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ABSTRACTING OTHERWISE:

IN SEARCH FOR A COMMON STRATEGY FOR ARTS AND COMPUTING

"Abstraction" in digital culture and in the arts is a contested term. As a technical concept in computing, it refers to the process of managing complexity through modeling and selective hiding or condensing of information and plays a key role in the development of software and computing architectures. In the arts, particularly in the West, abstraction is intertwined with histories of image-making, from the medium of photography to the movement of Impressionism and beyond, and it is often posited within a (false) binary of abstraction vs. representation. In the Western arts canon, abstraction after the invention of photography also tends to exclude certain artists that are marked as not artists, such as self-taught artists, women artists, craft artists, disabled artists, POC artists, and other others.[1] *In the digital culture, abstraction invokes the move away from matter and corporeality. Characteristic of the Western rationality, while also knitted into the understanding of the digital itself, it thus can be said to similarly reproduce the exclusion of those who were seen as too corporeal, too particular.*[2]

Our own thinking on abstraction is the result of a slow burn of working through translations and attempting to find a common language between our different disciplines. Translations between us necessarily take place in and between our modes of praxis, namely, critical-theory-informed analysis of computing and collaborative interdisciplinary art-making. In our work together, we began

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experimenting with thinking from our fields about the potential of abstraction as a strategy for composing a plane of relations and intensities—of doing abstraction differently. In this experimental, thoughts-in-progress text, we reflect on different discourses that we inhabit and attempt to propose some intersections where a common vocabulary could be formed.

Relying on trans*feminist, critical computing, new materialist perspectives as well as relational ontologies, we approach abstraction between arts and computing and investigate its potential through a theoretical lens stemming from the aforementioned bodies of thought as well as our own practices. By situating abstraction in the histories of Western science and philosophy, as well as the history of Western painting, we are exploring how this term can be reconfigured and rethought in a way that would leave space for imaginary and configuration of unexpected elements, while maintaining responsibility in its construction and refraining from erasure, straightforward extraction, or disappearing peoples.

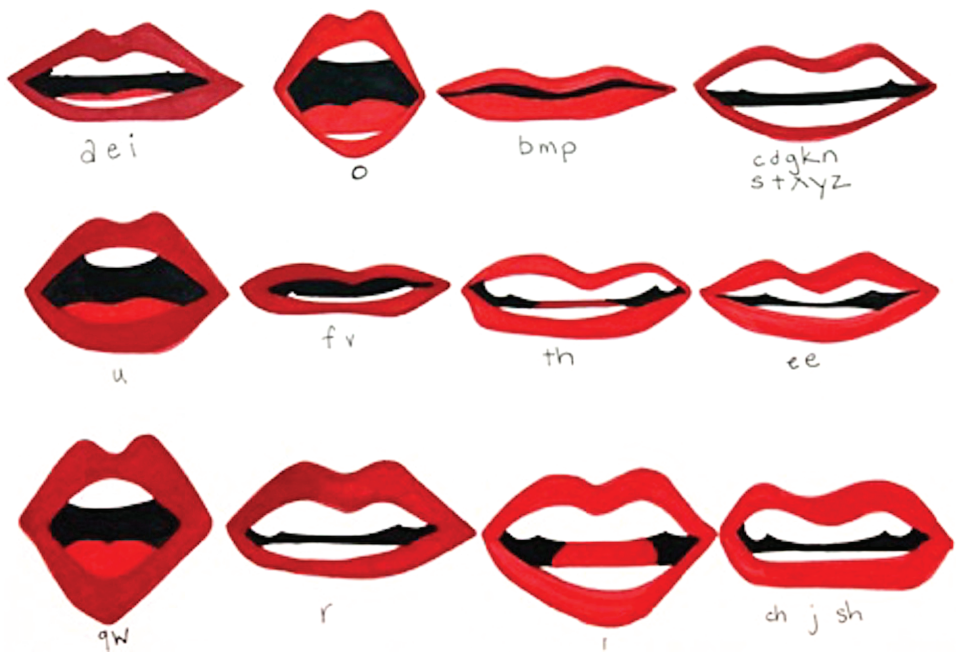

Figure 1.
Loren Britton, Mouth Translations *(2019). Marker on paper (23.4 × 16.5 in.). Courtesy of the Artist, Share Alike.*

Our work engages intersemiotic translation as a metaphor for how to think between disciplines, understood as the act of translating one language to another while keeping in mind the political and culturally embedded process that can impact both the originating and receiving cultures.[3] Intersemiotic translation often carries a source text or artifact across the sign systems and creates a likeness between different cultures. This approach recognizes that there are multiple possible versions of source and target texts and can help inform why there may be preconceptions or biases embedded in any translational work. This is a kind of translation that attempts to remain accountable to its source and destination by giving a network of reference points spoken, physical, and cited to form the way that thinking is constructed.

Our starting point for experimenting with assembling a common ground begins with the question: What are the connections between concepts that operate in different disciplines—such as "abstraction" in computing and in the arts? How does abstraction (computational/artistic) relate to matter and matter-reality? What kind of implications does this have for arts, and what kind of political potential can it open up? In investigating these questions, we suggest to rethink abstraction as a process of production and manipulation of trans*re*lationalities. Taking theoretical thought as a meeting venue for our collaborative questioning, we introduce the trans*re*lationality as a new concept that entails coagulation of the terms *transing*, *translating*, and *relating*, and discuss its theoretical inheritances. Finally, we propose that rethinking the process of abstraction as a matter of composing and modulating trans*re*lationalities allows abstraction the potential to inform possibilities of doing and thinking toward sustainable politics. We hope to invite the reader of this text to think with us on how we could abstract otherwise.

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COMPUTATIONAL ABSTRACTION AND ITS DISCONTENTS

In the most colloquial terms, abstraction in computing could be described as removing or hiding information that is irrelevant for a given problem while

preserving only those aspects that are relevant or essential for a specific task or process at hand.[4] Taught as part of a "computational thinking" skill set, abstraction has to do with condensing the problem by selectively focusing on some "essential" parts of it while disregarding others in order to come up with an adequate model to solve it. It is, in other words, a way of managing complexity through the creation of higher-order models or entities as well as layers of computation architectures. In computing, abstraction happens on multiple levels: from abstraction of continuous electrical current into a discrete off/on signal (corresponding to 0/1 of the binary code), to abstraction of electrical processes into languages, of multiple actions into a single function, of lines of code into software models, and so on. Abstraction thus is one of the key processes in computing and is closely related to processes of generalization (finding, constructing, and exploiting commonalities), decomposition (breaking down of the problem into smaller, more manageable parts), pattern recognition (observing similarities and differences within and between problems) as well as the building of algorithms (formal step-by-step procedures to solve problems)—further elements of computational thinking.

