

Husserl's Early Genealogy of the Number System

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Abstract

This article accomplishes two goals. First, the paper clarifies Edmund Husserl's investigation of the historical inception of the number system from his early works, *Philosophy of Arithmetic* and, "On the Logic of Signs (Semiotic)". The article explores Husserl's analysis of five historical developmental stages, which culminated in our ancestor's ability to employ and enumerate with number signs. Second, the article reveals how Husserl's conclusions about the history of the number system from his early works opens up a fusion point with his investigations from his mature texts, *The Crisis of the European Sciences* and "The Origin of Geometry". On the one hand, the essay shows that Husserl's methodology was similar, as he sought in both his early and late writings to uncover the essence of the history of the formal sciences and was not executing mere intellectual history. On the other hand, the article discloses that Husserl's insights from both time periods are strikingly analogous. Already in his early texts, Husserl saw that the sciences emerged from pre-theoretical experiences of the world and that the sciences are the result of a historical process, which involves the psychic activities of past individuals and the maintaining of discoveries over time by intersubjective communities. I conclude by showing how, in light of the analysis of this paper, we can rethink the evolution of Husserl's philosophy.

Keywords: Husserl; philosophy of arithmetic; semiotics; history of science; genealogy.

1. Introduction

The overarching goal of Edmund Husserl's 1891 *Philosophy of Arithmetic* (Hua XII; Husserl 2003. Hereafter PA) is to clarify the contemporary execution of arithmetic

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calculation by tracing it back to its origin in our everyday experience of number. Husserl demonstrates how the practice of arithmetic develops naturally and logically from those simple encounters with numbers. To begin this investigation, Husserl clarifies that I first experience numbers when I am “authentically presented” with them (Cf. Hua XII, 10–21; Husserl 2003, 15–22). During such authentic presentations, I have an in-person and immediate awareness of the number. I experience, what Husserl would later call, an “eidetic intuition” of the number species and I see that the number species applies to the counted elements of the multiplicity as a whole (Tillman 2012, 145).

These authentic presentations are not the only way I experience numbers. In fact, I am authentically presented with numbers in very few cases. Husserl claims that, as a result of the limitations of our psychic capacities, humans are capable of authentically presenting only those number species that are less than or equal to five, ten, or twelve, depending upon which quote one pulls from the text.¹ As one cannot authentically present these higher numbers, a tool was created by means of which one can be presented with, count, and solve arithmetical equations that concern or contain them; namely, number signs. I somehow become conscious of the numbers 38, 349, or 8,784 when I read the corresponding signs on the page. Husserl states that this manner of becoming aware of numbers via signs is a case of “inauthentic presentation”. The number signs inauthentically present their higher numbers (Cf. Hua XII, 193–195; Husserl 2003, 205–207). The number sign does not provide me with a direct awareness of the number species. Rather, I am conscious of the number species via mediation of the concept.² When I employ the number sign, “13”, the sign signifies the number species by way of the concept. The concept circumscribes the number species for me. It is these kinds of experiences, where I use the number signs to signify the number species via the concept, which Husserl calls the conceptual employment of signs.

This conceptual method is also not employed in all cases. When arithmetical calculation becomes very complex, I have to do without the concepts and use the number signs alone.

Husserl wrote that for mathematicians, “It is a fact that *in praxi* all numbering and calculating could dispense with recourse to the underlying concepts” (Hua XII, 242; Husserl 2003, 256). Here, the manipulation of the signs themselves stands in the place of not only the authentic presentation of the number species, but also the conceptual employment of the number sign. I use the signs themselves to come to the correct answer to the equation, rather than having to work with the concepts or the species.

Because of the complexity of the development of arithmetical calculation, Husserl spends nearly the entirety of PA tracing back the execution of contemporary arithmetic to our authentic presentation of numbers. Yet, Husserl was not content with performing that analysis alone. In a most curious and little studied passage from the end of chapter seven, Husserl employs his insights about the grounding of arithmetic calculation in our daily lives to develop a radical and new element of his philosophy. In the section entitled, “The Natural Origination of the Number System” (Hua XII, 244–252; Husserl 2003, 258–267), Husserl executes what can only be called a genetic-historical³ examination of the inception of number signs and the number system. He studies the different historical stages of sign development, which culminated in the first instance of the number system for primitive mankind. He searches, in that section, to make “intelligible how, in general, a sign system, that is artificial in its type and constitution, and whose consciously intended invention and theoretical justification would require abstract reflections of the most complicated sort, can come about through the course of natural psychological evolution” (Hua XII, 253; Husserl 2003, 259).

With regards to, “The Natural Origination of the Number System”, the paper has two goals. First, the essay simply elucidates Husserl’s early and extra-ordinary conclusions about the historical psychological generation of number signs and the number system. This task is; however, more complicated than it initially appears. In PA, Husserl does not provide the reader with enough information to fully grasp his historically-minded insights. He justifiably conducts his historical examination as an aside, because it is tangential to

the main objectives of his book. Husserl was fortunately not unaware of the limitations of that genetic investigation. Accordingly, in an often-overlooked⁴ 1891⁵ manuscript, entitled, "On the Logic of Signs (Semiotic)" (Hua XII, 340–373; Husserl 1994, 20–51 [Hereafter LZ]), Husserl supplements that historical investigation from PA. In LZ, he clarifies certain conscious mechanisms, which he did not properly discuss in PA, that allowed for the evolution of sign usage for primitive mankind. Accordingly, I will synthesize Husserl's insights from both PA and LZ to present a comprehensive and accurate picture of his early historical insights.

