

TACTILITY, SOUND AND DIAGRAMMATICS. ULTRASOUND IMAGING AS AN INTERFACE TO THE WOMB

By Nina Franz

“Emphasizing the diagrammatic aspects of ultrasound images can help to form a more complete picture of the technological and discursive components that led to the construction of the ultrasound image.”

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A law that went into effect in Texas in 2020 stated that an abortion was to be legal only before a “fetal heartbeat” could be detected. The “heartbeat” was defined as “cardiac activity or the steady and repetitive rhythmic contraction of the fetal heart within the gestational sac”¹ and made visible as a moving image on the screen of an obstetric sonogram, as early as six weeks of gestation. But the status of this image and its interpretation is anything but clear. Critics of the legislation, which in retrospect appears to be a harbinger of the momentous overturning of *Roe v. Wade*², argued that “the flickering that we’re seeing on the ultrasound that early in the development of the pregnancy is actually electrical activity, and the sound that you ‘hear’ is actually manufactured by the ultrasound machine”.³ This contestation of the legal status of embryonic cell development as “life” was only the latest in a long line of arguments that had been presented since the 1980s in feminist theory of technology, which criticized the particular impact that ultrasound imaging had on the political status of the female body.⁴ In the following par-

agraphs, I want to draw attention to the “diagrammatic” capacity of ultrasound imaging as one important denominator in the current debate on what could be described as the sonographic interface to the womb.

In her seminal work *Disembodying Women. Perspectives on Pregnancy and the Unborn*⁵ German historian Barbara Duden gives a historical account of the techniques of (visual) access to the pregnant body. Before physiological drawings, prints, models and, in the 20th century, postmortem-photography and obstetric sonography turned pregnancy into a purportedly objective process, rendering the pregnant body transparent to the outside observer, the status of pregnancy depended on the woman’s subjective judgement alone. As Duden shows by studying examples like the medical diaries of a *medicus* in the city of Eisenach in the early 18th century, a pregnancy began when the women felt the “quickening” – meaning the first movements of the fetus in her

1 Selena Simmons-Duffin and Carrie Feibel, The Texas Abortion Ban Hinges On ‘Fetal Heartbeat’ Doctors Call That Misleading. *NPR*, May 3, 2021; URL: <https://www.npr.org/sections/health-shots/2021/09/02/1033727679/fetal-heartbeat-isnt-a-medical-term-but-its-still-used-in-laws-on-abortion>, access: August 17, 2020.

2 The US-Supreme Court decision of 1972 established the constitutional right to have an abortion, it was overruled in June 2022 in a 6-3 vote.

3 Simmons-Duffin and Feibel, The Texas Abortion Ban Hinges On ‘Fetal Heartbeat.’

4 Just to name but a few: Ann Oakley, The Reign of Technology: Antenatal Care 1960-80, in: *Captured Womb: A History of Medical*

Care of Pregnant Women (Oxford, 1984), pp.155–209; Rosalind Pollack Petchesky, Fetal Images: The Power of Visual Culture in the Politics of Reproduction. *Feminist Studies* 13/2 (1987): 236–292; Carol Stabile, Shooting the Mother: Fetal Photography and the Politics of Disappearance. *Camera Obscura* 10/1 (1992): 179–205; Julia Epstein, The Pregnant Imagination, Fetal Rights, and Women’s Bodies: A Historical Inquiry. *Yale Journal of Law and the Humanities* 7 (1995): 139–162; Joanne Boucher, Ultrasound: A Window to the Womb? Obstetric Ultrasound and the Abortion Rights Debate. *Journal of Medical Humanities* 25/1 (2004): 7–19; Meredith Nash, From ‘Bump’ to ‘Baby’. Gazing at the Foetus in 4D. *Philament Journal* 10 (2007); Karen Barad, Getting Real: Technoscientific Practices and the Materialization of Reality, in: *Meeting the Universe Halfway* (Durham 2007), pp. 189–222. I am indebted to Heike Klippel for her important leads.

5 Barbara Duden, *Disembodying Women. Perspectives on Pregnancy and the Unborn*. Translated by Lee Hoinacki (Cambridge, MA 1993).

womb. Throughout the history of modern science, advances in medical imaging turned this private experience into a heavily mediated practice that took the assessment from the subjective perception of the woman and handed it over to the instruments of medical professionals, marking a shift from a “haptic-tactile to a visual-geometric”⁶ paradigm of obstetric perception. Thereby the female womb was transformed from an intrinsically private realm, defined by its categorical inaccessibility and invisibility to any outside view, to a politically contested, visually mediated “public space”.⁷