In order to think abstraction in computing as a strategy that goes beyond its "formal" definition as a process of condensing and generalizing for practical purposes, we would like to draw on subjectively selected but nonetheless telling historical moments that serve as precursors to modern relations between computing and abstraction. These historical moments also showcase the entanglement of computation and abstraction with automation, particularly highlighting how abstraction acts as a means for automating thought by enabling modeling and algorithmization with the help of categories and generalizations.

The foundational process for computing that enables its spectacular performance today is an algorithm. Algorithm is essentially a formalized procedure of automated calculation: a set of rules or steps to be followed in performing a calculation that has a clear beginning and an end.[5] Its name derives from the work of the ninth-century Persian mathematician Muḥammad ibn Mūsā al-Khwārizmī, whose name was latinized as "algoritmi," thus giving the procedure its title. Al-Khwarizmi's work falls within the period of the so-called Arabic-Islamic Renaissance or Islamic/Arabic Golden Age around 800–1200 CE. Toward the end of this period, in the second half of thirteenth century, logician and philosopher Ramon Llull, born in Mallorca, wrote the work

Ars Magna (final part published in 1305–1308) on the general art of truth-finding. Containing various metaphysical concepts and explanations of relations between them, it essentially constitutes a kind of universal symbolic machine of reason. By using a series of tables and diagrams detailing the relations between various concepts, one could, in theory, ask and answer metaphysical questions in an algorithmic way, following the lines of the if-then logic that should lead the reader toward truth.[6] In that sense, Llull's work showcases the interconnection between abstraction, generalization, and automation of thought through algorithmic logic. It is important to note that Llull's project was not neutral: the goal of his *Ars Magna* was to create a system that could be used as a tool for converting Muslims and Jews to Christianity based on logic and reason alone.[7]

"By using a series of tables and diagrams [. . .], one could, in theory, ask and answer metaphysical questions in an algorithmic way, following the lines of the if-then logic that should lead the reader toward truth."

Another exemplary moment of resonance between abstraction in mathematics and in philosophy occurred at the end of the seventeenth century. In the 1670s, Gottfried Wilhelm Leibniz invented calculus—a mathematical way of studying change—and introduced the idea of a universal (mathematical) symbolism and a calculus of reason. These notions and calculus as a mathematical tool were indispensable for the development of computing. Around the same time that Leibniz introduced the idea of universal mathematical language, an exercise in abstract language through synthesis of taxonomic and conceptual categorizations was performed in 1668 by British philosopher John Wilkins.[8] Wilkins created what he called a "Real Character"—the project of a universal philosophical language, based on elements that represented the abstracted, semantic essence of words. The words in this language were constructed of syllables that signified hierarchized categories instead of sounds, arranged in a specific order to designate a particular object. The Real Character was thus a *formal* language, the goal of Which was to facilitate communication across cultures and disciplines.[9] Both of these moments exemplify the role of abstraction in connection to generalization and categorization, and particularly the possibility to use abstraction for operationalizing knowledge and for expanding its reach through claims to universality of reason.

Figure 2.
Loren Britton, What Do We Have in Common *(2019). Paper pulp (19 × 25 in.). Courtesy of the Artist, Share Alike.*

Last but not least, abstraction played a key conceptual role in the work of Alan Turing, which was foundational for computer science and artificial intelligence. In his paper "On Computable Numbers, With an Application to Entscheidungsproblem," Turing presented the idea of a Universal Machine—a machine that was based on the way of expressing infinite numbers through finite abstractions.[10] Operating with the formal language of the binary code, this universal machine could be instructed to perform the work of any other machine, given that the description of the task could be expressed in universal formal language, fed to the machine through a long strip of paper. This essentially describes the basic principle of the modern computer, which is the ability for hardware to read and write software written in formal language, rendering the modern computer able to perform any task, as long as that task is computable. Turing's work not only was essential for the establishment of computer science and production of modern computers but also shows that abstraction was a major aid in mechanizing and automating logic and remains at the heart of computing today.

These historical moments point to the understanding and function of abstraction that is not limited to purely technological process. In fact, abstraction through the lens of these histories comes forth as a method of *ex*traction: of presupposed essences, shared features, generalized procedures, and representations.[11] It enables enormous conceptual and technological creativity by creating mobile models and opening up a plane of relations within which diagrammatic interventions and modulations become possible. At the same time, abstracting through extraction also posits that there is something that one abstracts from (a particularity, a singularity, a material, a concreteness). As we will see further, this is not at all an innocent process, since abstractions, once formulated, act back upon the concrete particulars and singularities, while also posing the

question to what extent should we rather speak of abstract-concrete entanglements instead.

Method of abstraction through extraction (of some sort of essential principles or aspects to be captured) is closely related to two further processes that are crucial for contemporary computing: firstly, formalization—the introduction of a formal language (such as binary code) or a formal, defined logic (expressed in algorithmic procedures); and secondly, categorization—a process of dividing objects and things into categories as a mode of knowledge production, and as a means of operationalizing this knowledge. Together with formalization and categorization, abstraction can and often does yield universalisms (statements or principles that presumably hold true beyond specific instances), which, too, are quite important for technological production and the dissemination of technological innovations.

