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The novel feminist diffraction concept: Its application in fifty-one peer-reviewed papers.

Diffraction is the term for a wave phenomenon that has been studied in the natural sciences since two hundred years.¹ It is currently widely employed in experiments and as analytical tool in physics, chemistry, biology and, their intersections with engineering science. Today, one also meets colleagues and students, who are interested in 'diffraction' as feminist methodology. The interest appears lively in traditional humanities and social sciences subjects as well as among scholars and students working with transdisciplinary technology studies.

What has happened in-between is that, in the early 1990's Donna Haraway initiated the development of a novel, feminist, diffraction concept. She suggested this term as an alternative to reflection as metaphor for – simply put – thinking things through.² The novel conceptualization of diffraction is yet another instance, where Haraway has brought a term from science and technology to feminist and gender studies. In 2007 Karen Barad made Haraway's invention one of the major themes in her book *Meeting the Universe Halfway* and her work has supported the continued interest in the concept.

Having studied and worked with wave theory and some of the range of analytical applications developed from it, I find that the novel terminology requires some amount of dedicated attention. From an interdisciplinary point of view, there is a difference between this transfer and other examples of Haraway's influence along the line of interdisciplinary feminist re-conceptualization. While particularly the cyborg figure – the *cybernetic organism* – already in its mainstream scientific-technological scope involves both fantasy and innovation, the term diffraction is in its conventional meaning descriptive. It merely represents an understanding that 'under such-and-such circumstances waves behave like this-and-that'.

The question has thus appeared, of how to relate to this novel concept. It seems to bounce back and forth, to and from various disciplinary directions of feminist and gender studies, gaining new forms and meanings on the way. Thinking this through has become a dimension of relating in a contemporary manner to feminist theory and debates – in one's teaching as well as research. It is not evident how one might understand the new concept and the possibilities to communicate around it.

Notably, my driving force is the need to relate to what evolves collectively, as part of the interdisciplinary exchange within the realms of feminism and gender studies. Unless students and colleagues had repeatedly brought the concept to my attention, I would have passed it by. The challenge implied thus points to the broad strokes of how the novel diffraction concept is taken in use and, how this use is motivated. Such a focus has a value of its own. By no means is it interchangeable with studies of the key texts behind the concept.

¹ This recount takes Thomas Young's experiments in 1801 as the starting point.

² Though metaphoric uses of the term diffraction are and were in use independent of and before Haraway's feminist interest in the term, the development of the feminist concept has gained a distinct collective character only after her introduction of a feminist utilization.

Wave phenomena as conventionally understood³

It is not trivial to discuss wave theory in interdisciplinary contexts. Rather typical in physics (and chemistry) is that there can be several models for explaining how approximately the same aspects of the world functions. These differences have to do with the effects to be explained, and the depth of insight among the audience that the explanations are directed to. This article applies the same description depth as is applied in the literature that this inquiry targets. Approximately this is a type of content that is introduced at the secondary education level.

Diffraction, as conventionally defined, is one among a number of wave phenomena. Generally in wave phenomena, as understood in the natural sciences, the surface of the medium that a wave hits and the media it travels through are parameters, besides the character of the waves and the angle of incidence. Thus, as understood in physics, an object that is visible to us, is so because when light impinges on its surface a part of the light gets reflected – if the object is a mirror as much as 95%. The remaining part gets absorbed or transmitted. Depending on the parameters, the wave might mainly pass through the medium (as sunlight through a glass window) or, for instance, be partly reflected (as sunlight on a leaf), or almost completely reflected. When a wave passes from one medium to another, it changes direction. This is known as refraction. In case the wavelength is in the order of magnitude of an obstacle, the waves spread out after passing the obstacle. This is known as diffraction.

To conclude, ‘interference’ should be mentioned. Conventionally, the term stands for the same as the word suggests: waves interfering with each other. Given that they are similar enough, where they meet waves either create a more intense wave together, cancel each other, or anything in between. This is the background to the so-called diffraction patterns that are central in the novel concept. X-ray diffraction analysis uses exactly this phenomenon. When X-rays impinge on a crystal, the well ordered atoms in the crystal diffract the X-rays, leading to formation of specific patterns based on the geometry of the atoms. X-ray diffraction can be used for a variety of interesting phenomena. For instance, the distance between atoms in a crystal can be measured. Interference is also of interest for other purposes, for instance in acoustics.

