New materialism:  
A theoretical framework for fashion in the age of technological innovation

ABSTRACT
Working from the case study of Dutch designer Iris van Herpen, this article proposes a new-materialist framework for fashion studies. The ‘material turn’ has gained substantial recognition in social and cultural research in the past decade but has received less attention in fashion studies. At the same time, fashion hardly ever figures in scholarship on new materialism. This article connects the two fields, surveys the literature, foregrounds key concepts and points to possible directions for fashion studies. The interdisciplinary field of new materialism highlights the role of non-human factors in the field of fashion, ranging from raw materials (cotton) to smart materials (solar cells) and from the textility of the garment to the tactility of the human body. New materialists work from a dynamic notion of life in which human bodies, fibres, fabrics, garments and technologies are inextricably entangled. The context of new materialism is posthumanism, which entails both a decentring of the human subject and an understanding of things and nature as having agency. The key concept is thus material agency, involving a shift from human agency to the intelligent matter of the human body as well as the materiality of fabrics, clothes and technology. The insight of material agency is important for acknowledging the pivotal role of technology in fashion design today, allowing greater attention for the

KEYWORDS
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Iris van Herpen
Through the marriage of the handmade and the machine made, a new aesthetic is emerging – one of exacting beauty and unfettered imaginings.

Andrew Bolton (2016: 13)

It matters what matters we use to think other matters with.

Donna Haraway (2016: 12)

**INTRODUCTION**

In the autumn of 2016, the renowned trend forecaster Lidewij Edelkoort announced in capital letters a new trend for the next year, in fact, for the next decade: NEW MATERIALISM (Edelkoort 2016).1 Interestingly, ‘new materialism’ has been on the agenda of cultural theory and academic thought for quite some time now. In that sense, the forecaster has finally caught up with a trend that has been growing steadily in universities for over a decade. Although what is known as the ‘material turn’ has gained substantial recognition in social and cultural research, it has, however, received much less attention in the field of fashion studies, and vice versa: fashion hardly ever features in scholarship on new materialism. In this article, I will connect the two fields and propose a new-materialist theoretical framework by surveying the literature, foregrounding some key concepts and pointing to possible directions for fashion studies. The futuristic dresses by the Dutch fashion designer Iris van Herpen are my privileged case, as her designs are ‘one of the present day’s most visionary expressions of technology’ (Quinn 2012: 12).

For Edelkoort (2016), new materialism involves a return to the materiality of fabrics and craftsmanship in fashion design: ‘We are in an age of new materialism, the making of materials comes first before form, colour, function’. However, for academics new materialism goes much deeper than that. At the heart of this highly interdisciplinary field there is ‘matter’. New materialism abides by the notion that things, objects, art, fashion, even people, are made of matter, that is to say they are all mixtures of mineral, vegetable and synthetic materials. Materiality refers not only to materials like fabrics or the garment, but also to the wearer’s body, and, at large, to the world of production and consumption. Within a new-materialist perspective, ‘matter’ is not merely raw and inert stuff on which humans act, but is itself alive and kicking, as it were. In the words of Jane Bennett (2010), matter is ‘vibrant’. The role of agency of non-human factors in the field of fashion can thus be highlighted, ranging from raw materials to smart materials and from the textility of the garment to the tactility of the human body. Such a perspective helps to understand fashion as materially embedded in a network of human and non-human actors. It decentres the human subject, expanding fashion beyond the frame of the human body and human identity to the non-human world of technology and ecology.

