effects concerning the welfare of the clones, such as large offspring syndrome (LOS), abnormal physiology, respiratory problems, immune system deficiencies, and stillbirth are to be expected (see [72]: 216ff.). Therefore, it is very likely that the clone will not be an authentic phenotypical copy. Although the clone is not a perfect "phenotypical copy," SCNT seems to provide a technique that is sufficient for the purposes of breeders, farmers, animal experimenters, and pet owners.

Besides unintended pre- and perinatal losses, there are other evidences that clones are not authentic copies of their progenitors.[18] In the case of Second Chance, a Brahman bull that was cloned at the Texas A&M University in 1999 (see [77], 166ff.), the decisive difference was the animal's behavior. While Second Chance and his progenitor Chance looked alike and had the same unusual eating manners, Second Chance once hurt his owner seriously. As Chance was described as a very gentle and peaceful animal, his owner Ralph Fisher recognized that despite their similarities, Chance and Second Chance were different animals. Different factors such as incomplete epigenetic reprogramming, spontaneous DNA mutations, incomplete development of certain organs in the embryonic stage (see [31]: 10), as well as different uterine and postnatal environmental influences may all be responsible for the phenotype of clones differing from their cell donors. But a comparison of the progenitor's DNA with the clone's DNA shows that they have the same or at least a very similar sequence. Therefore, the copy metaphor is valid on a genetic level, too. Due to the similarity of the DNA sequences, scientists prefer to speak of a clone only as a genetic copy (cites above) instead of a carbon copy (see [31]: 10).

This definition has already entered common language. In German, for instance, "cloning" is defined as "asexual reproduction of genetically identical copies of living beings" ([28]: 624, my translation).[19]

The definition of a "clone as a genetic copy" is still not precise enough for some scientists. The results of a SCNT study involving 10 sheep showed that "[…] although these ten sheep are authentic nuclear clones, they are in fact genetic chimaeras, containing somatic cell-derived nuclear DNA but oocyte-derived mtDNA" ([34]: 90). Being aware of this difference, Keith Campbell, a scientific colleague of Ian Wilmut, even thinks that "[i]n the strict sense of the meaning, the animals produced by nuclear transfer are not true clones" (Wilmut qtd. in [50]: 10). That is why clones are not described as copies but "genetic mixtures" ([38]: 24) or "genetic chimaeras"[20] ([34]: 90). As SCNT-cloned animals are in most of the cases genetic chimaeras, Houdebine's ([44]: 33) definition of cloning as "the reproduction of a cell and, more generally, of a whole living organism without any modification of its genotype" is too general. In this context, Seidl emphasizes not to overuse the terms clone or cloning, but instead use more specific descriptions ([68]: 215).[21] Sharing this view, some scientists claim that a clone is not a genetic copy of the cell donor, but only a genomic[22] one (e.g., [13]: 116; [78]: 20ff.).

[18] Names of company like "*Lazaron Biotechnologies*," "*Forever Pets*," or "*My friend again*" that provide cloning services suggest that it is possible to reanimate a dead pet through cloning. But this lies beyond the performance of SCNT cloning because genetic identity does not imply personal identity. Further discussion about cloning pets can be found in Bok [9] and Fiester [36].

[19] Orig: "*durch ungeschlechtliche Vermehrung genetisch identische Kopien von Lebewesen herstellen*" ([28]: 624).

[20] The term "chimaera" is also used for the results of interspecies nuclear transfer. These "heteroplasmic" clones possess the nuclear DNA from one species and the mitochondrial DNA from another. The difficulty to categorize these animals into existing classification systems is discussed by Friese ([37]: 23ff.).

[21] This view is also supported by Sarah Franklin who argues that in the case of Dolly "clone" is only used because of the lack of a more accurate term (cf. [38]: 24).

[22] With "genome," Brem and Wolf are referring to the genetic traits in the nucleus (nDNA, see below). I prefer to speak of a nuclear copy, because "genome" is already used for the complete genetic material of an organism.