As a Western tool of knowledge production, abstraction, like categorization and formalization, has deep connections to projects of imperialism, colonialism, and the reproduction of hierarchized binary frameworks such as nature/culture, man/woman, mind/body, human/animal, universal/particular, self/other, and so on—the so-called dualisms that refer back to the Cartesian dualism of mind *versus* body. As a method, it can easily be presumed to fall on the Human/Man/Culture/Mind/Universal/Self side of the binaries, further positing the otherness and the less-ness of animal/woman/nature/body/particular/other.[12] Claims to abstraction-based, categorizing and infallible universal logic, universal language, and universal reason have too often led to marginalization and downright oppression.[13] Feminist scholars have long criticized such abstract rational universalism and accompanying Western humanism as reinstating the racialized, sexualized, and naturalized hierarchical order, which equates the human with man and places the white, heterosexual, able-bodied, cis-gendered man at the top of the hierarchy.[14] As Rosi Braidotti has noted, "The experience of the marginal and the dispossessed teaches us that 'the human,' far from being a universal or neutral category, is a term that indexes access to entitlement and privileges," because "the fundamental social categories such as class, race, gender and sexual orientations, age and able-bodiedness have functioned as markers of human 'normality.'"[15]

The tendency toward a heteropatriarchal, universalizing, rational model of abstraction that permeates technoculture has also been criticized by early

cyberfeminists insofar as it characterizes the dreams to "leave the meat behind" and transcend matter, particularly the flesh-and-bones body, to acquire the universal god's view and mastery of nature.[16] This move toward universality is one of the critiques that could be leveraged toward abstraction as a mode of operation that characterizes the digital and the computational and its impacts on sociocultural-political life.[17] A second set of critiques of abstraction has to do with its uneasy relation to materiality, that is, its presumed positioning as diametrically opposite to matter, to concreteness, and synonymous with rationality. N. Katherine Hayles, in her volume *How We Became Posthuman*, argues that techno-utopian schemes, such as downloading the mind and leaving "the meat" behind, amount to a fantasy of transcendence that despises matter.[18] This raises questions about who has access to the fantasy of disembodiment and who gets relegated strictly to the domain of corporeality—a division that tends to get distributed along the already mentioned racialized, sexualized, and naturalized vectors of difference.

While much can be said about efforts to ameliorate such exclusions through the diversity politics of knowledge production, computing, and computer science as a discipline, the sterile, disembodied imaginary of techno-utopian abstraction is still alive and well, from the new escapist fantasies of Mars colonization, to the idea of computing technologies as "clean," which masks the enormous effects of digital waste.[19] However, we suggest that the diametrical opposition abstraction *versus* matter does little more than reify the binary thinking. Instead, we argue alongside contemporary new materialist thinkers that matter is self-organizing and agential; it generates abstractions and is affected by abstract computational means.[20] The first claim is based on the understanding of matter as a vital and active agent that has its own affordances and capacities, instead of a passive substance that requires form or external force in order to become activated.[21] Matter is capable of generating abstract principles of organization (e.g., fractal organization of matter), and at a certain level matter is susceptible to reconfigurings through computational tools, as exemplified in fields such as computational biology and genetic engineering.

The question to ask thus has rather to do with the positioning of abstraction. If we started from the understanding of abstraction as a process of extracting *from* something or *away* from something, surely it matters from which point and toward what we are abstracting—in other words, it matters which positionality

and which perspective we abstract from, and for what purpose. However, our proposition in thinking abstraction does not end here but rather invites to take a step further and rethink abstraction beyond extraction and as a broader process of "trans*re*lation"—an invented term that combines and diffracts through one another the concepts of transing ;pl translation ;pl relationality. Such rethinking, we will argue, allows to highlight the residues and inheritances as well as the production of new meanings that emerge through the process of abstraction as trans*re*lation.

Specifically, it invites to ask *which* residues and inheritances, which forms and models of relations get embedded and expressed in the abstractions that are generated? In computing, for instance, this would open up lines of inquiry into what kind of models of thought get embodied in performances of computational abstractions and categorizations. An example of such questioning can be found in the scholarship of Wendy Chun, who interrogates how algorithms re/produce and perform the principle of homophily and what are the repercussions of such re/production.[22] Furthermore, understanding abstraction as a trans*re*lational practice—a tactic even—opens up a possibility to attend to material as well as sociocultural and political aspects of it. Computation is itself a set of imperfect translations that generate a series of abstractions: from electrical current to on/off signal, to electrical events in the hardware, to machine languages, to software, to systems of human-computer interactions. Current examples of algorithmic biases, amplification and reproduction of structural inequalities through algorithmic systems point to the problems that arise when such translations-abstractions are performed within the universalist, decontextualized paradigm of knowledge production and technology design, where knowledge is operationalized as a modeling exercise for problem-solving.[23]

Calls for recontextualization, an algorithmic ethics, and a more systemic approach to algorithmic decision-making systems thus can be seen as one of the tactics of trans*re*lational abstraction.[24] Moreover, it already resonates with abstraction in computing as a tool for modeling interaction patterns.[25] As such, then, computing, and specifically computational abstraction, can be a mode of generative thought, as expressed also through computational arts (for instance, in the work of Mario Klingemann on how machine-learning algorithms perceive faces, and in the lifework of Frieder Nake and other new media/digital artists). Before we

expand on trans*re*lationality as a tactic, we would first like to briefly discuss abstraction in the arts.

ABSTRACT PROCESSES: ABSTRACTION AND ARTS PRACTICE

One possible way to understand abstraction colloquially in the so-called fine arts would be to approach it from within the history of painting and the "crisis" of painting in the West in the nineteenth century after the invention of photography. To follow abstraction in this way might lead from this crisis of painting to the movement of AbEx (Abstract Expressionism), and further all the way to a more contemporary take on how artistic practice can be conceptualized as shifting from considering how to make things toward asking how to make things happen. This question of abstract artistic practice and making things happen within it is a way to think through a mode of assemblage where questions of agencies, translation, and political realities all operate as shifting elements to be considered and worked with in abstracted artistic research.[26]

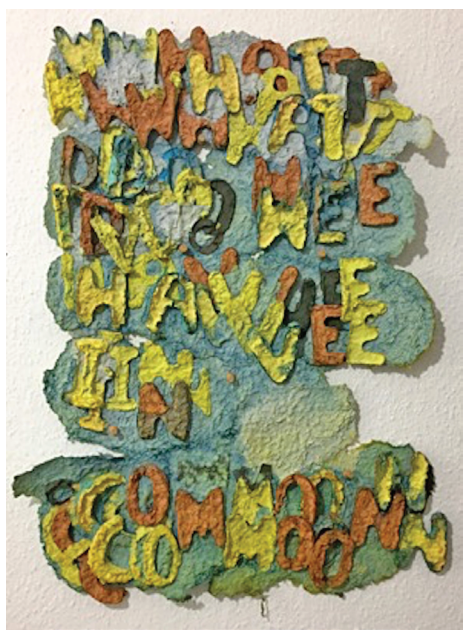

Figure 3.
Loren Britton, What Do We Have in Common *(2019). Paper pulp (19 × 25 in.). Courtesy of the Artist, Share Alike.*