This is all the more important because of the pivotal role of technology today. The exhibition titled *Manus x Machina: Fashion in an Age of Technology* (which the title of my article echoes) at the Metropolitan Museum of Art in New York...
in 2016, suggests that we should reconcile the distinction between the hand (manus) and the machine (machina) in the design and production of fashion. The new aesthetic that is emerging, which, according to Andrew Bolton (2016: 13), is ‘one of exacting beauty and unfettered imaginings’, can be found in the designs of Iris van Herpen, which featured prominently in Manus x Machina. As she says, ‘I love getting to know a material […] of having it do exactly what I want’ (van Herpen cited in Bolton 2016: xvii) – using technology like 3D printing to achieve control over details and movement to enhance the sculptural allure of her dresses and pieces. She combines an intense love for craftsmanship with the latest innovations in technology, and for this rare quality she won many prestigious awards. In the year 2016 alone, she received three awards in her home country, the Netherlands: the most important Dutch fashion award, the Grand Seigneur, for her ‘combination of traditional craftsmanship and innovative technology’ (Buis 2017); the Witteveen+Bos Award for fusing art and technology and for ‘her research into new materials’ (Witteveen+Bos 2016); and the Modestipendium (‘fashion stipend’) from the Prins Bernhard Fund for Culture for her artistic qualities.2 In 2017, Iris van Herpen won the prestigious Johannes Vermeer Prize for her groundbreaking and interdisciplinary designs.3

Another example of the importance of technology for a renewed focus on materiality is the ‘wearables’ (Smelik 2017). Wearable technology illustrates the uncanny agency of inanimate things. Clothes usually hang on the body,
moving along with it, but technologies, like solar panels, LED lights and microcontrollers enable the garments to act and move autonomously irrespective of the wearer (Toussaint 2018). Fabrics and clothes take on a life of their own, acquiring non-human agency, entangled with the human body. The notion of material agency highlights the fact that the technologies establish interactions between the garments and the body, between human and non-human entities. As I shall argue, material agency is not located exclusively in the technology nor in the human body, but in an assemblage of wearer, fashion and technology.

To understand the complexity of new materialism in relation to technological innovation requires taking into account not merely the materiality of fabrics, as Lidewij Edelkoort suggests, but rather working from a dynamic notion of life in which human bodies, fabrics, objects and technologies are inextricably entangled. I hope to show that such a perspective is productive for the study of fashion, because it helps to better understand cultural objects, like fibres, textiles and clothes, as significant and interconnected actors.

THE THEORETICAL FRAMEWORK OF NEW MATERIALISM(S)

The ‘material turn’ is a response to the so-called ‘linguistic turn’ of post-structuralism with its exclusive emphasis on the discursive and the textual (Barad 2003). It does so by turning – or returning – to the matter and materiality of things and objects, including human bodies and identities (Rocamora and Smelik 2016). The material turn encompasses ‘new materialism’ (Barrett and Bolt 2013; Dolphijn and van der Tuin 2012) or ‘new materialisms’ (Boscagli 2014; Coole and Frost 2010; St Pierre, Mazzei and Jackson 2016). Its sources of inspiration are manifold, including important adjacent fields to fashion studies such as material culture studies, with its roots in anthropology and sociology (Granata 2012). It stretches to a wide range of disciplines or schools of thought, from historical materialism – such as (neo-)Marxism – via (post-)phenomenology, actor–network theory and feminism, to Deleuze’s philosophy (for overviews of new materialism, see Bennett and Joyce 2010; Hicks and Beaudry 2010; and a helpful outline for design studies by Boradkar 2010). Given its rich heritage, the ‘newness’ of new materialism rather refers to a renewing of older traditions. As Diana Coole and Samantha Frost write, it is about rediscovering ‘older materialist traditions, while pushing them in novel, and sometimes experimental directions, or toward fresh applications’ (2010: 4).

As we are witnessing the ‘emergence of new paradigms for which no overall orthodoxy has yet been established’ (Coole and Frost 2010: 4), the debates are lively. This is the case for the field of cultural studies where the paradigm of semiotics and signification was dominant until recently or even today. Barthes’s ([1967] 1990) semiotic understanding of dress as representation pushed the realm of fashion into the sphere of immateriality. As Sophie Woodward and Tom Fisher put it: ‘representation privileges the immaterial’ (2014: 5). A focus on materiality is both welcome and necessary in order to restore the balance. John Storey, for instance, added the chapter ‘The materiality of popular culture’ to the seventh edition of his well-known Cultural Theory and Popular Culture (Storey 2015). While he readily acknowledges that popular culture takes a material form, giving a long list of random examples including cars, DVDs, toys and wedding rings, he also defends time and again that ‘[m]ateriality is mute and outside culture until it is made to signify by human action’ (2015: 229). Storey is wary of the claim made by theorists of material culture studies,
for him represented by anthropologist Daniel Miller, that ‘addressing questions of meaning is superficial’ (Storey 2015: 235). Similarly, Miller is wary of cultural studies scholars who reduce clothing ‘to its ability to signify something that seems more real […] as though these things exist above or prior to their own materiality’ (2005: 2). While the reproaches back and forth point to the vibrancy of the debate, we may want to keep the ‘entanglement of materiality, meaning and social practice’ in equal balance, as Storey recommends (2015: 235). According to Woodward and Fisher, ‘material culture studies attempted to reconcile both structuralist and semiotic approaches’ (2014: 4), by studying not only the material qualities of garments, but also ‘how garments are able to externalize particular cultural categories of identities’ (4).