Clone as a Nuclear Copy

It has been explained above that SCNT cloning involves transferring a nucleus into an enucleated oocyte. This expression was used to explain the principles of SCNT, but it does not refer to the fact that the cell nucleus does not include the entire DNA. The genome, understood as the entire genetic material of an organism, consists of the nuclear DNA (nDNA) and the mitochondrial DNA (mtDNA). While the nDNA is located in the cell nucleus, the mtDNA, which contains about 0.15 % of the entire genome, stays in the mitochondria and therefore outside the nucleus in the cytoplasm. The mtDNA outside the nucleus stems from the oocyte donor. Only if the cell nucleus and the oocyte stem from the same animal (or if the oocyte comes from a close relative with the same mtDNA), we can speak of a complete match of the DNA sequence. In all other cases, the clone's genome is not exactly the same as the cell donor's. The clone only has the same nDNA sequence as its progenitor. They are identical only in this limited sense.

If we reconsider the definition of a clone as a genetic copy or an "exact copy of traits" (cf. [42]: 165), we recognize that the definition is imprecise even on the genetic level, because the clone and its origin differ regarding the mtDNA. Therefore, Brem claims that clone is not a genetic copy, but only a "genomic" or nuclear one.

As we have seen so far, the use of the terms "exact" or "identical copy" on the phenotypical and genetic level is not precise. On the nuclear level, it is true that the clone and its origin have the same DNA sequence, as we will see in "The Process of Cloning by SCNT."[23] If we compare the phenotype and the genotype of the clone and its progenitor, it is still accurate to speak of the clone as a replication or copy of the cell donor because they look alike, even though the clone is not completely identical to its origin. If we only focus on the quantity of genes, it is not accurate anymore to speak of a clone as a "precise genetic copy."

The Process of Cloning by SCNT

So far, the focus has been on the clone on a phenotypical, genotypical, and nuclear level. I will now proceed to the last and main point of the analysis: the process of cloning by SCNT. It will be argued that even on the nuclear level, the clone's nDNA is not literally *a copy* of the cell donor's nDNA. The thesis is that the cloning process as copying or doubling can only be understood as a metaphor because none of the above mentioned involves a process of copying, doubling, or replicating of DNA. On the contrary, it is more accurate to consider cloning a *process of splitting*.

Focusing on the process of the SCNT, it will be clear that the cell donor's nDNA is never replicated, doubled, or copied. By contrast, the cell nucleus is physically extracted from the cell donor and transferred into the enucleated oocyte. The curious thing about cloning is that the result of the cloning process can be described as a copy without any copying process being involved. As a result of this splitting process, the clone develops from the nDNA of a certain cell from the origin. That is why they have the same nDNA sequence.

Furthermore, the relation between the clone and the progenitor is much more complex than the copy metaphor pretends. The difference between cloning and copying will be clearer when using the following fictional analogy: a standard copy machine is used to duplicate a piece of paper. The black letters on the original paper will be duplicated by a technology called "xerography," a technology which uses photography and electrostatics. The result of this process is another sheet of paper with the same black letters. If the attempt is successful, the copy cannot be distinguished from the original.

If it was possible to apply the SCNT cloning process to a piece of paper, it would work in the following way: a piece of the original paper is torn apart. This piece of paper would have the potential to grow to a second paper that cannot be distinguished from the original. The result may be the same in the first case, but the replication process is entirely different. In the first case, the letters are transferred to a foreign material. In the latter, the letters grow out of the separated piece of paper.

The view that cloning is rather a process of splitting than of copying is supported by Herbert J. Webber, who introduced the term clone as a technical term to the scientific community in his article in *Science* in 1903.[24] Emphasizing the advantages of "clon,"[25] "a

[23] Due to the fact that during the first cell division the DNA sequence may change because of spontaneous mutations, the DNA sequence is the same at least at the moment after the transfer before the cell starts to divide the first time.

[24] O. F. Cook must be seen as the actual originator of the term "clone" because of Webber's reference to Cook.

[25] According to Webber, first spelled without 'e'. Pollard [63] suggested to add a silent "e" to ensure the long "o" two years later.

short word, easily pronounced, spelled phonetically and with a derivation which at least suggests its meaning" ([76]: 502), he defines clones as "[…] groups of plants that are propagated by the use of any form of vegetative parts such as bulbs, tubers, cuttings grafts, buds, etc., and which are simply parts of the same individual seedling" ([76]: 502). The mentioned derivation refers to the Greek origin of clon (klon), meaning twig. Interestingly, Webber thought that vegetative parts such as strawberries, onions, and potatoes, which are separated as runners or tubers, remain the same plant: "The plants grown from such vegetative parts are not individuals in the ordinary sense, but are simply transplanted parts of the same individual, and in heredity and in all biological and physiological senses such plants are the same individual" ([76]: 502).