In order to think of abstraction in the arts as a strategy that goes beyond a formalized Western art history canon definition, we will draw on specific histories that show the shifting concerns of abstraction as a method or practice within the arts. We will use these historical moments as opportunities to reconsider what abstraction can do in service of socially engaged artistic work that makes things happen rather than only making things. We will think of abstraction as an approach to making images within a two-dimensional surface as well as a method that informs artistic practices outside of making discrete two-dimensional objects. Thinking of abstraction as a strategy or method of mixing, working with multiple people and nonhuman agencies and with rearranging histories, is a way to open up what abstraction might mean. We will chart abstraction as a historical mode of image-making and consider

how it moves off the two-dimensional surface toward being a process. Thinking of abstraction as a process creates space for it to address a more theoretical or broader set of concerns around agency, people, and political coalition rather than an artistic process purely defined within the frame of an artwork.

> ***"Thinking of abstraction as a process creates space for it to address a more theoretical or broader set of concerns around agency, people, and political coalition [. . .]"***

Tracing the role of abstraction from within the Western canon through the reaction to the invention of photography offers one possible starting point for the unraveling potential of what abstraction might do in the arts. In 1833 in France, Louis Daguerre invented the daguerreotype. Daguerre was a French painter and diorama maker who became known for his invention of the photograph, as we understand it today. In his collaborations with inventor Joseph Nicéphore Niépce, he worked with a number of light-based chemical processes for attempting to represent the world as it appears, through a lens.[27] After Niépce's death, Daguerre continued to evolve the processes that the two had been working on until he discovered the eponymous daguerreotype, a more stable photochemical process. These were the beginnings of photography as we know it today. At this juncture, in 1839, the French government bought the rights to the process and the released it "free to the world." Dramatically, the French history painter Paul Delaroche was said to exclaim, "today, painting is dead!"[28]

This crisis of image production in Western painting can be seen in the move away from reproducing still and portrait life with paint on a canvas, to exploring what paint as a material can do, and what kinds of static representations or abstractions might be more evocative of contemporary life. Around the time of the invention of the daguerreotype, Realism (from the 1850s) was the kind of painting that was most popular from artists like John Constable and Gustave Courbet. Realism portrayed realistic images of a life of ideal landscapes and romantic court life. The artists who produced these images were often closely tied to wealthy peoples. However, the so called "death of painting" that was supposedly portended by the daguerreotype also paved the way for painting to take on a different goal other than that of representation. The work of Impressionists (from the 1870s to the 1880s), such as Claude Monet and Louise Catherine

Breslau, began to portray the world with a very different impression, emotional quality, and image of its likeness, and the artists within this movement were notably not as tied to notoriety or to state wealth. The work of painters like Breslau challenged a presumed binary of abstract/material because in Breslau's paintings the attention was brought to the material of the paint itself, and the emotional quality of the abstracted image, rather than focusing on clear representations, which was popular in Realism.

Although painting was unhooked from the necessity of representation after the invention of the daguerreotype, still critically missing from any of these aforementioned painterly traditions was feminism. Even if the first wave of the feminist movement was just emerging at the time, we raise this point to acknowledge the fact that the history of Western art remains a canonical history where many were depicted without their own agency, a pattern of artistic practice that we are not writing toward.[29]

Feminist art history engages with the problematics and necessity of representation as well as the way in which abstraction can be politically motivated. Understanding the false binary of abstraction vs. representation is not a simple task.[30] To say that more representations are needed of more sorts of people is true, and to say that these same representations can also be dangerous for those who urgently need to be recognized is also true. This is the case of the 2014 so-called transgender tipping point that has led to a severe uptick in violence against trans*gender peoples, specifically trans*gender women of color. Furthermore, the quality and not just the quantity of representation matters too.[31] This has been pointed out by the work of Guerrilla Girls. Particularly in their 1989 work "Do women have to be naked to get into the MET. Museum?," they draw attention to the fact that, in that year, less than 5% of the artists in the modern art section of the Metropolitan Museum of Art in New York City were women, but more than 85% of the nudes were female.

Feminist art historians have worked on and with questions of representation, showing how the representation of bodies, power to act, and the ability to be seen are not equally distributed. In the case of the Guerrilla Girls' work, there is a violence in the unequal representation of women artists and the ways in which they become portrayed by presumably cis-gender men. In the case of the transgender tipping point, the increase of visibility by mainstream media

has the effect of making gender variance more conspicuous and therefore also more suspect; while, at the same time, there is still lack of any data on how many representations are by trans*gender peoples themselves.[32]

Equally important in histories of feminist art are artists who create artworks that engage with refiguring abstraction and what it might signify politically. An example of this is painter Harmony Hammond, who works with large-scale abstract canvases that speak back to abstract expressionist painters like Jackson Pollock through using similar painting techniques but claiming them within discourse as also available to women painters. Another example of this history is Carrie Moyer, who works in large-scale abstraction, specifically using forms for her paintings that are inspired by her activist work with Dyke Action Machine (or DAM!). Her large-scale glittery paintings use forms that are literally from the wheat-pasted campaigns that she and Sue Schaffner installed in the 1980s and '90s in New York City, creating a political substructure for her paintings that politicizes her abstractions.

The abstracted or ephemeral needs of othered bodies become solid and concrete when representations expose the extreme disparities evident within culture. So when we say that feminism was (and maybe still is) lacking in the Western canon, this is obvious, but the question is, what does feminism bring to painting and more broadly to artistic production? And how does feminism interlock with the potential of abstraction within art? Feminism, in our take, requires a consciousness of a body and its intersectional position as a vector in society along which many interlocking matrixes of domination and oppression are structured.