The focus on materiality in new materialism may be relatively new for a field like cultural studies, but this is less the case for fashion studies, which has its origin in dress history, paying great attention to the details of the object, especially the ‘material qualities of cloth’ (Woodward and Fisher 2014: 3; recent examples of such approaches are Sykas 2013 and Palmer 2013). The ‘Methodology’ issue of Fashion Theory from 1998 was concerned to address ‘the current divergence between object-based study, carried out by museum curators and makers of reproduction dress, and university studies of dress and fashion, usually based on written sources, images and statistics, but rarely on the real thing’ (Jarvis 1998: 300). The special issue testifies to the unease experienced by dress historians and museum curators who often felt that ‘dress study ha[d] been appropriated by the theorists, and buried in complex and inaccessible language’ (Jarvis 1998: 300).

In order to distinguish new materialism from traditional object-based studies, let me turn in more detail to the debates in the ‘Methodology’ issue of Fashion Theory from 1998. Object-based research is described by Lou Taylor as a method that ‘focuses necessarily and unapologetically on examination of the details of clothing and fabric’ (Taylor 1998: 347). In her contribution, Valerie Steele explains how archaeologist Jules Prown taught her ‘to “read” a dress’, by analysing an artefact in three stages: description, deduction and speculation (Steele 1998: 329). She expands Prown’s model with a second one proposed by E. McClung Fleming, which consists first of a fivefold classification of the basic properties of the artefact, i.e. its history, material, construction, design and function, and then ‘a set of four operations to be performed on these properties’: identification, evaluation, cultural analysis and interpretation (Steele 1998: 329). The combination of these two methods allows Steele to move from an object-based analysis of a dress or corset to a cultural analysis of gender and sexuality.4

In spite of Steele’s smooth operation, Lou Taylor refers in the same special issue of Fashion Theory to heated debates between object-based methods and theory-based cultural analysis. Indeed, Taylor introduces the infamous ‘great divide’ between the object-centred methods that emerged predominantly out of the work of museum curators versus academic and theoretical approaches situated in the universities (1998: 338).5 According to John Styles, the debate was fierce, with academic scholars being criticized ‘for their empirical ignorance’ and empirical researchers dismissed ‘as conceptually naïve’ (Styles 1998: 388).

Looking back on the debate almost two decades later, it is interesting to note that a focus on the gathering of data for description and documentation can no longer be considered the most appropriate approach for analysing fashion now that fashion studies encompasses such diverse issues as ‘identity, materiality, dress history, technology, and globalization, among others’
Anneke Smelik (Black et al. 2013: 1). Alexandra Palmer writes that ‘[t]he descriptive methodology has fallen out of academic fashion’ (Palmer 2013: 269), noting that the ‘seemingly old-fashioned museum-based approach of fashion studies, which begins with the description of the object, is a complex and underutilized approach for new scholars’ (268). Perhaps this is partly due to the fact that scholars lack specialized knowledge ‘of sewing technology, fabric types, various weaving techniques, different kinds of trim, cut[s] of fashionable and other dress throughout history and in different parts of the world’ (Skov and Riegels Melchior 2008: 10). Francesca Granata (2012) has reinstalled Prown’s method of ‘reading’ clothes, but in her case this method can only work by critically combining it with theories from film studies and cultural studies.