Representations, metaphors and their utilisation⁴

Discussing diffraction with colleagues and students in social sciences and humanities, the thought is near at hand, that the interest in the concept of diffraction essentially refers to its capacities as metaphor. The two diffraction concepts – the conventional and the novel feminist – can at least as a start, be understood as respectively a representation and a metaphor.

Natural science can be distinguished by its systematic interaction with the material constraints and opportunities of nature (Keller 1992). Meshing of representations with opportunities offered by material reality leads to what Keller labels ‘effective knowledge’. This is characterized by that it generates epistemological and technological success. “[N]o representation can ever ‘correspond’ to

³ Thanks to Karin Habermehl-Cwirzen who took time to discuss the diffraction topic with me, and gave input on how to position a description of wave theory. Thanks for advice also on matters such as my overall approach to the retrieved material. For any misunderstandings and mistakes in this text I am personally responsible.

⁴ Thanks to Fredrik Sjögren for valuable input regarding the use of interdisciplinary metaphors in gender studies, and for taking time to discuss the investigation along the way. The interpretations of the insights he shared are of course mine, why he cannot be blamed for any shortcomings.

reality. At the same time, however, some representations are clearly better (more effective) than others” (5).

Wave theory with its representations of diffraction and other phenomena, is one such epistemologically and technologically successful representation that in Keller’s terms successfully meshes with opportunities offered by material reality. The human knowledge about DNA, for instance, is closely connected to X-ray diffraction analysis. Nevertheless, success is an ambiguous term. Having the means to steer, Keller argues, does not mean that the direction taken is undisputable. Neither laboratories nor the results that they produce materialize beyond domination, competition over resources and struggles over knowledge and human identity. This includes the mapping of DNA, and this is something of which feminist scientists are aware. (See, for instance, Keller 2000; Shiva, 1989.)

For whatever achievements in gender studies that scholars from the natural sciences and engineering may have reached, we are in debt to the social sciences and humanities. Virtually all their sub disciplines have, at some point been engaged. In sum, they help us to grasp what it means that ‘natural science’ and ‘technology’ is produced by people who are situated in circumstances that are historically, socially and culturally specific. As an example from the investigated material, Jackson (2014) investigates impact on animal behavior research. She observes that female traits were noted in early animal-behavior scripts but were not systematically studied like the male traits were, and that ethology attended to female signals before sexual-selection studies did (738).

Be it guided by subconscious inclinations, strategic choices or convenience, in Academy metaphors are common, and it is common to lend concepts from one area to another as metaphors. Without metaphors much progress of thought would be difficult to articulate and, it is not always given where metaphors end and subject knowledge begin. But, West and Fenstermaker’s (1995) warnings can be recalled. They note that mathematical metaphors are common in gender studies. Gender, race and class are sometimes expressed as additive categories they note, and in other cases as linear axes that cross each other’s paths or, say, concentric figures. But, metaphors induce theoretical consequences that need be considered. West and Fenstermaker maintain that authors tend to leave the consequences without notice and thereby, neglect to assess the full implication of their metaphor choices. However, the main shortcoming of the mathematical metaphors in feminist thought, they argue, is their superficiality. They can be engaged without challenging the roots of social inequality, as they do not say anything about what produces them.

A discussion on relations between metaphors and representations in different feminist endeavors is part of the overall development of feminist involvement in technoscience. Where has the application of the novel concept brought the common effort? Is there something more to be derived from the interest in the diffraction concept, or is it merely a passing vogue?

The investigation and the presentation principles in this paper

Fifty-one papers from peer-reviewed journals are included in the material investigated in this paper. They are published from 2001 to June 2016, and identified through a conventional literature search using a set of well-known search engines.⁵ The academic publication procedure functions as a selective grid and, the search engines are selective as well. Thus, the material cannot be assumed to represent a complete exposé of the novel concept. Nonetheless, articles published in the traditional type of scholarly journal are likely to express and, after publication be incorporated among

⁵ For significantly contributing to identifying a search strategy thanks go to University librarian Lena Hansson, Luleå University of Technology.

understandings that circulate. Thereby, a standard procedure literature search gives, if not complete in any case relevant information for the purposes of the investigation.