These interlocking matrixes are discussed in Sara Ahmed's text "A Phenomenology of Whiteness," where she critiques Edmund Husserl's theorization of phenomenology.[33] Phenomenology, philosophically speaking, is defined as the study of consciousness and the objects of direct experience. Ahmed's text focuses on the conditions surrounding Husserl's ability to spend time at his writing desk, and it is critical of the history of phenomenology that focused on the experiences of a privileged few. She makes the critical point that the "here" of Husserl's writing desk from where his "world unfolds" is a "here" that many do not have access to. Husserl's unawareness of his class privilege, sexist dynamics, and undervaluing of reproductive labor produce the possibility for his "here" to be—a "here" for him to be alone theorizing in his room. This awareness of consciousness is

largely limited because it stops at Husserl's white skin and does not connect to how his bodily conditions for working are produced.

Frantz Fanon's *Black Skin, White Masks* goes one step further. Another crucial phenomenological text, from the chapter "The Lived Experience of the Black Man," Fanon recounts his own phenomenological experiences of reaching for a cigarette in front of a white gaze.

> All around the body reigns an atmosphere of certain uncertainty. I know that if I want to smoke, I shall have to stretch out my right arm and grab the pack of cigarettes lying at the other end of the table. As for the matches, they are in the left drawer, and I shall have to move back a little. And I make all these moves, not out of habit, but by implicit knowledge. A slow construction of my self as a body in a spatial and temporal world—such seems to be the schema.[34]

Fanon's awareness of his body shows a radically different construction of the intersecting concerns of how or why someone moves, and from where their "here" begins. Fanon knows, which Husserl is unaware of, in what ways there are differences of how one might move depending on who might be watching, especially in racialized experience.

These phenomenological experiences evidence how bodies are produced and act, or are acted upon, in social space, and how some are able to move differently depending on the context. This situating of context and knowledge of what it means to be oriented from somewhere, knowing "from where do I begin," is a feminist concern that is directly tied to Donna Haraway's concept of "situated knowledges."[35] Situated knowledges refer to partial objectivity, to only being able to know part of the "truth" because a viewpoint is directly informed by the material and intellectual positioning that one is speaking, knowing, doing, or understanding from.

Knowing where knowledge comes from, its context, and the answer to the question "from where do I begin?" are preconditions toward thinking of the kind of abstraction and artistic practice that roots the responsibility in the material and bodily conditions for its construction that we are interested in developing. Our argument here is that bodily awareness through phenomenology allows for the potential to feel the limits and possibilities of one's own situated position. It is

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within feminist art born out of a long line of artistic inquiry in the West that the potential for a political definition of abstraction emerges. Abstraction as we are wishing to define it allows for a process that is an assemblage of embodied, culturally specific, nonessentialist, and open ways of making things and making things happen, a process that does not normalize absences but rather renders presences present. This is a proposition for a mode of abstraction within artistic thinking and making that is in embedded relations with the communities it works with and for. Such artwork becomes meaningful within its context and allows for ties to the critical histories and aesthetic canons from which they emerge and/or which they try to undo.

In practical terms, Loren Britton has explored what this sort of abstraction might mean for their artistic work within the collaboration *Collective Conditions* (2019), hosted by the feminist technology association Constant in Brussels, Belgium. In this work, Britton created an installation for more than thirty participants for a workweek that investigated what kinds of conditions are needed for working together in complex collectivity. Specifically, the idea was to practice radical politics and explore what kinds of conditions are needed for each participant of a collective to show up with their whole selves. This abstract question was met with abstracted objects made by Britton that served as propositions for different orientations in space. For the space the participants worked in, Britton fabricated twenty *Way-Finding Tables* and thirty-five *Self-Determined Pillows* to create an installation full of uncommonly hard and soft surfaces. The *Way-Finding Tables* are directional and provisionally assembled, and the *Self-Determined Pillows* were made in such a way that their shape is determined when they are stuffed, but not before. This installation was made for the group of people working

Figure 4.
Loren Britton, Collective Conditions *(2019) Mixed media installation (dimensions variable). Courtesy of the Artist, Share Alike.*

together for the week and served as a proposition for what surfaces, squishinesses, orientations, and hardnesses might be needed for collaborative work. This collaboration attempted to engage the sort of abstraction within artistic practice that works for a specific community, and addresses specific concerns from it, in this case the possibilities and problematics of collectivity.

To sum up, we have approached abstraction in the arts from within the history of painting as it relates to the technological invention of photography, what phenomenology might have to do with artistic practice and process, and how representation and abstraction are posited on a false binary as pointed out by feminist artists and art historians. These histories and embedded processes have provided the groundwork for us to create the proposition of a different definition of abstraction in the arts, for which we gave an example through Britton's practice; although there are many other examples that could also be drawn

from.[36] In the next section, we will ask what common grounds can be found through the concept of trans*re*lationality as a theoretical basis for a more situated and embedded abstraction in both arts and computing.

ABSTRACTION AS MODULATION OF TRANS*RE*LATIONS

For rethinking abstraction, our specific goal is to approach it as a methodology that is responsible to its history and is invested in getting enmeshed in the thick and intersectional material problematics of the present from which it emerges. This is the kind of abstraction that holds open the conceptual link to computation and is posited as a generative movement capable of invoking different patterns and modes of relations. In this section, we would like to sketch out the theoretical framework for such rethinking of abstraction, particularly with the help of trans*re*lationality as a conceptual aid for constructing common ground from which to engage with questions such as: from where does one abstract and for what purpose? How things are assembled and how can they be assembled differently? What kind of affordances are created through the process of abstraction? In other words, how can abstraction be rendered as a generative mode of thought and practice?

We propose that abstraction as a situated practice—be it computational or artistic or both—has to do with manipulation and production of trans*re*lationalities. As a concept, trans*re*lationality coagulates the terms *transing*, *translation*, and *relation*, thus bringing together trans*feminist ethics, feminist politics of location and situated knowledges, new materialist thought, and relational ontologies. Trans*feminism specifically works against the kind of "abstraction" away from the body that we are affirmatively critiquing in our work together. The trans*feminism we engage begins with Emi Koyama's Trans*feminist Manifesto, which explicitly positions diversity as their strength, not their weakness, and posits inclusive coalition politics as the larger project of trans*feminism.[37] It suggests the ethic of collaborative work that focuses on thinking through shared needs, urgencies, histories, and leaving space for divergences. Beginning with trans*feminism includes beginning with a political basis of thought that radically works toward including all mothers and others who have been historically excluded from previous feminisms, and is intersectional, Black, crip, and trans* at its beginning. We understand this precisely not to be a theoretical endeavor but rather a set of embodied, ethical priorities for

which abstraction can function as a medium of translation between different lived experiences.