It seems that Webber's understanding of clone as a unit of genetic identical entities, including the progenitor, seems to fade away. In the case of cloning animals, it would seem quite strange to state that either Dolly is identical (in a strict sense) to her mother[26] or only a part of her—although she developed literally from a part of her—the extracted DNA. The point I want to make here is that the transfer of Webber's term to molecules and animals involves a semantic shift. As stated above, Webber originally introduced cloning as a splitting process in plants which happens naturally or can be imitated experimentally by producing cuttings. It results in one or multiple genetically identical plant descendants. Therefore, in every subsequent application of the term cloning to the reproduction of genes, blastomere transfer, embryo splitting, and SCNT in animals or most generally to all forms of asexual reproduction (see [44]: 33), it is used in a figurative sense.[27] In its original meaning, cloning was reserved for plants only. Considering the fact that Webber was searching for over 2 years for a precise and suitable scientific term for "plants that are propagated vegetatively by buds, grafts, cuttings, suckers, runners, slips, bulbs, tubers" ([76]: 502), in addition to the indicators given in its etymological roots and its linguistic advantages, the semantic distances and the degree of abstraction that cloning has covered in popular and scientific language seems rather astonishing.

[26] In fact, it is difficult to speak of Dolly's mother because three female sheep were involved in cloning her: the oocyte donor, the nucleus donor, and the surrogate that delivered Dolly.

[27] E.g. as a synecdoche. Synecdoche is a figure of speech substituting a part (or a subcategory) by the whole (or main category) or vice versa.

Deconstruction of a Normatively Charged Metaphor

As demonstrated, cloning can only metaphorically be understood as "copying." The use of metaphors in science is not unusual. They are omnipresent and their value is doubtless. Metaphors not only promote understanding in not easily accessible realities but are also essential for all forms of language and understanding (see [21, 29]: 126). As scientific communication depends on language—as arbitrary systems of symbols (see [26])—clearing scientific language from metaphors is neither required nor possible.[28]

However, I want to stress that metaphors are not neutral tools to describe the world. They are not only means to describe abstract phenomena. They carry values, express how the world is experienced, and literally shape the world: "More than describing reality, they inform and transform it" ([8]: 3). Although the metaphor clone as a genetic copy illustrates a complex process, it must be considered that it has some inevitable shortcomings in highlighting some aspects but hiding others[29] and may include some normative aspects, which should be handled very carefully in a descriptive field of science such as biology.

In this section, I focus on these normative components in a deconstructive analysis. Since deconstruction is used in various ways, e.g., as a philosophical position, political, or intellectual strategy or mode of reading in different disciplines (see [22]: 85), it is necessary to introduce and explicate its interpretation and purpose. I use it according to Jacques Derrida as "une stratégie générale de la déconstruction."[30] Its initial situation is a

[28] See also the statement of Terry Eagleton that not only the boarders between language of literature and science are not clearly defined, but that also all language "[…] is ineradicably metaphorical, working by tropes and figures; it is a mistake to believe that any language is literally literal. Philosophy, law, political theory work by metaphor just as poems do, and so are just as fictional" ([29]: 126).

[29] For the highlighting and hiding systematicity of metaphors, see [53]: Chapter 3.

[30] French for "general strategy of deconstruction" ([25], 41). The original terminology is used here instead of the term "method" in order to signify that according to Derrida, deconstruction is not a method in an ordinary sense. The difference is that deconstruction is not applied to a research matter from outside, following the dichotomy between (active) subject and (passive) object. According to Derrida, deconstruction is part of the matter itself, not having a particular beginning and ending. On the one hand, being aware of the limits of this article, it is on the other hand nevertheless necessary to start with an arbitrary cut and neglect this characteristic of deconstruction.

binary opposition that underlies every text, such as culture and nature, reason and emotion, human and animal, producer and product, etc. The crucial point according to Derrida is that the opposition of those terms is not the comparison of two equal ranking ones:

> […] in a classical philosophical opposition we are not dealing with the peaceful coexistence of a vis-à-vis, but rather with a violent hierarchy. One of the two terms governs the other (axiologically, logically, etc.), or has the upper hand. To deconstruct the opposition, first of all, is to overturn the hierarchy at a given moment. ([25]: 41) [31]

Deconstruction of such an opposition contains different, not chronologically organized phases, which Derrida ([25]: 41) calls a "double gesture," containing overturning and shift.[32]

According to Derrida, it is important not to remain in the phase of overturning a hierarchical order, putting only the latter instead of the first or the lower on place of the upper, because making the hierarchy totter or overturn is still operating in the given dual system:

> By means of this double, and precisely stratified, dislodged and dislodging, writing, we must also mark the interval between inversion, which brings low what was high, and the irruptive emergence of a new 'concept', a concept that can no longer be, and never could be, included in the previous regime ([25]: 42).

The result of the strategy of deconstruction is never permanent. The new construct—a world upside down—includes a new hierarchy that deconstructs itself again. Therefore, the following attempt must be seen as a fragment that is open for further deconstructive criticism.

The binary system we are concerned with is original–copy. For our purpose, it will first be necessary to prove that this binary opposition is not neutral ("Original–Copy: a Normative Distinction"). Second, if it is additionally possible to shatter it and to show that it is unstable, it would provide a good reason to reconsider arguments that are built on the distinction original–copy ("Overturning the Hierarchy"). The third and final step will be to shift the original–copy dichotomy and contrast it with a new paradigm ("Shifting the Perspective: from the Dichotomy Between Original and Copy to the Language of Objectification"). This new paradigm is found in the use of a terminology for objects that is used for non-objects like humans or animals.

Original–Copy: a Normative Distinction

According to Derrida's thesis, original–copy is not a neutral dualism, but a hierarchical order in favor of the original over the copy. This hierarchy is expressed in the following three examples: a) biologist Stephen Jay Gould ([40]: 44) wondered in the late 1990s why Dolly was the most popular mammal, even though she was just a carbon copy; b) referring to Leonardo da Vinci's *Mona Lisa*, Klotzko ([51]:148) states that "[a] copy of work of art is of lesser value both artistically and financially than the original"; and c) Habermas [42] states that "[t]here is a rational kernel to the archaic revulsion provoked by the vision of cloned human replicas." According to him, this rational basis lies in the asymmetry between the genetic original and the genetic copy in favor of the original. While the genome of the progenitor is a contingent construct of sexual reproduction, the genome of the clone is determined. This determination violates the "fundamental symmetry of mutual relations between free and equal legal persons" ([42]: 167). On one hand, the clone causes an intuitive feeling of repugnance that does not arise with the original.[33] On the other hand, the determination of the genetic traits of the clone subverts the reciprocity between persons. Habermas therefore puts forward two reasons for a hierarchical order between original and copy in favor of the original.

Overturning the Hierarchy

This asymmetrical power relation may be reversed or made unstable. a) First of all, it only makes sense to

[31] Feminist critique assumes that this binary opposition not only implicates a hierarchic order but that it also is gendered. The first half is not only more valuable than the other one but is also seen as the "male" part, while the less valuable half is viewed as the "female" part (see [49]: 39f.).

[32] A third phase of neutralization may also be mentioned, although it is not necessary in the process of deconstruction. Neutralizing an opposition means to harmonize or assimilate the hierarchical positions (see [25]: 41).

[33] Insofar as Habermas' argument corresponds with Leon Kass' "yuck factor" argument presented in *The Wisdom of Repugnance* (2002). Unlike Kass, Habermas tries to ground his moral intuitions with a rational argument.

speak of the concept of an original if a copy exists. The original depends as much on the copy as the copy depends on the original. It can even be claimed that the original does not generate the copy, but the copy generates the original, conceptually speaking. This sounds paradoxical because the original exists before the copy. Deconstruction does not challenge the temporal relation between the original and the copy but the hierarchical order between them as an arbitrary construct. In the case of Dolly, it is not even clear who has to be seen as the original. Her genome consists of the mtDNA of the oocyte donor and the nDNA of the nucleus donor and, therefore, of two different sheep. Either way, as the first successfully cloned mammal by SCNT, she was much more valuable than her nuclear donor, a 6-year-old Finn Dorset ewe, who did not even have a name—not to mention the unknown oocytes donors of the 277 oocytes. As a result of the importance of being the first copy, Dolly overthrew the hierarchy between original and copy.