In Web of Science (WoS) the combination of the search term 'diffraction' with 'feminis* OR gender' rendered seven applicable results.⁶ Scopus gave additionally 22⁷ and, from Ebscohost another 22 unique titles were retrieved⁸. Eighteen applicable papers appeared in more than one database.

The study included repeated steps of reading, word search, and documentation of draft impressions that were elaborated bit by bit. It has not been a purpose to produce a 'typology'. However, to make the statements made in the article open for investigation, they are accompanied by quotes and references from the material. They are intended as examples or indications towards the analytical process.

All relevant articles retrieved refer to either Haraway (for instance, 1992, 1997), Barad (for instance, 2007, 2014) or, in most cases to both.⁹ Barad, in turn, is explicit about fetching her feminist notion of diffraction from Haraway. A hypothesis could have been that exclusive reference to Haraway occurs among the earliest articles only. However, also more recently published articles refer to Haraway exclusively.

Some search results were in relation to the purpose of this investigation 'accidental'. They are not presented here. Especially in the WoS material, diffraction and gender often occurred together in settings where conventional diffraction methodology had been used for research in its conventional sense. In WoS, this was more common than the feminist scope. The topic could for instance be medicine. Furthermore, the investigation is limited to journal articles in English.¹⁰

Introduction to the role of diffraction in the papers

The texts retrieved through the literature search, represent many academic subjects and the topics addressed vary substantially. A sample of key words and subject terms, as given for the respective publications can illustrate this: *activism, aesthetics, archives, articulation, auto-biography, autism, biodiversity loss and extinction, childhood sexual abuse, data analysis, disability, discrimination, education, feminist women writers, IT design, journalism, letters, migration, museology, new media art, neuroethics, prototyping, race, sexuality education, science, social movements, teaching,*

⁶ Iovino (2015), M'charek (2010), Sefyrin (2012), Tamboukou (2014), Taylor (2016), Van der Tuin (2011, 2014).

⁷ Additional to articles retrieved in WoS also: Allen (2015), Bergsdóttir (2016), Cameron-Lewis (2016), Dejmanee (2016), Handforth & Taylor (2016), Juelskjaer (2013), Lather (2012), Lenz Taguchi (2013), Lenz Taguchi & Palmer (2016), Levy et al (2016), Nikoleyczik (2012), Phillips & Larson (2012), Pritchard & Prophet (2015), Prophet & Pritchard (2015), Schneider (2002), Sefyrin & Mörtberg (2010), Sherfinski & Chesanko (2016), Spector (2015), Tamboukou (2015), Whitesel & Shuman (2016), Wolfe (2017), Zavos & Biglia (2009).

⁸ Additional to articles retrieved in WoS and Scopus also: Charteris (2014), Buell (2010), Campbell (2004), Egeland (2004), Frykenberg (2015), Hayward (2012), Henderson et al (2014), Hird (2009), Hughes & Lury (2013), Jackson (2014), Kirby (2001), I'Anson (2010), Mazzei (2013), Nicholas (2001), Norris (2006), Phillips & Larson (2013), Rautio (2013), Roosth & Schrader (2012), Rouse (2009), Smith (2012), Taylor & Iverson (2013), Yusoff (2012).

⁹ Totally forty-four articles includes references to works by Haraway and forty-two to works by Barad.

¹⁰ In WoS two articles in Chinese with applicable use of the diffraction term were retrieved (Choi, 2007; Yu, 2004) and one in German (Hoppe & Lemke, 2015). All have abstract and list of references in English.

technological innovation, women's rights. A complete list would be longer but, already as is this extract demonstrates something important about the novel diffraction concept, namely that it has been taken up for deliberations on highly diverse topics.

Within the material, 'diffraction' is indeed explicitly described as a metaphor.¹¹ Yet, apparently, there is more to the feminist diffraction concept than briefly understanding one object through another. It is above all, described as encompassing methodological instructions.