Furthermore, we rely on the thought of Gilles Deleuze, as well as feminist politics of location and situated knowledges, in order to conceptualize abstraction as a situated process of modulating trans*re*lationalities.[38] With regard to Deleuze, the particular concepts of interest to us are *diagram* and *folding* as a process of material differentiation. Writing about Leibniz and Baroque, Deleuze conceptualizes the fold and the process of folding as characteristic of life itself and its differentiation: from coils of matter, to folds of the soul, folding is the infinite process where exteriorities are folded in and interiorities are folded out, in a constant bifurcation, forming layers and redefining multiplicity not as something that contains many parts, but as something that is folded in many ways.[39] Resting on the ontology of Spinozist monism, Deleuze's fold is in essence a process of differentiation in a univocal ontology that is characterized not by differential beings but by different degrees of differentiation.[40]

Abstraction for Deleuze is also an important concept, which moves away from representation and deals with intensities and expression of forces. The opposite of abstraction here is not concretization but rather *discretization*.[41] Viewed in this way, abstraction has to do with expression of relations rather than of fixed essences, of certain intensities rather than particular qualities. *Diagram* in this context comes in as that which captures the relations between abstract thought and its medium, a productive cartography of relations.[42] In a sense, we read this notion of diagram as a machine that modulates relations and we see abstraction as performing its work diagrammatically, at the level of relationalities.

Alongside this Deleuzian thought, we also rely on Adrienne Rich's call for a politics of location and Haraway's notion of situated knowledges as principles of knowledge production. By stressing the need to start the thought from the historically, politically and culturally embedded, materially embodied position (Rich), we open partial perspectives and thus partial truth claims as opposed to the universalist "God trick" that generates a "view from nowhere" (Haraway). This means not only that it matters from which perspective the abstraction is generated but also that abstractions always already carry with them traces of their locations, and vice versa—locations are generative of potentially different kind of abstractions, and new loci can get configured through processes of

abstraction. In other words, if Deleuze's thought points toward an entanglement of thought and matter, an ontology that posits relations as fundamental and prior to entities and a notion of abstraction as a nonrepresentational yet diagrammatic process of modulating forces and intensities, then feminist thought of Rich and Haraway adds to that the dimension of thinking seriously about accountability and generative materiality.

Trans*re*lationality as we are defining it through our work is a material, embodied, and relational way of thinking. Etymologically, "to translate" means to remove from one place to the other, to "carry over," while "relation" implies correspondence, from Latin *relationen*—"a bringing back, restoring; a report, proposition."[43] Translations are always imperfect; they involve duration ("to carry over") and change, thus pointing to creation of different assemblages and agencies. Translation and relation together invoke a recursive, iterative movement toward, which accounts both for the specific starting conditions and histories, and which is attentive to the planes that such movement traverses. Particularly intersemiotic translation, which is the understanding of translation that we are operating with, highlights the situatedness of translations as well as the multiplicity of possible ways of translating.

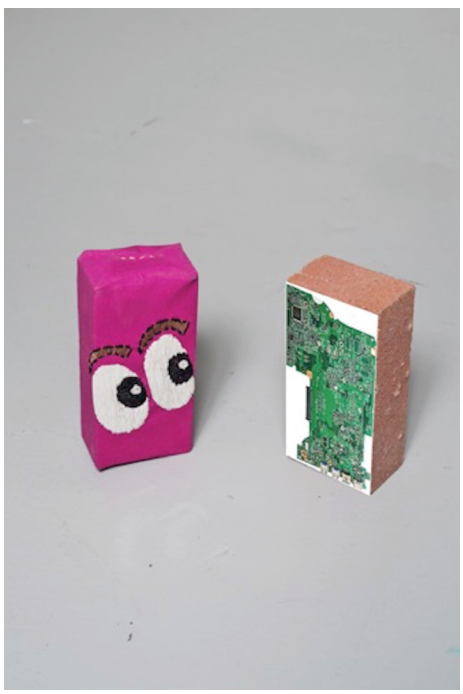

Figure 5.
Loren Britton, Are You My Mother? *(2018). Digital and physical collage (dimensions variable). Courtesy of the Artist, Share Alike.*

To consider abstraction as translation means that abstracting from somewhere keeps the perspective of its source in the abstracted thing. Abstraction is a way of tethering thought and movement to matter because it must have been abstracted from somewhere. And this "somewhere" is directly or indirectly evoked in the abstracted process that it comes from; the stakes are of making visible where influence, movement, and assemblages come from as a way to take abstraction as a process of situating influence. This also means that the process of abstraction gets more embedded within the call

to responsibility and accountability toward the multiple "somewheres" and the effects of abstraction.

Adding to that, trans*re*lationality includes, through the prefix "trans," a transpositional, transversal sensibility, and a "transing" as a process that challenges the neat binaries of dualist Cartesian thinking.[44] Thinking/doing abstraction trans*re*lationally thus implies a process that acts diagrammatically: it entails folding in and out of meaning and matter on a level of intensities and forces, where the focus is not on entities or objects but on relations that constitute them. Abstraction here creates a possibility to modulate relations, where the questions of where one abstracts from and how does one abstract are integral parts of the process.

Doing abstraction as trans*re*lational process lays down the groundwork for a collapsing of multiple perspectives into a process, in which abstraction becomes a relational language of traces. The important questions thus become from where to where are we abstracting and what kind of elements do we select to include in the trans*re*lationalities that we are building through abstractions. For instance, what are the traces left behind of a previous material reality? How can we follow the trace to find starting points? How can this thread allow multiple perspectives to be woven into a way of creating a set of concerns and practices that work across disciplines and lay the grounds for collective connectivities? Insofar as the "we" is multiple and differently bodied, trans*re*lational abstraction points to the need to include nonhuman actors into the collective subject, whether they be computers, algorithms, data sets, evaporation processes, or other material assemblages.