The second objective of the paper is to demonstrate how Husserl's 1891 philosophy of the historical origination of the number system prefigures his mature philosophical writings about the history of the sciences. Indeed, those familiar with Husserl would have already noted that his historical investigations from PA and LZ appear anachronistic, as they bear a striking similarity to Husserl's examinations from his final works, *The Crisis of the European Sciences* (Hua VI; Husserl 1970a [Hereafter KW]) and, "The Origin of Geometry" (Hua VI; Husserl 1970b [Hereafter UG]). Indeed, in all four texts – PA, LZ, KW, and UG – Husserl traces formal scientific projects back to historical psychic accomplishments in the world of pre-scientific experience. The paper will show that such similarities are by no means superficial. Naturally, in his first writings, Husserl could not yet have formulated his conclusions about history in the same terms or with the same nuance that he did in KW and UG. In the 1890s, he had not discovered concepts such as meaning-sedimentation, life-world, horizon, or passivity, amongst others. Despite this fact, the essay demonstrates that many of the methods and key ideas, which would play an important part in Husserl's last writings on history and science, were already well developed in his early texts. In other words, the second goal of the article is to reveal a fusion point between Husserl's writings from the 1890s and the 1930s.

To accomplish these objectives, the paper is divided into two further sections. In section two, I address Husserl's examination of the inception of number signs and the number

system from LZ and PA. In section three, I then demonstrate how his method and insights from the early texts prefigure his historical analysis from KW and UG. I then conclude by briefly demonstrating how this connecting point, between Husserl's immature and mature writings, reveals an inadequacy with and frustrates contemporary interpretations of the evolution of his philosophy.

2. Husserl's Early Historical Genetic Analysis of the Origin of the Number System

In the following sections, I investigate Husserl's analysis of the historical generation of the number system, as he described it in LZ and PA. Before broaching Husserl's observations; however, it is necessary to more clearly outline the goals of this historical-genetic analysis and to examine the methodology employed during its undertaking. To be certain, Husserl's investigation is not an attempt to provide an accurate historical account of the development of arithmetic in, for example, ancient Greece, Egypt, or China. He writes that, "The periods within which the origination of number systems and number sign systems falls are unknown to any historical tradition. Therefore there can be no thought of a reproduction of the historical development." (Hua XII, 245; Husserl 2003, 259) Husserl sees that his theory must rather account for how arithmetic arose during its independent "discovery by different peoples, which is deducible with certainty from the existing differences (e.g. the choice of the base number of the system), found alongside all commonalities" (Hua XII, 245; Husserl 2003, 259). Husserl is also not seeking to demonstrate that the evolution of the number system *depends* or is *contingent* either upon the psychological composition of the human mind or on the particular factual developments of human history. He does not here – nor anywhere in PA – psychologize or historicize the number system or arithmetic.⁶ Instead, while still accounting for the "general traits of human nature", Husserl's true objective is to disclose the "psychological evolution of such formations ... in all its essential points" (Hua XII, 245; Husserl

2003, 259). He hopes to show what is *essential or necessary* in the historical inception of the number system.⁷

Methodologically considered, Husserl executes his analysis by identifying and exploring five stages of the psychological evolution of the number system. The grounding assumption of Husserl's theory is that the ancients were able to enumerate with inauthentic number signs and thereby develop the number system, because they had mastered the use of other kinds of signs first. There is a chain of increasingly more complex kinds of signs, where one must first be able to utilize the simplest kind of sign before one is capable of learning the next and more elaborate kind of sign in the series (Hua XII, 250–251; Husserl 2003, 263–265). Keeping in mind the goals of Husserl's overall historical-genetic analysis, in what follows, I examine how Husserl describes each of the developmental historical stages, which were necessary for the inception of the number system.

2.1 Natural Mediating Signs

The necessity of bringing in LZ to augment Husserl's historical analysis from PA is clear from the start, because his examination from the latter begins too late in humanity's development. In PA, Husserl initiates his investigation by looking at the second stage of this historical development – not the first. Husserl, in the 1891 book, examines how humans came to formulate the simplest kinds of number signs. Yet, in LZ, Husserl asserts that certain other experiences are necessary even before the creation of number signs is possible. In that manuscript, Husserl examines this first stage of development, which opens up the possibility of sign creation; namely, the experience of “natural signs” (Cf. Hua XII, 345–346; Husserl 1994, 24–25).

Even though Husserl, in LZ, does not thoroughly describe natural signs, the meaning behind this term can be made clear on the basis of his analysis. An example will help. As is well known, when cooking meat over a fire, it goes from a bright red to a brown color. Eating meat when it is red can be dangerous, as parasites and diseases may remain in the meat.