A predicament that follows from the material's opulence, is the difficulty it creates to compose a general presentation. However, to make the results of the investigation clear, it is enough to indicate it at a principal level. Among others Sefyrin (2012) articulates her conceptualization in a manner that is accessible also for non-experts. It is thus suitable to present some basic steps in her argumentation to illustrate how the novel feminist diffraction methodology can be interpreted.¹² First, she introduces diffraction as metaphor and, explains how she generally interprets it:

If diffraction is understood as a metaphor for research, the empirical material is the light, and the slits in a screen are research practices, such as the practice of formulating the purpose and research questions of an article, practices for gathering empirical material, the situatedness of the researcher, the choice of theories and the methods, and the format of the text. Hence if these are changed, so does the interference pattern that is the result of the diffraction. (715)

Sefyrin also explains in more detail what this means in her research. She has:

[U]sed diffraction as a method to ask for several stories, interpretations, angles, or perspectives, and to look for complexities and richness in the empirical material, for several layers of meanings and realities. More specifically, this meant that I looked not only for the dominant story of women's absence or marginalization in the IT design project (Sefyrin 2010) but also for counter stories; that is, how they were participating. This meant looking deeper than professional positions, into practices of how actors came into being as specific actors in the various project contexts. (715)¹³

Sefyrin's notions are not unique in the material. Still, the variation is considerable. She proclaims a kinship with Foucault and Law (715). However, as format, critique directed to perceived standard procedures in the respective authors' own subjects are more usual than declarations of resemblance.¹⁴

Diffractional reading is described as the methodology used in seventeen of the papers. Often, this is in accordance with a development by Barad (2007) that, as described by the authors, implies reading texts or works of art, through one another.¹⁵ Cross-reading, in a general sense, is one of the fundamental techniques for academic advancement, so this can be recognized as a variation of a

¹¹ See, for instance, Pritchard and Prophet 2015:6-7; Buell 2010: 334; Spector 2015: 448.

¹² For similar examples but where the methodological 'instructions' are interpreted into other subjects see, for instance, Cameron-Lewis (2016: 493), Schneider (2002), Sherfinski & Chesanko, (2014: 26).

¹³ Among other Nicholas (2001) describes a similar scope.

¹⁴ See, for instance, Schneider (2002).

¹⁵ Among others Lenz Taguchi (2013, 1103) refers to Barad as the source for this method.

familiar theme. With the diffractive reading concept, not least traditions from the humanities come forth, and an attention to emotion as an instrument of being, knowledge and cognition.¹⁶

The few papers that concern areas where diffraction analysis in the traditional sense are applied, do not however investigate such properties. Nikoleyczik (2012), as one example, presents suggestions for how gender studies knowledge can contribute to neuroscientific research. Here, the novel feminist concept provides a frame for the different suggestions that she presents. This is completely logical. Conventional diffraction analysis would not have been of help for arriving at such ideas, only communication among people. Over the years, they have been developed within the feminist community.

Only scholars within the individual subjects themselves can make genuine assessments, of the capacity added by the feminist diffraction metaphor, to the range of subjects where it is applied. From asking *how* the papers' authors have used the novel concept the investigation continues with asking *why* they did it. What do the authors themselves state that they seek and find in the novel concept?

The feminist alternative to reflection and its capacities

In thirty-four of the fifty-one papers the word 'reflection' occurs. The diffraction metaphor, as introduced by Haraway, takes stance in an opposition to the long established concept of reflection that refers to cultivated thinking and commonly is used for examination and contemplation. In her article *Interventions in a cat's cradle* Egeland includes a quote which expresses the core of the novel feminist diffraction concept, as it unfolds in the material studied. It pinpoints the problem identified in the established metaphor 'reflection' and lists the attributes sought after:

Diffraction patterns record the history of interaction, interference, reinforcement, difference. Diffraction is about heterogeneous history, not about originals. Unlike reflections, diffractions do not displace the same elsewhere, in more or less distorted form thereby giving rise to industries of metaphysics. Rather, diffraction can be a metaphor for another kind of critical consciousness at the end of this rather painful Christian millennium, one committed to making a difference and not to repeating the Sacred Image of Same. (Haraway 1997: 273, cited in Egeland 2004: 90)

Reflection reproduces 'the same'. It makes no difference. Nicholas (2001:52) continues on Haraway's thought as to why diffraction is a feminist choice, namely "if this emerging culture is to do anything other than replicate or intensify current social practices of inequality."¹⁷ What the one is, the other is not.