b) Klotzko's statement that the original painting is always more valuable than its copy may be questioned. Being influenced by philosophical deconstruction and intertextuality, the current artistic genre of "appropriation art" uses original art objects as the basis for its work. The decisive point is that the original artwork is not transformed or, if it is, only slightly. Nevertheless, appropriation art is covered by copyright laws and is therefore treated like the conventional art. The copy has the same legal status as the original. For example, in 1936, the photographer Walker Evans made portraits of the Burroughs family, which Sherrie Levine rephotographed in 1979. Then, Michael Mandiberg scanned these photos and made them accessible on the Websites "Afterwalkerevans.com" and "AfterSherrieLevine.com."[34] The popularity of Evans' original photographs increased after the copies produced by Levine and the copies of the copies produced by Mandiberg. Another example from the field of pop art comes from Roy Lichtenstein who made art history by painting mass-produced comic strips. His paintings sell for millions and are part of the collections of the world's most famous museums. In contrast, the original comic panels were sold for a few cents and painted by artists who are still hardly known. These examples raise questions about authorship, originality, and digital reproduction. Against Klotzko's position, neither in artistic nor in financial terms the copies from Levine, Mandiberg, or Lichtenstein can be viewed as less valuable.

c) According to deconstructivism, Habermas' asymmetrical relation between the progenitor and the clone can be made unstable too. Habermas fears that the person who sets himself as a master over the genetic code of another revokes reciprocity between persons, making the clone inferior to its progenitor. The claimed asymmetry consists of the fact that the genome of the clone is determined by the progenitor. But first of all, Habermas confirms the picture of the clone as an exact duplicate by using the copy metaphor quite often (e.g., [42]: 163, 164, 165, 168). This conceals that cloning is not as determining as he contends. As Bailey ([5]: 109f.) states:

> A clone that grew from one person's DNA inserted in another person's host egg would pick up "maternal factors" from the protein in the egg, alternating the development. Physiological differences between the womb of the original and the host mothers could also affect the clone's development. In no sense, therefore, would or could a clone be a "carbon copy" of his or her predecessor.

Second, he compares human cloning with slavery. His comparison begins with a definition of slavery: "Slavery is a legal relationship signifying that one person disposes over another as property" ([42]: 164). This is followed by a statement that the possession of a person is incompatible with human rights and human dignity. He concludes: "According to the same moral criteria, then, and not merely on religious grounds, the copying of the genetic material of a human being must be condemned" ([42]: 164). Leaving aside the fact that no genetic material is copied within the process of SCNT cloning, the crucial point of Habermas' comparison between cloning and slavery contains an important aspect for our investigation of the copy metaphor in the last section.

Shifting the Perspective: from the Dichotomy Between Original and Copy to the Language of Objectification

Up to this point, we have remained between the binary opposition of original and copy. After overturning the

[34] See http://www.afterwalkerevans.com/ and http://www.aftersherrielevine.com/ [13].

inherent hierarchical order, I would like to proceed to the second part of the "double gesture" of Derrida's deconstruction strategy: the shift. It involves a step out of the terminology of the binary system, questioning its conditions from an external perspective.[35] This change of focus leads to the insight that the copy metaphor not only does conceal certain normative aspects but also makes other normative considerations visible, considerations which are ethically relevant in the context of SCNT cloning and animal experimentation in general. These new normative aspects concern the way scientific language is used as an instrument or indication of *objectification tendencies* in biotechnological research.

The ethical problem of reproductive human cloning is not the determination of genes—which in fact does not reach as far as Habermas assumes. But his fear expressed as "archaic revulsion" (see above) as well as Leon Kass' ([47]: 78) "wisdom of repugnance" or Ian Wilmut's uncomfortable feeling about the fact that cloning does not treat people as individuals[36] (see Wilmut qtd. in [50]: 24), lies in the idea that humans are dehumanized (or in the case of animals, deanimalized) and treated as copies and, therefore, as things.