Yet, when brown, the meat is safe to eat (albeit, less savory). After years of cooking meat on an open fire, the ancients would have had many experiences of themselves or other's contracting certain illnesses after eating red meat and they would have experienced a certain rejuvenation after eating meat, which was cooked until it was brown. As a result, there could become established an association (an associative link) between the brown color of the meat and its healthiness. For the early Husserl, this association is the mechanism behind the signitive operation of natural (and all) signs. Once that associative link is installed, when the villager, who is cooking the meat, sees that the meat has a brown color, the associative link, which has been sedimented, is reactivated. The authentic presentation of the brown-ness of the meat would associatively awaken an awareness of the healthiness of the meat. The brown would function as a sign, as it – by means of association – points beyond itself, that is, signifies the meat as healthy. Husserl calls this sign and others like it, "natural", because they are not the result of human invention, but rather arose organically through man's pre-theoretical experiences of the world.

Of importance is that a natural sign – if it is univocal and sufficient to pick out the signified object – is a "temporary" inauthentically presenting sign or a "mediating" sign.⁸ In LZ, Husserl describes these (simplest) kind of signs as, "mere intermediaries for the production of authentic representations corresponding to them" (Hua XII, 351; Husserl 1994, 31). When mediating signs signify by means of association, they *lead or prompt me* to authentically present their signified objects. They function by means of mediation and not via replacement. For the above example, when villagers would be authentically presented with the meat as brown, the brownness would function as a natural mediating sign, which would have associatively prompted the villagers to authentically present the meat as healthy.

2.2 Conventional Mediating Signs

The second phase of historical sign development occurs on the basis of the first. In LZ, Husserl concludes that once

cavemen had “the capacity for understanding signs”, which would arise organically or naturally, then and only then would they have the capacity to create signs, which he calls – for obvious reasons – “conventional” signs (Cf. Hua XII, 349–350; Husserl 1994, 28–29). The ancients needed to see that the one object can mediate our awareness of another, that is, signify the other, before they could themselves fashion conventional signs. Husserl writes that, “the natural modes of procedure must precede that of the conventional” (Hua XII, 366; Husserl 1994, 44). At the same time, Husserl emphasizes that that realization is not enough. After recognizing the mediating and signifying power of signs, our ancestors would then have also had to employ their will to fashion a sign, which was meant to communicate something to others or to themselves (Hua XII, 345; Husserl 1994, 24–25).

To return to the above example, if, after realizing that the brownness of meat awakens an awareness of the healthiness of meat (that is, functions as a sign, which associatively signifies the meat's healthiness), one caveman could use certain berries and the bark of trees to create a brown paste, where he could then “paint” certain warriors, who were most healthy and skilled, with a brown color. By doing so, that ancient person would be employing his will to conventionally use what was initially a natural sign. He would be willfully marking the warriors with signs, which could signify to others the fact that these warriors are most healthy and robust. When the warriors would be authentically presented to the villagers with the brown paste covering their bodies, the previously established associative link between brownness and healthiness could be reawakened. The brownness would function as a sign, which would signify the healthiness of the warriors for the villagers, as the brownness-sign on the warriors would prompt the villagers to authentically present the warriors as healthy. Importantly, Husserl claims that these first conventional signs are also, like the simplest natural signs, mediatory signs. Conventional signs were first created to mediate others' authentic awareness of the signified. The brown paste on the warriors would not replace, but rather mediate the villagers' authentic presentation of the warriors as healthy.

Husserl asserts that this first creation of conventional signs is possible on the basis of the experience of natural signs, because both operate by means of the same mechanism; namely the association that prompts the authentic presentation of the signified object. The difference between them is that conventional signs were created by humans by using their will. Indeed, because they both function via mediating association, this jump from natural to conventional signs is easy to make, such that, “we should not be amazed when animals make themselves understood through signs, to a certain extent” (Hua XII, 345; Husserl 1994, 25). At the same time, even though they both function by means of the same associative mechanism, Husserl asserts that conventional signs open many possibilities for communication and knowledge, which were otherwise closed off. He writes that, “For the conventional techniques do not merely do the same thing better than the natural ones. Rather, they do incomparably more” (Hua XII, 366; Husserl 1994, 44).

On the basis of the above remarks, it is possible to explore Husserl’s genetic-historical analysis of the number system from PA, which begins at this second stage. Without mentioning that our forbearers must have first understood the power of natural signs before they could have fashioned conventional signs, Husserl just starts his discussion with an examination of the creation of the conventional signs, which can mediate the authentic awareness of number species. He states that, among the ancestors, there must have been an interest in sensible groups of the same kind and that there would be a “drive to communicate concerning the events of practical life, in which determinate groups of such objects played a great role” (Hua XII, 245–246; Husserl 2003, 260). There was, for example, a practical need for accurately determining how many sheep were in a herd and whether one of the sheep had been eaten by a wolf the previous night. This need could be met, Husserl claims, via, “an imitation⁹ by sensible means of the things represented”. There needed to be discovered some sensible objects, which could clearly “imitate” the objects, whose amount needed to be determined. These imitating objects should be easy to access and clearly differentiated from each other. For Husserl, the objects, which could perform this function, are self-

evidently the fingers on the hand. He writes that fingers would "have come immediately to mind for the imitation and symbolization of corresponding groups of arbitrary other objects" (Hua XII, 246; Husserl 2003, 260).