In my view, fashion studies may be well equipped to integrate the divergent strands and bring together dress and art historians, anthropologists, sociologists and cultural studies scholars, in their shared acknowledgement that fashion consists of material objects and involves a bodily and social practice of dressing. For Jules Prown, material culture studies aims to study objects for the purpose of better understanding culture (1982: 2). Anthropologists regard clothes as objects in their own right or as meaningful within practices of dressing (Küchler and Miller 2005), while art historians like Caroline Evans (2003) combine attention to dress with a solid understanding of postmodern culture. Ethnographic approaches are important methodologies for understanding what people wear and why in their everyday lives, making choices about how to construct their identities through the act of dressing (Woodward, 2007, 2016). Joanne Entwistle (2015) has argued for an empirically grounded sociology that takes the embodied practice of dress seriously, and cultural studies scholars like Angela McRobbie (1998) shifted the focus to the conditions in which fashion is produced. Recently, Bruggeman and Van de Peer foregrounded the materiality of conceptual fashion, ‘the actual material objects of [Viktor&Rolf’s] collections as well as the living, fashioned bodies on the runway’ (2016: 9). We can then safely say that fashion studies has always privileged the materiality of clothes and the relation between clothing and the body. Because these diverse approaches have been vital methodologies for fashion studies (see for a good overview, Jenss 2016a), the question is what does new materialism have to add, or how can it advance the study of fashion?

As we have seen, fashion studies has developed many different methods for analysing garments, but the field needs new ways of conceptualizing fashion as a complex and ever-evolving phenomenon. It is essential to address conceptual issues if we are to understand what the field of fashion has become in all its multiplicity and complexity in contemporary society, where new technologies and social media have changed modes of production and consumption. I am advocating a move towards a more conceptual apparatus so as to be able to ask new questions and seek new explanations. New materialism is here presented not so much as a methodology, but rather as an interdisciplinary perspective grounded in a theoretical approach. My effort in this article is to construct a theoretical framework for understanding materiality in an age of technological innovation.

A new-materialist approach offers fresh perspectives for the study of fashion for two reasons: (1) it rethinks dualisms and (2) it interrogates the notion of material agency. New materialism endeavours to rethink dualisms between, for instance, the natural and the social, the human and the non-human, the material and the immaterial (Bennett and Joyce 2010). The deconstruction of binary oppositions was already at the heart of poststructuralism, but the critique is further ‘intensified’ in new materialism.
In material culture studies, this perspective has recently gained more ground. Woodward and Fisher, for example, claim that it is crucial to examine ‘the role of materials in the creation and dissolution of fashions’ (2014: 6). Such an approach offers ‘a useful way to understand fashion’s mutability and transience without presuming that we should either characterize fashion as ‘immaterial’ or that the materiality of things is just an unambiguous ‘carrier’ of the meanings of fashion’ (2014: 6). In other words, for a deeper understanding of fashion it is important to overcome the dualism between the material and the immaterial (Bruggeman and Van de Peer 2016). In rethinking matter through the prism of new materialism, the classical divisions between the material and immaterial, the human and non-human, animate and inanimate, begin to break down. People are things too, as new materialists like to emphasize (Frow 2001: 285; Ingold 2012: 438). People and things are not separate entities but constitute one another in the process of becoming.

The entanglement of things both human and non-human is thus crucial for new materialism. The context of this radical shift in thought is ‘posthumanism’ (Braidotti 2013), which entails both a decentring of the human subject (Coole and Frost 2010: 4) and an understanding of things and nature as fundamentally ‘agentic’, that is, as having agency (14). As Prasad Boradkar puts it: ‘Human beings and things together possess agency, and they act in conjunction with each other in making the world’ (2010: 4). For St Pierre, Mazzei and Jackson, this viewpoint points to an ethical imperative:

If humans have no separate existence, if we are completely entangled with the world, if we are no longer masters of the universe, then we are completely responsible to and for the world and all our relations of becoming with it. We cannot ignore matter (e.g., our planet) as if it is inert, passive, and dead. It is completely alive, becoming with us, whether we destroy or protect it.