Though the term reflection does not occur in seventeen of the fifty-one papers, it should probably be kept in mind that the silence can result from that the diffraction-reflection opposition is seen as given. It might not in all cases be regarded as unimportant. Still, looking at the face value, a fair share of authors do not pay the opposition to reflection any attention at all.¹⁸ A few other do as Haraway

¹⁶ See, for instance, Charteris (2014), Tamboukou (2015).

¹⁷ In additional papers mirror, mirroring, and so forth, is used in accordance with Haraway's metaphor as an opposite to diffraction. It showed difficult to quantify this use, though, with a basic word search.

¹⁸ Whitesel and Shuman (2016), for instance, put diffraction in the forefront as the methodological key of their investigation but, pass the opposition to reflection without attention.

has actually done herself in her diffraction texts, and mix the common and novel use.¹⁹ Nonetheless, a main function of the reflection concept is that through discarding reflection as insufficient for feminist purposes authors create momentum for diffraction and thereby in their investigations. The reason tends to follow Haraway's closely. For instance, Smith (2012, 332) writes: "Unlike reflections, which purport to mirror reality, diffractions describe interdependency and disruption as well as continuity."

Another main stream is *materiality*, the ambition to incorporate that there is power in all presence, animate as well as non-animate. Writes Bergsdóttir (2016):

When it comes to materiality, the main concerns of current feminist theorizations, such as post-human feminisms and material feminisms, are re-workings of feminist frameworks that can encompass human and non-human matter, in ways that are capable of recognizing their agency. (128)

Where this perspective is emphasized, the ability to achieve its' ends is depicted as a capacity, consequence or, quality of 'diffraction'. As a typical example, in Jackson's (2014) explanation of the diffraction concept she involves conventional diffraction analysis (as described by Barad) and engages the hierarchical opposition diffraction-reflection. Thus, she determines the merits of the feminist diffraction metaphor-methodology:

Barad argues that reflective metaphors overemphasize culture and thus disempower nonhuman nature as a "passive and immutable" medium waiting to be read and discovered by active science. (742)

[Barad] utilizes diffraction because, unlike mirrors or reflective tools, the structure of the diffraction grating used in the experiment (specifically the number of slits) affects the pattern produced. (742)

It seems reasonable to think of two alternative approaches to the novel diffraction concept. The diffraction metaphor can probably be perceived as a useful instrument, without further reference to other wave phenomena or wave theory of any sort. For instance, Sefyrin's (2012) description of her use of the concept follows the standard introductory description of a diffraction experiment closely and, this type of connection to an easily understood principle may well, for some researchers, be enough in itself. In parallel, among the papers investigated, there is a stream of insistence on deeper, or perhaps wider, congruence with wave theory.

Insistence on congruence

Wave theory can help to construct and calibrate an X-ray diffraction instrument but not to handle sexuality education, activism or journalism. Achieving uniformity is not a goal in itself, between the conventional and novel concepts, between the theory of waves and its implementations – where diffraction is one of the phenomena studied – and the metaphorical use that takes stance against another metaphor – reflection – and for which knowledge development is the object of study. Still, physics is important in the rhetoric and the script is quite confusing.