It was not enough; however, for the ancients to have recognized that the fingers could imitate groups of objects, for those fingers to function as signs, which mediate our authentic awareness of the number species and number concepts. Number concepts and number species also have a generality, which needs to be realized. Number species are not instantiated in just one group of objects alone, but are rather instantiated in any concrete multiplicity, which contains that number of objects. Moreover, the concept, to which the finger sign refers (and can mediate our awareness of the species) is also applicable to any number of groups, which have that same number of members. In order to realize this generality, Husserl states that cavemen had to look back and forth between, on the one hand, different groups of the same number (for example, three arrows, three sheep, three warriors) and, on the other, the fingers (the three fingers that are held up). By doing so, they would see that the three fingers serve as a sign that can signify all of the different groups of three objects, where this would allow for a recognition of the generality of the species or concept. Husserl writes that, it was "only through constant back-reference from groups of the most various types to the finger groups, sharply distinct in sensible appearance [that] finger numbers rise to the level of representatives of general concepts" (Hua XII, 246; Husserl 2003, 260).

Finally, with the willful creation of the conventional mediating finger signs, the ancients could begin enumeration. According to Husserl, enumeration with finger signs must have been initially very difficult and would have required a great deal of psychic energy.¹⁰ In order to enumerate in a secure manner, our ancestors would have to work through every single number to reach higher numbers, where they would raise one finger to represent each of the members of the group. For the first member, the pointer finger could have been raised, for the next member, the middle finger, then the ring finger, and so on (Hua XII, 246–247; Husserl 2003, 261). This sequencing of

numbers by our forebears represented the dawn of the number system for mankind.

2.3 Surrogates

While enumeration represented an important step forward in the historical development of the number system, in its first form, it was still very limited. During the period when humans only had access to mediating signs, which are the first kind of signs that were discovered, they would have only ever been able to enumerate up to the number 12. To understand why this is the case, we remember first, that only numbers up to 12 can be authentically presented, and second, that mediating number signs prompt the authentic presentation of numbers. With these two ideas in mind, we can say that if I saw the number sign 13, and if that sign functioned as a mediating sign, it would prompt me to authentically present the number 13. Yet, this is impossible, because – as was discussed in the introduction – the number 13 cannot be authentically presented. As such, it seems that the number sign 13 and any greater number signs could not signify its number species nor signify at all.

Yet, Husserl claims that enumeration, “could be continued beyond [the narrow domain of authentic representations]” (Hua XII, 246; Husserl 2003, 261). This was only possible for ancient peoples when they were equipped with a new kind of sign, which could signify non-authentically-presentable numbers. The discovery of these novel signs, which Husserl terms, “surrogates”, “replacements”, or “permanently inauthentically presenting signs”, is the third stage of historical sign development. A surrogative sign does not prompt one to authentically present the signified. Instead, when the number sign 13 functions as a surrogate, it can signify the number concept, even though that number is never authentically presented. The number surrogate simply deflects consciousness to the non-apparent or not-authentically-presented signified object.¹¹ By means of this replacing or deflecting function, surrogates allowed for ancients to count beyond those numbers, which could be authentically presented.

Concerning surrogates, it should also be noted that while they are different from mediating signs, the former also operate by means of the same general mechanism as the latter; association. The object, which will be the surrogate, also must first be associatively tied to a signified object, such that when I again see the surrogate, that associative link is reawakened, where the surrogate deflects me to or replaces the other signified and not authentically presented object.

The specific historical details of the evolution of mediating signs into surrogates are only briefly discussed by Husserl in LZ. He writes, "Only in consequence of constant usage, with the associations which develop, and occasionally also through experimentation – or through a mixture of the two – do conventional signs (provided they are actually suited for it) assume the character of surrogates" (Hua XII, 366; Husserl 1994, 44–45). In this quote, Husserl is affirming that the forbearers did not create conventional signs to function as surrogates. Conventional signs were first created as mediating signs. Yet, some conventional signs naturally evolved to become surrogates. Indeed, the fashioning of signs as surrogates could only occur at much later stages of history. Husserl writes, "We already have a high developmental level of spiritual culture when we invent conventional surrogates with full consciousness of their function" (Hua XII, 367; Husserl 1994, 45). It can, therefore, be concluded that fingers originally served as mediating conventional signs and that, only after their continual usage, did they then assume the character of surrogates. It can also be claimed that each of the three now outlined stages of development follow each other chronologically. By first experiencing natural mediating signs, ancients were then able to use their will to craft conventional mediating signs. Finally, these conventional mediating signs organically became conventional surrogative signs.¹²

By employing surrogates, our ancestors could then enumerate beyond the limits of authentic presentation. When discussing this development of enumeration, Husserl provides a more explicitly historical analysis and even employs numerous anthropological examples to support his case. He again begins at the simplest level, stating that ancient men would count up

to five using the fingers on one hand, before using their other hand to count up to ten. Here, the ancients ran into a dilemma – a fortuitous dilemma – that could only be solved by creating a more advanced number system. Simply stated, the dilemma is; how should they continue to count beyond ten? There were no more fingers for them to count on and it seemed that this was thus the upper limit of enumeration. Yet, Husserl claims that the continuation of counting was possible, by making a note, which would allow for the cavemen to remember that they had already counted through all ten fingers. He writes that, “there obviously remained nothing left but to make a note – on the side, by a sensible sign – of the fact that the fingers had been numbered through once, and then to count off the objects yet remaining by means of the finger again” (Hua XII, 247; Husserl 2003, 261–262). In this case, the mark on the side operates as a surrogate. When cavemen saw this mark, they were not motivated to authentically present the ten objects; rather, the mark served to replace and signify the counting through of the ten fingers, which had already occurred. This solution would be reapplied when ten marks on the side became noted, that is, when all ten of the fingers were counted through ten times. A new sign would be created, which would signify the ten counting through of the ten fingers. To clarify exactly what he means with this idea, Husserl draws in an example from the anthropologists, E.B. Taylor. According to Taylor, the villagers in south east Asia enumerate, “by using in counting a small stone for the ones. When ten of these are together, they are replaced with a small piece of coconut shell. When ten of these latter are together, then a larger piece of coconut shell is used” (Hua XII, 247; Husserl 2003, 262).