Although these authors only refer to human cloning, it will be demonstrated why the difference between human and animals is not primarily relevant within the category of objectification. I will do this by applying the seven notions of objectification by Nussbaum ([58]: 218) to SCNT cloning, asking if, and if yes, especially which tendencies of objectification can be found in biotechnological research and why it is ethically questionable. Criticism against objectification is not limited to the biotechnology of cloning and not all the notions of objectification are necessarily linked to every SCNT experiment. [37] But, as I will demonstrate, it is not unjustified to use it in this context.

Nussbaum developed her account in the context of sexual relationships among humans, specifying the sexual oppression of women. While the parallels of the oppression of women and animals are made by others (e.g., [2, 3]), it has been demonstrated by Klaus Petrus [62] that applying the category of objectification to animals is also fruitful. Even if Nussbaum refers to humans only, her definition of objectification as "treating as an object, what is not an object" ([58]: 218) allows for an application to the objectification of all kinds of entities which are not objects: humans, animals, and plants. The (trivial) assumption that only non-objects can be objectified opens the field to apply the category to animals.[38]

As the moral status of (all types of) animals cannot be defended within this paper, I will only refer to animals which can be described as experiencing "subjects-of-a-life" ([66]: 243).[39] The ethicist Tom Regan defined all humans and nonhuman animals who possess cognitive abilities such as consciousness or awareness of themselves as distinct entities with a past and a future as experiencing subjects-of-a-life. Those beings are aware of the world and have subjective preferences and interests in their welfare. Any entity of whatever species that fulfills these requirements has a moral status. This means that it is morally considerable for its own sake. According to this egalitarian approach with regard to objectification, it is not necessary to distinguish between cloning humans and animals because, at least in the case of all mammals involved in SCNT cloning (progenitors, oocyte donors, surrogate mothers, and clones), they can be described as experiencing subjects-of-a-life with a moral status. Treating any subject-of-a-life, regardless of his/her species, *as an object* while it really is not an object is morally wrong because one can do with objects whatever one likes. This is not permitted with subjects-of-a-life. They must be respected as members of the moral community.

After this remarks on why the category of objectification can be applied to all entities who are subjects-of-a-life and why this is ethically questionable, I will explore what being treated as a thing could mean in detail.[40]

[35] As stated above, the shift contains the step from one binary opposition (here: original–copy) to another one (object–living being). The new opposition may be the subject of a new deconstruction, which itself contains another shift and so forth.

[36] It is not obvious if he is referring to the progenitor or to the clone.

[37] In the biotechnological context, "objectification" is generally used in a very broad sense to describe the act of treating as an object what is really not an object, but an animal (or a human being). Further investigations are required to define specific ways as well as similarities and differences of objectification of humans and animals.

[38] For the purpose of this article, the issue of objectification of plants will be left aside.

[39] At this point, it is neither necessary to defend Regan's view of animal rights nor the value theory on which it is built on. But I borrow his terminology of "experiencing subject-of-a-life" because it serves the purpose to express a clear distinction between objects and certain non-objects.

[40] The category of objectification could also be applied to humans and animals who are not subjects-of-a-life. But it is possible that some notions of objectifications must be adapted to them, e.g., the notion of autonomy (see below) must be considered differently in the cases of animals, children, or comatose people because there are forms of self-determination that cannot be found in these cases.

Nussbaum ([58]: 218) detected seven notions of objectification: instrumentality, denial of autonomy, inertness, fungibility, violability, ownership, and denial of subjectivity. At least four of these notions can be found in the context of animal cloning. Instrumentality and ownership are clearly present because the cloned animals are owned by a company, institution, or person and instrumentalized as research models for different purposes. In this paper, therefore, I focus on fungibility and violability. As I will not go into detail regarding the question if any of these are sufficient conditions for objectification and how they are related to each other, I will use them as a loose cluster to indicate forms of objectification within SCNT cloning.[41] So, the phenomenon of objectification is not a categorical one, but rather one that comes with gray areas and different degrees.