To conclude, repositioning abstraction as a process where the composition and modulation of trans*re*lationalities is at stake reinstates its capacity to enable synthetic thought, decentering oneself to constitute a "we" without violence or effusion. Our proposal, thus, is to think and practice synthetic thought from where we are, with the hope that "we" can fabulate a "we" that desires otherwise. As we search for a common strategy of abstraction, a proposition, a vector for thought, a terrain from which a composition of a different kind of "we" would be possible, we wish not to forget to question the "we" who does the abstraction or bears the effects of it. "Who are 'we'?" Rosi Braidotti pointedly asks, and we echo the urgency to ask this question in light of a resurgence of fascism and nationalist movements, devaluation of culture and the arts,

and antiscience conspiracy theories.[45] Beyond our own collaborative work, we (the authors of this article) are addressing the kinds of figurations of collaborative thought that exist within the arts as well as within computing, from our fields' specific histories and toward thinking of other people who could join our "we" that want to work toward entanglement, especially between the arts and sciences. We selected theory as our meeting point and investigated how different theoretical references can yield common ground. We hope that abstraction rethought as a situated process that is rooted in relational ontologies, and as a process that creates and shifts trans*re*lationalities, can become one such common term in the transdisciplinary dictionary.

Notes

[1] Critical insights on these exclusions have been provided by: Linda Nochlin, "Why Have There Been No Great Women Artists?," 1971, *ARTnews*, May 30, 2015, https://www.artnews.com/art-news/retrospective/why-have-there-been-no-great-women-artists-4201/; Connor Garel, "Why Have There Been No Great Black Canadian Women Artists?," *Canadian Art*, January 10, 2019, https://canadianart.ca/essays/why-have-there-been-no-great-black-canadian-women-artists/; J. Pick, "Why Have There Been No Great Disabled Artists?," *Disability Arts Magazine* 2, no. 4 (Winter 1992): 19–23; Una Rey, "The Grass Ceiling: Painting, Gender and Intercultural Collaboration," in *Double Desire: Transculturation and Indigenous Contemporary Art*, ed. Ian McLean (Newcastle: Cambridge Scholars, 2014), 45–70.

[2] N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999).

[3] "Intersemiotic Translation and Cultural Literacy," *Cultural Literacy in Europe*, https://cleurope.eu/activities/sigs/intersemiotic_translation/.

[4] What follows here is by no means a full account of the technical functionality of abstraction in computing and its different roles. In a sense, to speak of abstraction as a single process in technical terms is a simplification itself. Therefore, instead of focusing specifically on how abstraction is performed in modern computing, we will look into abstraction as a mode of thought that has deeper historical connections to other computational and thinking methods, such as generalization, formalization, and categorization.

[5] As a *process*, algorithm could be traced back to rituals and forms of organization of space. See, for example, Matteo Pasquinelli, "Three Thousand Years of Algorithmic Rituals: The Emergence of AI from the Computation of Space," *e-flux* 101 (June 2019), https://www.e-flux.com/journal/101/273221/three-thousand-years-of-algorithmic-rituals-the-emergence-of-ai-from-the-computation-of-space/.

[6] For explication, see Francesca Hughes, "Truth Is in the Tower," *e-flux* 84 (September 2017), https://www.e-flux.com/journal/84/149170/truth-is-in-the-tower/.

[7] Ibid.

[8] Both Wilkins and Leibniz were members of the Royal Society.

[9] For a good description of how Real Character worked, see the blog entry by Katherine McDonald, "Ancient Languages and John Wilkins's Real Character," June 22, 2016, https://katherinemcdonald.net/2016/06/22/ancient-languages-and-john-wilkins-real-character/.

[10] Alan Turing, "On Computable Numbers, With an Application to Entscheidungsproblem," *Proceedings of the London Mathematical Society, Series 2* 42, no. 1 (1936): 230–65.

[11] This is not necessarily the formal understanding of abstraction that computer science would espouse—rather, it is our own reading of how abstraction works as a broader principle in thought and computing, in light of its historical uses.

[12] See Genevieve Lloyd, *The Man of Reason: "Male" and "Female" in Western Philosophy* (1984; London: Routledge, 2004).

[13] See, for instance, Aníbal Quijano, "Coloniality and Modernity/Rationality," in "Globalization and the De-Colonial Option," ed. Walter D. Mignolo, special issue, *Cultural Studies* 21, nos. 2–3 (2007): 168–78; as well as other post- and decolonial thinkers. For an overview, see Gurminder K Bhambra, "Postcolonial and Decolonial Dialogues," in "Decoloniality, Knowledges and Aesthetics," ed. Ramaswami Harindranath, special issue, *Postcolonial Studies* 17, no. 2 (2014): 115–21.

[14] See, for instance, María Lugones, "Toward a Decolonial Feminism," *Hypatia* 25, no. 4 (Fall 2010): 742–59; and Rosi Braidotti, *The Posthuman* (Cambridge, UK: Polity Press, 2013).

[15] Rosi Braidotti, "Posthuman, All Too Human: The Memoirs and Aspirations of a Posthumanist" (Tanner lecture, Yale University, New Haven, CT, March 1–2, 2017), https://tannerlectures.utah.edu/Manuscript%20for%20Tanners%20Foundation%20Final%20Oct%201.pdf, pp. 19–20.

[16] See Hayles, *How We Became Posthuman*; Sherry Turkle, *Life on the Screen. Identity in the Age of the Internet* (London: Weidenfeld & Nicolson, 1995); María Fernández, "Cyberfeminism, Racism, Embodiment," in *Domain Errors! Cyberfeminist Practices*, ed. María Fernández, Faith Wilding, and Michelle M. Wright (Brooklyn, NY: Autonomedia, 2002), 29–44.

[17] On the critique of universalizing and possibly colonizing impetus in computing, see Paul Dourish and Scott D. Mainwaring, "Ubicomp's Colonial Impulse," *UbiComp '12: Proceedings of the 2012 ACM Conference on Ubiquitous Computing* (September 2012): 133–42; and Syed Mustafa Ali, "A Brief Introduction to Decolonial Computing," *XRDS* 22, no. 4 (2016): 16–21.

[18] Hayles, *How We Became Posthuman*.

[19] See Jennifer Gabrys, *Digital Rubbish: A Natural History of Electronics* (Ann Arbor: University of Michigan Press, 2011).