Importantly, by utilizing their fingers and marks or coconut shells in this way for counting, cavemen had established a system of counting that was recursive. Once the cavemen had counted through all of the fingers once, after making a note on the side, they would begin the process over, by starting to count with the first finger again. They would go back to the first finger every time all of the fingers had been counted. This method of “restarting” the counting is what makes the system recursive. Moreover, this recursive system

was also a decimal system, because the number at which the counting restarted was ten. When all ten fingers were counted, the counting would start back with the first finger after the mark had been made. Ten thus became the “base number” of this recursive system – hence the term decimal. Husserl summarizes these important points, by writing that, “In this way one was led to a general procedure for the enumeration of groups, through which each larger number is already constructed in the form of a polynomial function of powers of ten” (Hua XII, 247; Husserl 2003, 262).

2.4 Language Signs

Soon after the invention of sign language and the manipulation of small tokens, Husserl concluded that conventional language signs were created and used to signify numbers. The word signs themselves and the method of enumeration with word signs; however, did not somehow stand apart from enumeration with fingers and tokens. Instead, the latter serves as the foundation for the former. Husserl writes that the way in which enumeration was developed with the word signs, “was not merely a “fortunate move”, but rather was a necessary consequence of the further development of counting with fingers” (Hua XII, 250; Husserl 2003, 264). How is this the case? On the one hand, the first several word number signs were, “a mere translation of finger numbers into word numbers” (Hua XII, 246; Husserl 2003, 261). The first finger was translated into 1, one finger and one finger was translated into 2, one and one and one finger was translated into 3.

On the other hand, the *method* of enumeration was a direct working out of the *method* of enumeration with fingers. We know that when the ancients finished counting with both hands, they would set aside a mark and begin again. This starting over at ten established that number as the base number of the system. That is, it established the recursive decimal system. Because that base number was already established, when ancients began to enumerate using word signs, they counted in a recursive manner and often employed ten as the base number for their system. When they reached

ten number words and wanted to add one more item, they also would begin the process over. This time; however, they did not add a mark to the side to signify that the first ten digits had been run through, but rather placed a “1” in the tens column to show that the first ten numbers had been counted. That is, they took the “names for the numbers up through ten” and formed the higher numbers “through the mere combination of these” (Hua XII, 248; Husserl 2003, 262). In the same way, when ten tens were counted out, the ancient mathematicians, following the established decimal system, began the sequence again after placing a “1” in the hundreds column.

2.5 Mechanization

Husserl concludes that the transformation of the decimal system from the use of fingers and tokens, to that of language did “facilitate and simplify counting itself” (Hua XII, 248; Husserl 2003, 262). He states that, “Through these modifications, enumerations would become more cohesive and systematic and simultaneously independent of sense perceptible instruments other than words” (Hua XII, 248; Husserl 2003, 262–263). As a result of this simplification, Husserl claims that the mechanization of enumeration became possible. Because the decimal recursive system made it so effortless to generate the number language signs, “as soon as the systematic was mastered through practice, the mental process of concept formation automatically had to vacate the field to the external reproduction mechanism of name formation” (Hua XII, 250; Husserl 2003, 265). Husserl outlines two ways in which the linguistic decimal system allowed for this mechanization – which is the fifth stage of development – to take place.

First, this linguistic decimal number system, which is an extension of counting with fingers, allowed for language number signs to be easily brought to consciousness. Concerning generation of these signs, I do not have to memorize ten thousands distinct signs to be capable of counting to that large sum. Instead, I only must remember 10 number signs (0–9) and continually implement them in the recursive manner.¹³ Second, the decimal system, which employs words, allows for the

number signs to signify in a univocal manner, such that enumeration can be trusted – and does not have to be checked (or double checked) by some other means. The ancients were assured that the smaller numbers signs signify in an unambiguous manner, because they set them up in such a way that they have a one-to-one correspondence to their authentically presented numbers. By continuing the formulation of number signs according to the established recursive method beyond those that have authentically presentable numbers, the univocal link between the sign and its number is maintained, where each higher number sign continues to have a one-to-one correspondence to its number.