In the material overall, while the term metaphor is explicitly used, authors also claim that there is an interdisciplinary connotation, in fact, that their metaphor is authorized by representing knowledge

¹⁹ For use of the term reflection in its more common sense see, for instance, Charteris et al (2014, 106), Levy et al (2016), Handforth & Taylor (2016:628).

from the natural sciences, and connect to observation and theoretical explanation of nature. The following quote, is one example of how all these, and additional, elements can come together:

We conduct a diffractive reading of ALife practice and Barad's agential realism [2] in order to move beyond thinking of the disciplinary domains of science, theory, and art as separate, and rather to see them as entangled, that is, retaining difference, variation, and heterogeneity. Donna Haraway [19] suggests that the metaphor of diffractions can be a useful counterpoint to reflection. Both are optical phenomena, but whereas reflection creates a mirror image, or a copy, diffraction attends to patterns of difference. As Lynne Keevers and Lesley Treleaven explain, diffraction produces the spectacular colours and rings sometimes seen around the moon. These rings cannot be attributed to the moon or the clouds but are produced through the intra-action of the moon and the clouds" /.../ Rather than producing something to be known, diffraction examines the entangled state of knowing and being in the world. It records the history of material-discursive entities, not as reflections that end up as categorizations, but as a passage. (Prophet & Pritchard 2015: 334)

The exact term *physics* is used in half of the papers, in all cases in descriptions of and advocacy for the feminist diffraction concept and methodology – its frames, qualities, and means for inquiry. The term *physicist* appears in one fifth of the papers – in all cases referring to Barad. In addition, where the exact term 'physicist' is not used, wordings such as 'Barad's training in physics' are common and appear in additional papers. A quote from Tamboukou (2014) effectively captures much of the instances that tend to be engaged: "Being a physicist as well as a feminist theorist, Barad is scrutinizing diffraction as an optical phenomenon in not just classical physics but also in quantum physics" (621). Barad's training, and specifically in quantum physics are recurrently pointed to as being of consequence for the workings and merits of the feminist diffraction methodology.²⁰

It is very much in this insistence on congruence between the novel metaphor-methodology and the conventional wave theory that obstacles rise, against seamlessly joining existing creative debates (as was a feasible alternative with the cyborg concept).

Incongruence: waves

When Haraway introduces the novel concept, she writes about diffraction as mapping and recording: "Diffraction is a mapping of the interference, not of replication, reflection, or reproduction" (1992: 300)²¹, "Diffraction patterns record the history of interaction, interference, reinforcement, difference" (1997: 273)²². These descriptions, it appears, are intended to recount so-called diffraction analysis, where interference patterns are produced, through diffraction, and utilized for analytical purposes. Only that the order is turned. In Haraway's words, if taken literally, diffraction detects interference.

Descriptions with focus on demonstrating the principles of interference are common in presentations of the feminist diffraction concept. Rather than diffraction, the phenomenon that Haraway puts in opposition to reflection and suggests as the new feminist metaphor is interference. Likewise, to judge from the fifty-one papers studied, in the collective construction of the novel 'diffraction'

²⁰ Haraway's background as biologist is in no case brought up as consequential for the capacity of the feminist diffraction concept.

²¹ As quoted by, for instance, Smith (2012, 332), Hughes & Celia (2013: 792).

²² As quoted by, for instance, Egeland (2004: 90).

concept, the interest in diffraction as such is actually minor. This is one reason why the options for creating a forthright relation between the conventional and the novel concept appear limited. From training in conventional wave theory and its application in analytical methods, one might understand interference so that it appears when there is a specific relation between coinciding (superimposed) waves, irrespective of the history behind this relation. To remind oneself how much more interference as well as reflection are, than conveyed in the feminist diffraction concept, one can think of many interesting cases. Why not interferometry or, perhaps, the standard case for early physics education ‘interference caused by reflection in thin films’?

Barad (2007) defends Haraway’s concept by inducing reasons for accepting a fundamental difference reflection-diffraction. Reflection can be described with simple ‘optical geometrics’ while an explanation of diffraction requires the full theory of ‘physical optics’ (81-82). Maintaining a distinction between diffraction and interference is a ‘purely historical’ understanding among physicist that only some hold on to (28-29).

But, picking, choosing and mixing among case descriptions and explanation levels does not help. Why should it? The source of the novel diffraction concept is a moral quest for which a thought about diffraction analysis as compared to mirroring apparently seemed an illustrative metaphor. It never was made with scientific rigour. Therefore, it is a strange situation, to discuss what is correct wave theory or not, in Haraway’s concept and in the works where the novel concept is applied.