(St Pierre, Mazzei and Jackson 2016: 101)

In the same year, Donna Haraway pleads in Staying with the Trouble for ‘cultivating response-ability’ for a damaged earth (2016: 34), which means a ‘becoming–with each other’ (60). For Haraway, the other always includes non-humans, or what she refers to as ‘companion species’ like dogs or monkeys, but also bacteria, fungi, spiders, synthetic hormones or polymer fibres.

So far I have shown that taking the materiality of things seriously entails transcending and undoing the dualism of subjects and objects, of people and things, of human and non-human actors. In the following section I will further focus on materiality through the case of Iris van Herpen’s technologically infused designs. The methodology that supports my interpretation of van Herpen’s designs consisted of extensive online research and desk research over the past few years. This was combined with visits to various solo exhibitions of van Herpen’s work in the Netherlands, of which the most extensive was the one in the Groninger Museum in 2012, which travelled to several countries and is now touring in the United States under the title Iris van Herpen: Transforming Fashion. She herself considers the support of the Groninger Museum as pivotal to her career (Bolton 2016). I could not revisit the Groninger Museum for this research because all thirty pieces by van Herpen that were in their archive are now on tour for the American exhibitions and will not return to the museum until 2019. However, I paid a visit to the archive of the Centraal Museum Utrecht, where I was allowed to view,
touch and photograph van Herpen’s designs. Unfortunately, despite repeated efforts over the last two years, I was not allowed to visit Iris van Herpen’s studio in Amsterdam.

MATERIALITY, OR THE FOLDS IN IRIS VAN HERPEN’S DESIGNS
Like most of her collections, *Seijaku*, Iris van Herpen’s couture winter collection from 2016, features dresses in the most stunning folds and inimitable shapes in the strangest fabrics. Hi-tech materials are transformed into layers of plastic lamellae, glass beads or transparent organza that are folded onto each other in otherworldly silhouettes. Morphing art, fashion and technology, van Herpen’s designs come across as alien, perhaps even slightly scary and off-putting. Van Herpen’s fractal style of undulating waves and post-Euclidian geometric patterns does not only derive from her imagination, but is also inspired by new technologies that she developed with scientists (e.g. MIT Media Lab, CERN) or in collaboration with artists (e.g. architects Daniel Widrig and Philip Beesley, choreographer Nanine Linning and sound designer Salvador Breed). Generally considered ‘one of few designers marrying tech and couture’ (CNN Style 2016), she is one of the pioneers of 3D printing, for which she has used new materials like super-polymers, inorganic fibres based on carbon, glass or ceramics, metallic or optic fibres, or microfibres, and even nanomaterials, which are all examples of high-performance textiles (Quinn 2010; Bolton 2016).

Van Herpen describes the complex ways in which she created the fabrics for *Seijaku*: she coated thousands of hand-blown glass bubbles in transparent silicone.

![Figure 2: Iris van Herpen, Seijaku, F/W 2016, dress made of hand-blown glass bubbles in transparent silicone. Photo and copyright by Peter Stigter.](image-url)
silicone, creating a ‘bioluminescent prism around the body’ (van Herpen 2018). She used a similar technique to silicone-coat tens of thousands of Swarovski crystals, creating a dress with ‘the look of a wet skin covered in dew drops’ (van Herpen 2018).

Other techniques included stitching pearl-coated rubber fabric onto black tulle or laser cutting and stretching a dress over black wire to scroll around the body. She also applied ‘a 3-D moiré technique in which hand-plisséed and line-printed organza is hand stitched on transparent tulle’. Japanese organza is woven from microfibres – ‘threads five times thinner than human hair’ – which endows fabrics with greater softness by allowing the fabric to be moulded with the traditional Shibori technique of folding, binding and wrapping. Elsewhere, she describes how 3D printing enables her to create the finest detail up to ten lines a millimetre (van Herpen cited in Bolton 2016: xvii). Already in earlier work (Micro collection, S/S 2012), van Herpen had used laser cutting of acrylic strips to create a plissé style: ‘I love using non-traditional materials to evoke traditional techniques’ (van Herpen cited in Bolton 2016: xx). According to Quinn, the use of advanced materials and pioneering new processes emphasizes and enhances ‘strong shapes and extraordinary silhouettes’ (2012: 12), and expresses the fusion of fashion and technology in all its futuristic splendour.