With these ideas in mind, it is possible to understand Husserl's brief historical outline of the mechanization of enumeration. He first writes, "Originally one counted by a mental action, picking out of the group one member after another: one, one and one is two, two and one is three, and so on" (Hua XII, 250; Husserl 2003, 265). During this enumeration, the ancients experienced those signs as surrogates for their number concepts. After one had learned the numbers 1-9 – by following the recursive decimal pattern, it became easier and easier to generate the number signs. Ultimately, our forbearers could mechanically or 'instinctually' count through the numbers without experiencing them as signifying their concepts, that is, without experiencing their conceptual content. Husserl writes that after long practice, "one counted mindlessly, so to speak, or mechanically, by following out the sequence of names ... without any reflection on their conceptual signification" (Hua XII, 251; Husserl 2003, 265). This led to a further simplification, where the ancestors did not have to sequence every number, by picking out one member after another ($1, 1 + 1 = 2, 2 + 1 = 3$), as this sequence was rather "abbreviated into the sequence of terms 1, 2, 3 ..." (Hua XII, 251; Husserl 2003, 266).

To conclude this section of the essay, I note that, during his genetic-historical analysis, Husserl does not discuss any further steps of the development of arithmetic, which would have occurred after the ancients had formulated the language decimal number system. Most noticeably, he does not

investigate the mechanization of arithmetical calculation, whereby one follows the rules of arithmetic to calculate without any reference to the concepts. He simply mentions that with the development of the “Indic system, [the number signs] first assume the character of a logically perfect instrument of arithmetic, but also of an instrument which originated through scientific reflection” (Hua XII, 252; Husserl 2003, 266). The fact that Husserl does not discuss this development is in line with the goals of this passage from PA, because he asserts that he only seeks to clarify the historical evolution of the number system and is not accounting for the genesis of contemporary arithmetic calculation here.

3. The Fusion Points with Husserl’s Mature Investigations

As stated in the introduction, I conclude this essay by revealing the fusion points between Husserl’s early examination of the historical development of the number system and his historical analysis of the generation of physics and geometry from KW and UG. I discuss how Husserl’s analyses from the early 1890s already provided him with many of the tools and insights necessary to conduct his final genetic-historical examinations. In other words, I will demonstrate that Husserl’s methodology is similar during both time periods and I show that the results of his studies of historical genesis are analogous. Finally, I briefly discuss how these conclusions challenge the standard reading of Husserl’s philosophy and thus require a rethinking of the development of his phenomenology.

To reveal the methodological similarities between the works arising from the distinct periods of Husserl’s life, we first remember that, in LZ and PA, Husserl was not concerned with discussing the factual historical developments of the number system. Instead, he disclosed the essence of the historical emergence of the number system. Husserl adopts a very similar methodology in KW and UG. In these final writings, he is not interested in conducting intellectual history. If Husserl were doing so, as David Carr writes, “he would seem to share the

ontological commitment of the 'natural attitude' involved in all normal historical inquiry by his own accounts, i.e. the concern with men who actually existed" (Carr 1970, xxxii). Rather, Husserl is – as he was in his early works – seeking to uncover the *essence* of the historical development of the sciences, here physics and geometry. Even when he investigates the insights of, for example, Galileo and Thales, he is not examining the particular historical details of their discoveries, but is rather analyzing the insights of those thinkers as *examples* of the historical development. In UG, Husserl writes, "For, as will become evident here in connection with one example, our investigations are historical in an unusual sense, namely, in virtue of a thematic direction which opens up depth problems quite unknown to ordinary history ... Our problems and expositions concerning Galilean geometry take on an exemplary significance" (Hua VI, 365; Husserl 1970b, 353). By studying those thinkers as examples, Husserl's late analysis remains focused on determining the essence of history and does not engage in a study of factual events.

More importantly, in his final writings, Husserl executes his investigation by taking up and revising the idea, which guided his analysis of history in LZ and PA; namely, that the number system was generated by means of different psychic discoveries, which compound on each other over the course of time. In those early texts, he concluded that after the first and simplest kind of sign had been learned and often employed, the next and more complex kind of sign in the series could be discovered. Even for the early Husserl, the number system did not present itself to the ancients (and does not present itself to us) in a pre-formed manner, but rather manifests itself as the production of the psychic activities of distinct individuals, whose discoveries became maintained by future generations. In alignment with this, Husserl writes in UG that, "These sciences are not handed down ready-made in the form of documented sentences; they involve a lively, productively advancing formation of meaning, which always has the documented, as a sediment of earlier production, at its disposal that it deals with logically" (Hua VI, 375; Husserl 1970b, 365). Here, Husserl is telling the reader, as Mohanty states, that geometry "is thus a

moving process. It is related to an entire generation of workers in the field sharing a common horizon” (2017, 421). With this guiding idea in mind, in KW and UG, Husserl sought – as he did in PA and LZ – to dig back up the meaning-sedimentations, which were required or essential for the development of the sciences – now, the sciences of geometry and physics. He looks to the distinct essential stages of the historical development of the sciences and reveals how the discoveries of each stage became sedimented and how individuals and communities worked from the previous stages to develop their own insights, which would in turn become sedimented. In sum, in his later writings, Husserl unearthed geometry’s “first acquisition, out of first creative activities”, and traced “one set of acquisitions to another”, thereby discovering, “a continuous synthesis in which all acquisitions maintain their validity” (Hua VI, 367; Husserl 1970b, 355).