Another issue arises more directly from questions about coherence within feminist theory itself. In the midst of the strivings to acknowledge the agency of non-human matter or non-human nature, the novel concept takes a completely human-centered stance. From a human point of view, we may perceive certain types of reflections as ‘more or less distorted’ replicas, as ‘the same’. This does not make that, the objects and surfaces involved when they are produced, are more ‘passive’ than those that induce, say, diffraction. If the goal is to build capacity to encompass matter in feminist research, it does not make sense to deny more or less any agency involved in wave propagation, but that of slits in diffraction analysis experiments.

To develop a sustainable approach to the use of the novel diffraction concept, it is not solely the founding texts that are of interest but as much how they are furthered and taken in use. In the material, the faithfulness to Haraway’s – and Barad’s – reason about reflection is striking, and so is the engagement in reproducing and affirming it. This stance combined with the insistence on congruence with physics, was not the only possible direction the broader engagement with the concept could have taken. It can be noted that also refraction originally is put as an opposite to diffraction. Nevertheless, Hayward (2012) takes inspiration from Haraway’s concept when she suggests and explores refraction as a meaningful and constructive feminist metaphor-methodology.²³ Doing so, she thoroughly describes the agency of a world of surfaces as well as media and, suggests that: “the ontological status of refracted light is an irreducible nexus of enacted, active, and nonactive properties” (175). This indeed is a feminist post-humanist capacity building effort.

Notably, also Hayward lets the re-conceptualized refraction term take place alongside diffraction as a ‘better’ alternative to the ‘less feminist’ reflection (192). To find something of a discussion with Haraway and Barad, regarding the construction of the diffraction-reflection polarity, one need go

²³ As some other authors note, the wave phenomenon refraction is included in that from which Haraway differentiates diffraction. This is not taken quite so seriously as the rejection of reflection though. ‘Diffraction does not produce “the same” displaced, as reflection and refraction do’, originally found in Haraway (1992: 300), is quoted by M’Charek (2010), Smith (2012), Hughes & Lury (2013) and other. See also, for instance, the development of the topic by Roosth & Schrader (2012).

outside the material retrieved in the literature search.²⁴ Alander (2007) who in her PhD thesis employs and extensively describes the novel diffraction concept, elegantly indicates the limitations it ultimately carries, when she remarks: “it is worth pointing out that the diffraction pattern we see is a reflection” (24, *our translation*).

Incongruence: practice

The way waves behave is of no consequence for the themes and topics, to which the novel diffraction concept is applied. Therefore, it is not of consequence for the quality of the research presented in the material studied if wave theory is correctly described or not. The matter is of interest as a question of future interdisciplinary exchange for knowledge development within feminism and gender studies. To understand how to possibly contribute to the discourse, it is important to see the differences clearly and, before concluding, there are some issues to discuss that have to do with the practices of working with wave phenomena in science and engineering. Writes van der Tuin (2014: 236):

The visionary potential of diffraction makes “a mapping of interference, not of replication, reflection, or reproduction.” Diffractive mappings are not rationally made, because the productivity of diffraction comes from elsewhere.

This interpretation is not by far representative for all articles but neither is it unique. As an example, Taylor (2016:203) quotes van der Tuin on this topic. Phillips & Larson (2012) develop a similar description:

[D]iffraction is not a replication nor it is a reflection (Barad, 2007)—it is a riding of the wild and unpredictable waves, the following of lines of flight along the contorted paths of rhizomes, finding whatever “our” and “selves” might be, entangled in the phenomena we once thought we knew /.../.” (229)²⁵

When van der Tuin claims about diffraction mappings that they are not rationally made, it can be argued that this understanding applies also within natural science and technology. At least in the sense that, for any wave phenomenon rationality is a meaningless criterion. Likewise, in the core of the term ‘wave’, lies that it is generated ‘somewhere else’, so van der Tuin’s statement on that topic can represent any wave or wave phenomenon, diffraction included.