A milestone in this development was the publication of Lennart Nilsson’s seventeen photographs of the developmental stages of human embryos and fetuses in the cover story “Drama of Life Before Birth”⁸ for *LIFE Magazine* in 1965, whose eight million copies sold out within only three days. This “unprecedented photographic feat in color” portrayed the fetus sixteen and eighteen weeks after conception in its amniotic sac, completely detached from the surrounding body. Like an astronaut the fetus floats in a dark, empty space – a prototype of the detached individual that lacks any social

connection.⁹ As Duden and others have pointed out, this depiction of the fetus as completely detached from its real physical context lent itself readily to political instrumentalization. Ironically, the anti-abortion activists who later upheld the image of Nilsson’s fetus as an icon for their “pro-life” struggle were conveniently unaware that the images were taken of aborted fetuses that had been elaborately arranged by the photographer, propped up, backlit and colored to look “alive” outside of their physical context. But Nilsson’s images not only convey a false autonomy of the fetus. Duden highlights that at the same time its attachment to the placenta through the umbilical cord also presupposes the presence of a supply system, which is conspicuously absent from the picture.¹⁰ This surrounding “ecosystem” with the capacity of sustaining the life of the fetus is the pregnant woman.

While the impact of Nilsson’s photographs on public perception (and, likewise, the *perception as public*) of “fetal personhood” can hardly be overestimated, the real breakthrough for the obstetric interface came with ultrasound technology. For Duden, this difference is marked by the progression from the fetal image as “ideogram” to “diagram”.¹¹ Citing

6 Quoted from the German edition: Barbara Duden, *Der Frauenleib als öffentlicher Ort. Vom Mißbrauch des Begriffs Leben* (München 1991), p. 67.

7 This is conveyed much more strongly by the title of the original German edition than in the English translation: *Der Frauenleib als öffentlicher Ort. Vom Mißbrauch des Begriffs Leben* [The Female Womb as Public Space. On the Misuse of the Concept of Life].

8 Lennart Nilsson, Drama of Life Before Birth. *Life*, April 30, 1965.

9 Duden, *Der Frauenleib als öffentlicher Ort*, p. 29.

10 Ibid.

11 Ibid., p. 42. To quote the complete sentence (which is missing in the English translation) on the distinction between “ideogram” and “diagram”, a distinction that is also relevant for semiotic perspectives on diagrammatics: “Ich will eine Brücke bauen, die vom Hocker zum Fötus, vom Ideogramm zum Diagramm, von Frauenahnungen zu medizinischen Diagnosen führt.” [I want to build a bridge leading from the squatter (fetus in a squatting position, N.F.) to the



Figs. 1a & b: Lennart Nilsson, "Drama of Life Before Birth," cover story for *LIFE Magazine*, April 30, 1965; image excerpts.

Hildegard von Bingen, Duden shows that in the 12th century, the imagination of the fetus used to be approached through metaphors and holistic descriptions rather than analysis, "the complete opposite of anatomy",¹² the inside of the womb as a secret that awaits interpretation. In this way, the ideogram conveys through words that which is hidden in the inside of the womb, categorically invisible. The iconic semblance of Nilsson's fetus on the other hand, while heavily manipulated, is a more or less direct visual representation, while the sonographic image approximates a diagrammatic operation, in so far as it visualizes the measurements of sound waves of frequencies above the threshold of human audibility (typically 1-30 megahertz for diagnostic ultrasound¹³). An ultrasound transducer uses piezoelectric crystals to induce oscillations, which are then transmitted as ultrasound waves into the body. The ultrasound is emitted in short pulses, as a narrow beam. A grid of such beams builds a two-dimensional image. The same piezoelectric crystal acts as a receiver, converting the reflected or back-scattered pulses (the echo) into electronic signals that allow calculation of the distance to the object based on the time the beam travelled. The measurements are then translated according to machine settings into a brightness factor on the graphical screen interface, where they form the basis for the diagnostic ul-

¹² *Ibid.*, p. 43.

¹³ Elisabetta Buscarini et al., *Manual of Diagnostic Ultrasound*, vol. 1 (Geneva 2011), p. 3.