Not only Husserl’s methodology, but also many of the conclusions of his studies from his first and last philosophical writings are strikingly analogous. I here mention two similarities. First, we remember that Husserl concluded, in PA, that the invention of finger number signs did not arise from a theoretical interest, but rather from within a pre-theoretical attitude. Finger signs were developed, because there was a need for communicating with others about, “the events of practical life, in which determinate groups of such objects played a great role” (Hua XII, 246; Husserl 2003, 260). The number of sheep and the number of arrows needed to be determined not for a science or theory of nature, but rather simply for the needs of survival. The number system was generated out of the practical needs of the pre-theoretical and everyday world of the ancients. In line with this, in his mature works, Husserl claims that the theoretical attitude of, for example, the Greeks, was preceded by and arose out of “original natural life” (Hua VI, 327; Husserl 1970a, 281). Husserl writes that natural life, “can be characterized as a life of naively, straightforwardly directed at the world” (Hua VI, 327; Husserl 1970a, 281). This world of natural life, that is, the world experienced prior to theoretical interests, is what Husserl famously called the “life-world” in KW (cf. Carr 1970, xl). The

life-world, the late Husserl concludes, serves as the context within which the sciences were and continue to be developed and is that which the sciences study and relate back to in distinct ways.¹⁴ On the basis of these similarities between Husserl's insights, it can thus be concluded that Husserl's seminal idea – that the life world is the ground for all theoretical activities – can be traced back to his writings about the number system from the early 1890s.

A second important commonality between Husserl's conclusions from his immature and final writings can be discovered by looking at his investigation of the consciousness of idealities, such as that of numbers, squares, circles, or formulae. As we know, in PA, Husserl observed that the ancients were able to become aware of the number concepts and species only after they had invented signs for them. By "constant back-reference" from the finger signs to groups of objects, the forebearers discovered the generality of the concepts and species. Moreover, the invention and employment of linguistic number signs simplified and standardized their meanings. Similarly, in UG, Husserl seeks to determine, "how does geometrical ideality proceed from its primary intrapersonal origin ... to its ideal objectivity" (Hua VI, 369; Husserl 1970b, 358)? Just as he decided in PA, Husserl now states that the invention of certain signs is the condition of possibility for the consciousness of ideal objectivities. When the geometrical ideality takes on a linguistic garb, it has the possibility of becoming an ideal object. He writes, "In advance we see that [this realization of ideal objectivity] occurs by means of language, through which it receives, so to speak, its linguistic living body" (Hua VI, 369; Husserl 1970b, 358). From these insights, we see why Husserl executes his studies of the historical development of the number system and of geometry, in part, as investigations of the development of signs. As he concludes in the works from both time periods that signs are the pre-condition of our thinking of ideal numbers and shapes, he also concludes in all four texts that it is by accounting for the evolution of sign-manipulation that he can clarify the (historical) development of the sciences.¹⁵

On the basis of the above conclusions,¹⁶ it can be made clear why the revelation of these connecting points between the methods and conclusions of Husserl's early and final historical analyses challenges the current understanding of the development of his philosophy. Simply stated, while other scholars frequently claim that Husserl revolutionized his philosophy when he executed a historical investigation of the origin of physics and geometry in his very late works (e.g. Bernet et. al. 1993, Hopkins 2011, Mohanty 1995, Zahavi 2002), the paper has shown that this is not the case. This essay demonstrated that Husserl's concern with understanding the historical inception of the sciences was there from the start. He had, already in 1890, executed a robust historical analysis of the essential meaning-sedimentations necessary for the development of the number system and – by extension – the formal science of arithmetic. He saw that the sciences emerged from the pre-theoretical experiences of the world (the life world) and from practical demands that that world placed on mankind. He had, at the very first stages of his career, realized that the sciences are the result of a historical process, which involves the psychic activities of individuals and the maintaining of discoveries over time by intersubjective communities. These insights further problematize interpretations of Husserl's works, because they seem, in some ways, inconsistent with his critiques of Dilthey, which he famously put forward in his 1911, "Philosophy as a Rigorous Science" (Hua XXV/2002). However, this is not the place to engage in an analysis of Husserl's argument against Dilthey, as it has instead been the goals of this essay to clarify Husserl's early prodigious conclusions about the historical inception of the number system and to reveal the important links those insights have to his later works.

NOTES

¹ For five being the maximum number of things one can authentically present, see Hua XII, 114; Husserl 2003, 120. For ten being the greatest, see, in the respective texts, 224/ 236, and for twelve, see 192/202.

² What exactly a concept is for the early Husserl, is difficult to determine. However, I think Willard comes closest to properly elucidating Husserl's

understanding of concepts when he claims that the notions of presentation (in his terminology representation (*Vorstellung*)) and concept are equivalent, "without interesting exception (1984, 26) in PA. According to Willard, "a concept or representation is treated by Husserl as a repeatable and shareable thought (1984, 27).

³ Understandably, the reader may be hesitant to accept my use of Husserl's later terminology during my discussion of his early works. Yet, on my reading, these terms are the only ones that would correctly convey the meaning of Husserl's historical analysis of the genesis of the number system from the 1890s. Indeed, it is a goal of this essay to show that there is little difference between Husserl's conclusions about the origin of geometry and physics from his final writings and his ideas concerning the generation of the number system from these first texts.

⁴ To the best of my knowledge, there are nine articles that discuss the tenets of LZ in some detail. These are: Byrne 2017a, 2017b, 2017c; D'Angelo 2013; Ierna 2003; Majolino 2010, 2012; Zuh 2008, 2012.