Van Herpen’s designs are characterized by pioneering technologies as well as by detailed handwork. Remarkably, in spite of her predilection for innovative technologies, craftsmanship remains important to van Herpen’s work. Each garment, however much technologically designed and manufactured, is finished with the finest detail by hand: ‘between 70 and 90 percent of my work is done by hand – hand cutting, hand stitching. […] For me, handwork is a form of meditation’ (van Herpen cited in Bolton 2016: xvii). In other words, the fusion of technology and craftsmanship is paramount. The renewed focus on craftsmanship is intimately connected to the technological world in which we live. As Richard Sennett writes, ‘technical understanding develops
Confusingly, the website marks both Seijaku and Lucid as F/W 2016.

Through the powers of imagination’ (2008: 10). The artisanal qualities of craftsmanship bring the new technologies within our physical grasp, making the hi-tech world more human and accessible. Moreover, the focus on craftsmanship betrays a new interest in the very materiality of matter in a hi-tech world of digital technologies (Barrett and Bolt 2013). Where for Sennett it seems utopian for craftsmen to work with machines productively (2008: 118), Iris van Herpen is apt at combining craftsmanship with technology in a way that can be related to the original Greek meaning of the word techne: art, skill, craft. Although the initial designs are made on the computer and transferred by a technician into a 3D format, van Herpen moves beyond the virtual technology by finishing the object off by meticulous handwork. Her design practice shows a traditional approach to materials, except that those materials happen to be produced by the latest technologies.

From a new-materialist perspective, matter is not just passive and futile stuff, but should be considered as an active and meaningful actor in the world (Barrett and Bolt 2013: 3, 5; Ingold 2012). In this respect, let me take a closer look at the materials and technologies developed by Iris van Herpen for Lucid, another collection from 2016, in which she made dresses ‘from transparent hexagonal laser-cut elements that are connected with translucent flexible tubes, creating a glistening bubble-like exoskeleton around the wearer’s body’. She again fused technology with handcraft for ‘two 3-D printed Magma
dresses that are combining flexible TPU printing, creating a fine web together with polyamide printing’. She claims that one of the dresses is stitched from 5000 3D-printed elements, creatively fusing silicon fibres, tubes and stitches. By mixing old and forgotten crafting techniques with technological innovation and new materials, van Herpen creates assemblages linking the past with the future.

Combining traditional craftmanship with new technologies not only allows van Herpen to focus greater attention on the material aspects of dress, but also to create engaged and meaningful interconnections with the human body. In van Herpen’s designs, the technology is not hidden, but is expressed as part of its aesthetic. Her sculptural silhouettes invite the wearer to inhabit the freedom of co-creating the body into new shapes. Elsewhere, I have argued that van Herpen’s futurist designs point to ways of de-organizing and deterritorializing the human body (Smelik 2017). She creates a dynamic body that opens up to a multiplicity of lines, notches, gaps, holes and fissures. Materiality, or matter, pertains to things – to high-performance fibres and smart materials – and to the human body and identity, as well as to the interaction between the two.

The privileged relationship between clothes and the body in fashion studies predates the claims of bodily agency within the framework of new-materialist thinking. Fashion studies has claimed that clothes are ‘dead’ without a human body wearing them. Elizabeth Wilson argues that there is ‘something eerie’ about old clothes displayed in a museum or hanging in the closet of a deceased person, because they ‘are so much part of our living, moving selves’ (Wilson [1985] 2003: 1). Steele writes that ‘a museum of fashion is ipso facto a cemetery for “dead” clothes’, and that ‘collecting and exhibiting clothes in a museum effectively “kills” their spirit’ (1998: 334). Joanne Entwistle (2015: 29) has convincingly argued that dressing is a situated embodied practice located in space and time. According to her, any analysis of dress should include the body and explore the dynamic relationship between fabric and flesh (Entwistle 2002: 148). ‘The materials we hang at the margins of our body enjoy a close proximity to the flesh, outlining, emphasizing, obscuring or extending the body’ (Entwistle 2002: 133). New materialism then departs from a respectable tradition of taking the body seriously in fashion studies.