Laboratories, on the other hand, where diffraction analysis is performed, are difficult to comprehend other than as rationally produced, managed and maintained. The rationality includes but is not limited to the background in wave theory, where the behaviour of waves is predicted. By ‘rational’ is not meant ‘objective’, ‘bias free’ or in any way ideal but, the term here rest on Keller’s theory about the efficiency of natural science (1992). Achieving successful meshing with nature is an embodied and immanent matter.²⁶ It hardly is an innocent pursuit. This makes it difficult to support the imagery of ‘diffraction’ as unequivocally ‘good’, ‘free’ and ‘wild’. The way in which the materiality of physics is culturally and socially contextualized, in the production of the novel diffraction concept, presents a challenge beyond what is merely about being theoretically correct. Or rather, the issue is that the

²⁴ In effect, it is by chance it was brought to attention for this article, which brings attention to the limitations in the research method, where the construction of search engines decides the material.

²⁵ The opposition to reflection is also in Philip’s and Larson’s (2012) motivation fundamental.

²⁶ See, for instance, Myers (2006) who describes differences in opinions regarding correct procedures for X-ray diffraction. The article appeared in the search but does not fit the investigation criterion.

contextualization feminists in other instances have struggled to draw attention to, is lost in the discourse.

Discussion

As far as conclusions can be drawn from the study here presented, when approaching the novel diffraction concept, it need be understood that it is not wave theory that makes the core of the feminist diffraction concept and methodology. The core is the reflection concept representing contemplation and learned thinking. The opposition to traditional contemplation-reflection Haraway sets as foundation when introducing the novel concept is the point around which the dynamics evolve. What diffraction is, reflection is not. That far, the novel concept could be just any metaphor, like describing thinking things through as 'reflecting'.

It becomes more difficult to grasp what is taking place when descriptions, elaborations and motivations of the use of the novel concept dually imply authentication from a connection to physics and, redefine wave phenomena into forms that are not supported by the natural sciences. In the material investigated, every implementation and elaboration does not abide to the letter to each attribute in Haraway's concept. The discovery of how dominant it nevertheless has become to do just that is an important result of this study. Haraway's sketch of a mirror and a diffraction laboratory experiment is dealt with as was it a full description of wave theory, a complete representation that perfectly meshes with nature. In a fair share of the material, Haraway's invention of putting diffraction and reflection as metaphors for thinking in hierarchical opposition is literarily interpreted into physics.

This brings to the factors that interdisciplinary exchange entail. Comparing with West and Fenstermaker's views on shortcomings associated with the use of interdisciplinary metaphors, it appears that as wave theory is of no consequence for the subjects investigated, it is of no consequence for the knowledge produced how wave theory is handled. In that sense it is more important that authors' articulation of their materialist approaches correspond to the actual subject of each paper's investigation.

It can furthermore be asked to what extent and in what circumstances it is relevant to discuss congruence between the novel concept and wave theory. Striving to understand and finding a reasonable relation to the novel concept one might keep in mind that Haraway's motive for suggesting her feminist diffraction concept principally was moral. It had to do with bettering the way in which knowledge is produced. Nevertheless, it may also be asked if it matters for the development of the collective feminist capacity how interdisciplinary metaphors are treated.

As Alander gently reminds us, even if it is not how we apprehend it, most of what humans see, will see and have ever seen are reflections. What does it make to a collective knowledge effort if this fundamental factor for where we are, what we are, and how we have come to be is estranged? Does it matter if the active role is acknowledged or not, that objects and surfaces play in creating the differentiated impressions that we detect? If, in a description of a light phenomenon around the moon, it is not theoretically-ideologically possible to account for its' first condition, namely that the moon reflects light that emanates from the sun? For my part at least, as feminist engineer, it is not an option to disregard the meshing of representations with nature.

The interest in the diffraction concept can possibly provide an opening for discussing interdisciplinary relations in feminist materialist and post humanist thinking, not just for us individual scholars when talking with students and colleagues, but in the collective feminist curriculum. Difference, change, interaction, history and traces, are all there, in all forms of wave phenomena and in the many ways in which organisms utilize detection and creation of waves of all sorts, not limited to light. The novel

diffraction concept has so to speak brought them to the table. But, would the power of the novel concept be considered lost by the community that has found it effective, unless the opposition to reflection (and refraction) can be kept as its foundation? If so, would that affect the options for development in other directions?

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