The copy metaphor makes an initial notion of objectification visible. It regards the notion of *fungibility*, which dovetails with the denial of individuality: When describing a subject-of-a-life as a copy, a terminology is applied that is only suitable for things. Some objects are used interchangeably as consumable materials. For example, it does not matter which pen I use, as long as it works. If it breaks, I take another one. The reason why it does not matter which pen I use is that they only have an instrumental value according to their usefulness. As pens lack a moral status, they are exchangeable without raising moral issues.[42] In contrast, Regan postulates an inherent value for all subjects-of-a-life, which should be respected (see [66]: 248).[43] If an entity has an inherent value and therefore a moral status, it should not be reduced to its instrumental value. Therefore, if certain animals are subjects-of-a-life and if they are treated as interchangeable objects, this is morally condemnable because they are reduced to their instrumental value, and their individuality is neglected. The following examples show how the individuality of animals is disregarded in certain cloning experiments. While Megan and Morag, the first sheep cloned by SCNT out of embryo derived differentiated cells (see [18]), Dolly, the first mammal cloned by SCNT out of adult cells or Polly, the first transgenic sheep reproduced by SCNT (see [67]), are known to the public as individuals with names, many clones are born anonymously or die nameless pre- or perinatal. In the case of the first cloned dog Snuppy (acronym for *Seoul National University* combined with "puppy") (see [15]), who was cloned out of adult skin cells from an Afghan hound, he was the lucky one. From 1095 reconstructed canine embryos transferred into 123 recipients, three pregnancies resulted in two live births: Snuppy and NT-2. The latter, labeled impersonally with the initials of "Nuclear Transfer 2," died in the 4th week from aspiration pneumonia. A similar example of anonymous animals involved in cloning is described by Bonnicksen ([10]: 267), where 276 nuclear transfers in cattle resulted in six pregnancies and in four live births. While one calf died shortly after birth, the three remaining transgenic calves were named ACT 3, ACT 4, and ACT 5 (see [19]).

As Brandt [12] demonstrates, the origin of cloning was related with standardization, genetic identity, and mass production. These ideas can be recognized in the copy metaphor and the aforementioned examples. The first one (Snuppy) reduces the animal to its genetic traits and its relation to the progenitor. The latter examples (NT-2, ACT 3, ACT 4, and ACT 5) anonymize the cloned animals with numbers and initials. Both make the individual animal disappear. What remains is a genetic code or a number, reminding us of the "absent referent"—the animal that is made invisible through language (see [1], 66f.).[44] The scientific language present in these cases and others neglect that the clones are individual subjects-of-a-life.

The second notion of objectification concerns *violability*. An animal is objectified if "[t]he objectifier treats the object as lacking in boundary integrity, as something that it is permissible to break up, smash, break into" ([58]: 218). Within the process of SCNT, the animals are not violated intentionally. On the contrary, scientists are interested in a high efficiency rate. But as long as SCNT cloning is uncertain and unpredictable, stillbirths,

[41] I do not agree with all the details of Nussbaum's description of her proposed notions and relations between them. Nevertheless, her classification serves as a rough guide for the structure of my own interpretation.

[42] Of course, it is morally questionable if I borrow a pen and overuse or break it. But the moral problem would not be grounded in violating the pen itself, but its status as the property of an owner.

[43] The link between the inherent value and the moral status, as well as the distinction between the inherent and the instrumental value, are common in animal ethics. As Regan states, his attribution of an inherent value is a postulate, a theoretical assumption that he argues for (cf. [66]: 247). I will use both expressions as a heuristic instrument but want to stress that his theory of value is neither necessary nor the only way to ground moral status for animals.

[44] Carol J. Adams' concept of the "absent referent" describes a similar process of making an animal anonymous in the process of eating meat. That is why it is suitable to use her terminology here.

welfare problems of cloned animals, and cesareans of surrogates are to be expected. As the following statement of Cibelli et al. shows, the intended stress for the animals, which can vary from minor to major (see [16]: 46), would not be acceptable when applied to humans:

> However, until nuclear transfer is better characterized and understood—and the danger of generating a handicapped child eliminated—the unpredictability of the procedure strongly counsels against its application in human reproduction. But this does not justify a federal law banning experiments and applications of nonreproductive cloning with human material, or reproductive cloning of animals ([20]: 14).