In a 2011 interview, Iris van Herpen claimed that the human body is essential for her creations, although the designs, certainly at the time, look avant-garde and sculptural, and, frankly, rather unwearable in their stiff unfamiliarity. While van Herpen focuses first and foremost on the materiality of textiles, as fashion designer she is also interested in the materiality of the human skin and body. The innovative materials allow for new forms and structures that extend the shape of the (female) body. Warwick and Cavalarro have argued that

[i]n its relationship with dress, the body is an eminently osmotic shell: when we adopt certain garments, we do not confine ourselves to knowing their qualities and attributes, since, through direct physical contact, we also assimilate them, we make them our flesh.

(Warwick and Cavalarro 1998: 116)

Van Herpen says so much herself: ‘For me fashion is an expression of art that is very close related to me and to my body. I see it as my expression of identity combined with desire, moods and cultural setting’.
Having been a dancer, van Herpen understands that movement is essential to the body as well as to the clothes: movement ‘infuses every aspect of my design process’ (van Herpen cited in Bolton 2016: xvii). She claims that the technology of 3D printing helps her to explore movement three-dimensionally (van Herpen cited in Bolton 2016: xvii). Motion and emotion are not only etymologically linked, but also quite literally: the movement of the clothes and the motion of the body reveal the human body as full of passion, affect and intensity. As Giuliana Bruno claims, ‘Sensorially speaking, clothes come alive in (e)motion’ (Bruno 2010: 222). When watching the video of Seijaku, one can see the intimate relation between motion and emotion (van Herpen 2016). The show is a meditative performance rather than the spectacle of a catwalk, taking place in a cathedral-looking space, the oratory of the Louvre, and accompanied by a live sound installation of Zen bowls by the Japanese musician Kazuya Nagaya. The models walk into the space, pass the installation of the bowls and take up a position on a pedestal somewhere in the ‘church’. At the end of the performance all models stand on pedestals in the space, shot through with light from very high windows, moving their arms and hands along with the ethereal sounds of the minimalist music. The five-minute video is rendered in slow motion, enhancing the almost religious atmosphere, creating a strong effect of awe and wonder.

The clothes move along with the body in the unique folds of the 3D-printed garments, while the organza dress flows softly through space. The rise and fall of the garments is quite intricate, following the complicated folds of the 3D-printed materials. As the movement – of garments, of bodies – is soft and careful, the fashion designs open up a process of becoming, dissolving the distinction between inside and outside, depth and surface, being and appearing. Such vibrant movement can be linked to the notion of the fold. In my view, van Herpen’s fundamental stylistic feature is the inimitable fold: her designs ripple, loop, wave, twist, curl, wrinkle, circle and undulate. These fractal folds have been made possible by the technology of 3D printing. While the polyamide in the designs of the first years was still very hard and stiff, in more recent years the new materials have become softer and more elastic. The 3D printed folds and creases of the more recent designs are enabled by the plasticity of new materials like super-polymers – fibres based on carbon, glass, ceramics, metallic fibres, microfibres, silicone rubbers (Quinn 2010) or nanomaterials (Bolton 2016).