⁵ If one assumes Carlo Ierna's dating (2005, 36–40), Husserl wrote LZ immediately after composing his letter to Carl Stumpf, within which he admitted that the project of his forthcoming *Philosophy of Arithmetic*, to ground mathematics in the concept of number, was fundamentally misguided. In contrast, if one follows Willard (1986, 111–116) or Hopkins' (2002, 60–71) interpretations, he composed LZ even prior to the correspondence with Stumpf!

⁶ While there are indeed many problems with Husserl's descriptions in PA, advocating for psychologism is not one of them. Husserl clearly did not believe that numbers were mental entities. Rather, he states that the collection or numbers of objects are objective. He writes that, "the domain of numbers takes in an unrestricted manifold of species", which are "the numbers in themselves, that is, the numbers that are in general inaccessible to us." (Hua XII, 260; Husserl 2003, 275). Hopkins explains, "The collection is not an objective (*sachliche*) unity grounded in the contents of the collected things. This is not to say, however, that Husserl thought that the unity of the collection is not objective. The objectivity of its unity is never in question for him" (Hopkins 2006, 92). In line with this, Husserl concludes that the concept of number applies to the number of objects and not to the collecting act: He asserts that a concept applies to the object if the object possesses certain determinations or relations that the concept connotes. Finally, Husserl believed that the truth or falsity of numerical calculations were not relative to human psychological composition. He asserted that the truths of arithmetic were necessary truths, which could be demonstrated by the "analysis of concepts" (Hua XII, 268; Husserl 2003, 284).

⁷ Important to note is that Husserl does not claim that this is an analysis of the historical *a priori*. Instead, he asserts that he is describing this evolution "in an *aposteriori* fashion" (Hua XII, 245; Husserl 2003, 259).

⁸ Husserl calls only those signs that univocally signify and thus can lead us to assured truth and knowledge of the world in a scientific sense, "inauthentic presentations" (Hua XII, 351; Husserl 1994, 30–31).

⁹ Husserl later recognized that his use of the term “imitation” was misguided and required revision. He wrote in a footnote, “This mode of expression, although incorrect is nevertheless appropriate here, because it is suited to the mental level concerned. The psychical activities brought to bear upon sensible groups supply concepts which the more naïve consciousness regards as abstract positive moments of the respective intuitions themselves” (Hua XII, 246 n. 1; Husserl 2003, 260 n. 2).

¹⁰ Husserl even uses here an anthropological example to prove this point, stating that, “reports about counting among savage peoples confirms this” (Hua XII, 246; Husserl 2003, 261).

¹¹ This interpretation of Husserl’s theory of surrogates is fundamentally different from my reading of those signs from my previous publications. In those previous articles, I claimed that the surrogate replaces the signified object by being confused for it. As a result, I asserted that Husserl had an “intuitive theory of meaning” in his writings from the early 1890s (In particular, see Byrne 2017b, 223–226).

¹² Husserl does mention that, in some cases, it is possible to skip the second stage of sign development: He observes that a natural sign could, without further ado, become a natural surrogate (Hua XII, 367; Husserl 1994, 45).

¹³ A further development of linguistic number signs, which Husserl discusses in PA, is that it allows for one to straightforwardly compare and contrast number signs, because the recursivity is structured via columns (ones, tens, hundreds, etc.). I place a number sign in a distinct column depending upon how many amounts of tens that sign is supposed to signify. When I am then presented with two number signs, I can immediately ascertain which quantity is greater by first examining the left most column (which concerns the greatest multiples of ten) and contrast the number signs found there ($\overline{7}78 > \underline{3}41$ and $\underline{7}78 > \underline{0}78$). If this does not settle the matter, I continue comparing the number signs in the columns from left to right until I find a disparity ($\underline{6}6\overline{5} > \underline{6}6\underline{3}$) or ultimately see them as equal ($1,356 \equiv 1,356$). Concerning all of these points, see Hua XII, 256–257 and 238; Husserl 2003, 281–292 and 252.

¹⁴ In these mature works, Husserl also goes into more detail about how intersubjectivity plays a critical role in the historical development of the sciences. Because we operate within the context of the sciences, which were discovered and maintained by past thinkers, Husserl even concludes that consciousness essentially possesses an intersubjective and historical component. The thinkers of the past serve as the background of our individual and collective consciousness. Carr states that, for the Husserl of the Crisis, “The background of the past now becomes that of the social or intersubjective past, which now belongs to the individual subject by virtue of membership in a community” (2016, 161).

¹⁵ Indeed, Husserl already emphasized this point in LZ, writing that the developments of sign usage, “do not merely accompany psychic development, but rather they essentially condition it, making it possible to begin with. Without the possibility of external, enduring marks of reference as supports for our memory, without the possibility of symbolic representations ... there would simply be no higher mental life – much less, then, science” (Hua XII, 349; Husserl 1994, 29).

¹⁶ I must highlight that one should by no means read these conclusions as entailing that there are no important differences between Husserl's first and final works. Indeed, there are. To merely mention one significant example, in KW, Husserl considers his genetic-historical analysis to be an essential introduction to phenomenology, where this conclusion holds its own set of problems. In contrast, Husserl's study of the history of the number system in PA is executed as an aside; it is tangential to the overarching objectives of that book.

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