According to the authors, the risks of SCNT cloning are not reasonable for humans, but for animals.[45] Assuming that animals are vulnerable entities with a subjective welfare and that their *violability* is not seriously taken into consideration, this notion of objectification seems appropriate too. These two examples of objectification support the thesis that the copy metaphor not only is a rhetorical tool, but also contributes, or at least mirrors, objectification tendencies that can be found in some SCNT experiments. Depersonalizing animals as numbers, regarding their stress as collateral damage, denying their individuality, and not taking their welfare into account accurately transforms them into interchangeable copies.

The relation between objectification and the copy metaphor is indistinct and multifaceted, and therefore cannot be fully developed here. But if Bensaude Vincent and Loeve [8] are right when stating that metaphors actively shape the world, calling a clone a genetic copy is already an act of objectification.

The result of deconstructing the duality of original and copy may provide good reasons against SCNT cloning. However, it also shows that Habermas' argument against reproductive human cloning is not convincing. According to Bensaude Vincent and Loeve, when Habermas refers to a clone as a copy, this already makes the clone an object that can be possessed (notion of objectification of *ownership*). When he compares cloning to slavery where the owner possesses the slave, this is kind of a circular reasoning (*petitio principii*). He presupposes the asymmetrical relation between progenitor (original) and clone (copy) that he wants to justify. But first, as shown in "Overturning the Hierarchy," the copy metaphor conceals that cloning is not as determining as Habermas contends. Second, the asymmetrical relation between clone and progenitor does not necessarily have to be assumed because clone can de defined without a negative connotation.

[45] It should be mentioned that the quoted statement is not followed by any explanation of the normative grounds it is built on.

Conclusions

The initial point of this investigation was to explicate the different layers of meanings of the word clone and the efforts of science to defend a scientifically precise definition. On that basis, the definition of a clone as a genetic copy has been well established.

This definition was critically examined on a phenotypical, genetic, and nuclear level. The result was that a clone as copy can only be understood as a metaphor because clone understood as a genetic copy neglects the biotechnological principles of SCNT cloning. Nevertheless, the similarities between the phenotype, the genotype, or the nuclear DNA of the clone and its progenitor make the metaphor valid. While the clone as a result may be described as a copy on different levels, it is more accurate to understand SCNT cloning as a process of splitting rather than of doubling or copying. Therefore, a clone is not a genetic copy in a strict sense, but in a figurative one. Due to this result and the fact that the clone as copy metaphor is not necessary to define clone and the technique of SCNT, there is *prima facie* no need to use it in a scientific context. If it is used because of the epistemological performance of metaphors that are able to illustrate abstract and complex processes like SCNT cloning, it should be used deliberately and consciously. The user must be aware of the nature of metaphors to highlight some aspects (similarity between the clone and its progenitor) while neglecting others (principles of SCNT cloning). Furthermore, metaphors are not neutral rhetorical tools. They construct reality and shape perspectives.

A deconstructive analysis according to Derrida's *Positions* revealed the normative potential of the original–copy dichotomy. Calling something a copy of something implies a hierarchical power relation in favor of the original. Examples in art, science, and ethics confirmed this thesis.

The second step of the deconstruction implied the possibility of questioning and even overturning the

hierarchy between original and copy. Thus, ethical arguments against cloning, stating that a clone is a mere copy with its negative connotation as well as arguments pro cloning stating that a clone is an identical copy with positive connotations that ground on this hierarchy, must be examined carefully. First, they are built on uncertain grounds. Second, both arguments neglect that an animal is always more than its genetic traits.

The latter point was the subject of the last part of the deconstruction, which consists of the shift from the binary opposition between copy and original to another opposition. In our case, it was the language of objectification, which relies on the opposition between things and living beings. Applying Nussbaum's seven notions of objectification (instrumentality, denial of autonomy, inertness, fungibility, violability, ownership, and denial of subjectivity), the suspicion of objectification in the context of animal cloning, which is indicated in the clone as a copy metaphor, can be confirmed. Focusing on the notions of fungibility and violability, it was shown that animals are treated as things in the mentioned SCNT experiments.

The functions of the clone as copy metaphor in acts of objectification are various. It could be merely an index for objectification tendencies in biomedical research, or it could support such tendencies, or it could even play a central role in generating them. This is another reason why the clone as copy metaphor should be used carefully in contexts of biomedical research.

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