[20] See Rosi Braidotti, *Metamorphoses: Towards a Materialist Theory of Becoming* (Cambridge, UK: Polity Press, 2002); Diana Coole and Samantha Frost, eds., *New Materialisms: Ontology, Agency, and Politics* (Durham, NC: Duke University Press, 2010); Iris van der Tuin, "New Feminist Materialisms," *Women's Studies International Forum* 34, no. 4 (2011): 271–77; and and Rick Dolphijn and Iris van der Tuin, *New Materialism: Interviews & Cartographies* (Ann Arbor, MI: Open Humanities Press, 2012).

[21] See Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press, 2010).

[22] Wendy Hui Kyong Chun, "Queerying Homophily: Muster der Netzwerkanalyse," *Zeitschrift für Medienwissenschaften* 10, no. 18 (2018): 131–48.

[23] For overview of algorithmic biases and their relations to structural inequalities, see Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: New York University Press, 2018); Virginia Eubanks, *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor* (New York: St. Martin's, 2018); and Cathy O'Neil, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (New York: Crown, 2016).

[24] Such as Claude Draude, Goda Klumbytė, Phillip Lücking, and Pat Treusch, "Situated Algorithms: A Sociotechnical Systemic Approach to Bias," *Online Information Review*, ahead-of-print (November 2019): 1–18, https://doi.org/10.1108/OIR-10-2018-0332.

[25] Timothy Colburn and Gary M. Shute, "Abstraction in Computer Science," *Minds & Machines* 17, no. 2 (2007): 169–84.

[26] See Gilles Deleuze and Félix Guattari, *A Thousand Plateaus* (1987; Minneapolis: University of Minnesota Press, 2005); also see Manuel DeLanda, *Assemblage Theory* (Edinburgh: Edinburgh University Press, 2016).

[27] Malcolm Daniel, "Daguerre (1787–1851) and the Invention of Photography," *The Metropolitan Museum of Art*, October 2004, https://www.metmuseum.org/toah/hd/dagu/hd_dagu.htm.

[28] Quoted in Caterina Bellinetti, "'From Today Painting is Dead': Photography's Revolutionary Effect," *Art & Object*, April 9, 2019, https://www.artandobject.com/shorts/today-painting-dead-photographys-revolutionary-effect.

[29] Absent from the Western art canon in the nineteenth century were, with few exceptions, artists who were women, people of color, poor people, or disabled people, or depictions of these people in the way they wished to be shown.

[30] Within the history of painting, Western artists like Jackson Pollock became known as "democratic" and "Western," whereas eastern European artists like Valentin Serov or Ilya Repin were representational and depicted workers or everyday life, and were therefore colloquially known as more quotidian. This is another bias of abstraction vs. representation

that echoes capitalist Western flows and establishes "abstraction" as that which is contemporary, Western, and of an upper class, whereas "representation" is that which is old, quotidian, and not about ideas.

[31] See Samantha Allen, "Whatever Happened to the Transgender Tipping Point?," *The Daily Beast*, April 10, 2017, https://www.thedailybeast.com/whatever-happened-to-the-transgender-tipping-point; Laurie Penny, "What the "Transgender Tipping Point" Really Means," *The New Republic*, June 27, 2014, https://newrepublic.com/article/118451/what-transgender-tipping-point-really-means.

[32] This is changing, however, with the incredible work of gender nonconforming/trans*gender artists and scholars working with representations of trans*gender life, such as: Alok Vaid-Menon, Olave Basabose, Jack Halberstam, Susan Stryker, Janet Mock, Paul B. Preciado, Trish Salah, Os Keyes, and Sandy Stone to name just a few.

[33] Sara Ahmed, "A Phenomenology of Whiteness," *Feminist Theory* 8, no. 2 (2007): 149–68, https://doi.org/10.1177/1464700107078139.

[34] Frantz Fanon, "The Lived Experience of the Black Man," in *Black Skin, White Masks*, trans. Charles L. Markmann (1952; New York: Grove Press, 1967), 90–91.

[35] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no.3 (1988): 575–99, https://doi.org/10.2307/3178066.

[36] Including the work of artists like: Otobong Nkanga, Read-in and Annette Krauss, Campus in Camps, and Torkwase Dyson. Due to our specific backgrounds as well as the focus of this article, we are not particularly referencing new media arts and digital arts. We do believe, however, that a study of new media and digital arts in this respect would provide an interesting perspective on the workings of abstraction.

[37] Emi Koyama, "The Transfeminist Manifesto," in *Catching a Wave: Reclaiming Feminism for the 21st Century*, ed. Rory Dicker and Alison Piepmeier (Boston: Northeastern University Press, 2003), 244.

[38] See Adrienne Rich, "Notes toward a Politics of Location (1984)," in: *Blood, Bread, and Poetry: Selected Prose, 1979–1985* (Norton, 1994), 210–31; and Haraway, "Situated Knowledges."

[39] See Gilles Deleuze, *The Fold: Leibniz and Baroque*, trans. Tom Conley (1988; Minneapolis: University of Minnesota Press, 1992); and Gilles Deleuze and Jonathan Strauss, "The Fold," in "Baroque Topographies: Literature/History/Philosophy," ed. Timothy Hampton, special issue, *Yale French Studies* no. 80, (1991): 227–47, http://www.jstor.org/stable/2930269.

[40] See Brent Adkins, "Who Thinks Abstractly? Deleuze on Abstraction," *Journal of Speculative Philosophy* 30, no. 3 (2016): 352–60.

[41] Ibid.

[42] Manuel DeLanda, "Deleuze, Diagrams, and the Genesis of Form," in "Chaos/Control: Complexity," ed. Hanjo Berressem, special issue, *Amerikastudien/American Studies* 45, no. 1 (2000): 33-41, https://www.jstor.org/stable/41157534.

[43] "Translate" and "relate," *Online Etymology Dictionary*, https://www.etymonline.com/word/translate and https://www.etymonline.com/word/relate.

[44] See Camille Nurka, "Animal Techne: Transing Posthumanism," *Transgender Studies Quarterly* 2, no. 2 (2016): 209–26.

[45] Rosi Braidotti, "Don't Agonize, Organize!," *e-flux*, November 2016, https://conversations.e-flux.com/t/rosi-braidotti-don-t-agonize-organize/5294.

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