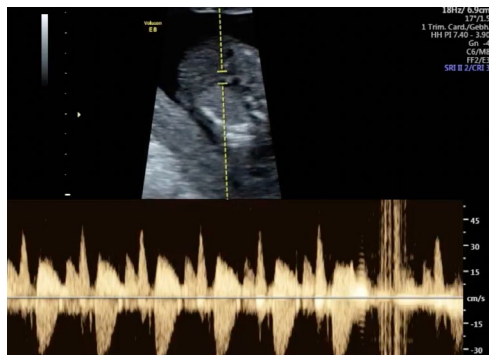
fetus, from the ideogram to the diagram, from female intuitions to medical diagnoses.]

trasound image.¹⁴ Although the resulting screen image appears to be “photographic” (or videographic) in that it depicts either the surface or a cross-section of the fetal body, still or in motion, it has to be understood as a graphic representation made up of measurements that are then pieced together and interpreted to be readable for the human eye. This *diagrammatic* capacity of obstetric sonography – as a heavily mediated visual interpretation of measured data – is lost to the recipients of these images. In the “fetal heartbeat”¹⁵ debate this has consequences for the political contestations that are at stake, namely, the establishment of the embryo or fetus as a new category of legal person, and its precedence over the legal status of the woman. At six weeks of gestation, electrical impulses in the cells that will form a functional organ only much later (at approximately 20 weeks of gestation¹⁶) are translated to a moving screen image as well as an audible sound effect by means of ultrasonography. The result is a compelling effect that, in combination with a specific discursive emphasis on “fetal life”, seems to prove the existence of a functional organ, and, by extension, the existence of an autonomous, legal subject that takes prec-

edence over the rights of the body that carries it.



Fig. 2: Ultrasound image at seven weeks of gestation, author's own archive.



Figs. 3 and 4: Ultrasound images at 14 weeks of gestation, author's own archive.

14 See *ibid.*, pp. 9–10 as well as Reinhard Lerch et al., *Technische Akustik. Grundlagen und Anwendungen* (Heidelberg 2009), pp. 587–589.

15 At six weeks of gestation the correct term is “embryo”, not fetus. To speak of a fetus here is in itself an ideologically-tinged misnomer.

16 Eleftheria Pervolaraki et al., *Antenatal Architecture and Activity of the Human Heart*, *Interface Focus* 3, 2013, pp. 1–10. I want to thank Paul Edwards for pointing out this reference.

While diagrams are defined by their capacity to convey information through visual or graphic means, often in combination with textual and numerical elements, the question has been raised if the meaning of the term could be expanded to include auditive and even tactile signs.¹⁷ Obstetric ultrasonography presents an interesting hybrid between material components that are sonar (the ultrasound wave), tactile (the piezoelectric crystal that acts as transducer and both emits and receives the sound wave, as well as literally touching the surface of the body) sonar-tactile (the interaction between womb/embryo and ultrasound), and diagrammatic techniques that present measured data in form of a topologically composition on a screen, as well as through sound, which are always accompanied and made interpretable by text and numbers. As the comparison with Nielson's fetal photographs reveals, the truth value of such images as purportedly "direct representations" is no less contestable than that of the diagrammatic representations, which, by their very nature, contain an interpretative element that is built into the technology of visualization.¹⁸ Emphasizing the diagrammatic aspects of ultrasound images can help to form a more complete picture of the technological and discursive components that led to the construction of the ultrasound image.

Karen Barad has highlighted the importance of recognizing this "relationship

between the material and the discursive"¹⁹ in what they call *agential realism*. In continuation with the long history of feminist discourse on ultrasound, their chapter on "Entanglements and Re(con)figurations"²⁰ in *Meeting the Universe Halfway* (2007) puts a critical focus on the images of obstetric sonography and uses the piezoelectric transducer as the prime example to illustrate what they describe as the "intra-action" between observing subject, technology, and the object of observation. According to Barad, "the piezoelectric transducer is [...] the machine interface to the body"²¹ and "the marks on the computer screen (the sonogram images, sonic diffraction patterns translated into an electronic image) refer to a phenomenon that is constituted in the intra-action of the 'object' (commonly referred to as the 'fetus') and the 'agencies of observation'". If we follow Barad, putting the focus on the numerous tactile, sonic, visual and discursive elements that produce the diagrammatic image of the fetus/embryo reconfigures the interface to reveal an "intra-face"²² of the womb. This makes it impossible to think of "unborn life" as an isolated entity, but puts forward the idea of an entity that is quite literally entangled with the physical reality that surrounds it.

19 Karen Barad, *Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning* (Durham, 2007), p. 191.

20 Barad's chapter on Ultrasound inspired Aleksandra Domanić's work for her exhibition "Becoming Another" (September 16 – October 21, 2021, Audemars Piguet Contemporary, Berlin), which in turn inspired the research for this article, along with a new series of images by the artist (in this issue, pp. 51–67).

21 Barad, *Meeting the Universe Halfway*, p. 202.

22 Ibid. 201.

17 Roland Posner, *Diagrammatische Zeichen, Einführung. Zeitschrift für Semiotik* 31/3–4 (2015): 213–229, here 215.

18 Cf. Johanna Drucker, *Graphesis. Visual Forms of Knowledge Production* (Cambridge, MA 2014).

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