In his book The Fold, the philosopher Gilles Deleuze ([1988] 1993) unravels the material qualities of the fold as a continuous dialogue between inside and outside. Turn the fabric of a dress from the Seijaku collection this way and a fold shows the inside; turn it that way and the fold shows the outside. Deleuze uses the concept of the fold to undermine the idea that subjectivity consists of an opposition between interiority and exteriority. He claims that the fold is a dynamic and creative force that opens the subject up to a process of infinite becoming. Elsewhere, I have argued that the fold functions as an interface between the inside and the outside, depth and surface, being and appearing, and as such demolishes binary oppositions (Smelik 2016). Again, we see how new-materialist thought is fundamentally non-dualistic. Van Herpen’s designs are hybrid assemblages of fibres, materials, skin and body that are always in the process of becoming, or becoming-with, in Haraway’s words (2016). The term assemblage was introduced by Deleuze and Guattari to understand life as a rhizomic network made up of ‘semiotic flows, material flows, and social flows simultaneously’ (Deleuze and Guattari [1980] 1987: 22–23). This creative
entanglement is visually replicated in van Herpen’s pieces in *Seijaku* and so many other collections. The multiple layers of fold upon fold show the assemblage in all its dynamic force. As Iris van Herpen herself says, ‘[t]o me, plissé is about layering and using those layers to create flexibility and movement’ (van Herpen cited in Bolton 2016: xx). In connecting with the body in ways that are not static, rigid or normalized, the collections open up possibilities to slowly morph, transform and become together. In a new-materialist context, the notion of becoming as a process (rather than as static being) is important: ‘complex, even random, processes have become the new currency’ (Coole and Frost 2010: 13). We can understand van Herpen’s experimental designs as an invitation to engage the wearer in a creative process of becoming, by transforming the body, and going with the flow of the movement of the folds. In 3D printing fold after fold, pleat after wrinkle, wave after ripple, her designs create a play of multiple becomings, fast-forwarding the human body into the post-human world of a future that has already begun (Braidotti 2013: 182).

Working from the level of heterogeneous materials, I have moved to the entanglement of matter and meaning, and of materiality and the human body. This points to the notion of agency, but it begs the question where such agency can be situated: in the materials, the garment, the body or the individual? To further highlight the relevance of new materialism to fashion studies in the age of technological innovation, I will now turn to the concept of material agency.

**MATERIAL AGENCY**

Valerie Steele admonishes that ‘[t]ape measures, scales, and magnifying glasses are useful tools’ to ‘read’ a garment (1998: 329). However, when I studied Iris van Herpen’s dress from the collection *Escapism* (2011) in the archive of the Centraal Museum, I was struck that the curator, Ninke Bloemberg, and I were rather confused as to what was back to front or up and down.10 We could not make much sense of the 3D-printed piece that we were holding in our hands, without looking at an image of a model wearing it. Touching the hard material also did not give much information about the kind of ‘fabric’ or technology we were confronted with, although we could see the plastic had been smeared with the make-up of the model who wore it on the catwalk. Although we measured the garment (length 120cm, width 60cm, depth 60cm), the conventional tools of object-based dress studies seemed to fall short to even begin to describe this garment of intricate fractal folds. The website of the museum gave the information that the dress had been created together with the architect Daniel Widrig, with a then still novel technique called ‘Selective Laser Sintering’. For more information we reverted to a video specially curated by the Centraal Museum on the making process of several of those garments.11 My experience in the museum’s archive shows that technological innovation requires new methods of analysis and new concepts. It is within this context that I explore a novel concept from the framework of new materialism to present as a theoretical lens through which we can think about new materials and technologies: ‘material agency’.

Agency is conventionally aligned with human intentionality: traditional philosophy has it that people are endowed with a will and therefore have agency. New materialists make a radical shift from this by attributing agency to non-human actors, like things, artefacts, technologies, animals and nature in general. Fully acknowledging the role of materiality in our daily lives’
recognising distinctive forms of agency and effectivity on the part of material forces’, as Tony Bennett and Patrick Joyce maintain (2010: 3). In the field of material culture studies, there is a central debate whether objects can be said to have agency (Knappett and Malafouris 2008). Daniel Miller has long made up his mind and speaks of material culture as ‘having agency all of its own’, wittily adding: ‘Things do things to us, and not just the things we want them to do’ (2010: 94). Do we not all recognize this when an app on our tablet fails, a dress doesn’t fit us anymore or a woollen sweater itches? Alfred Gell can be credited with being the first anthropologist to have focused on the agency of art objects in his posthumously published Art and Agency (1998). Woodward and Fisher (2014) draw on Gell’s book to propose that agency emerges within a web of people and artefacts: ‘Objects are part of the generation and actualization of the agency of people, and, through their materiality, can carry or thwart people’s agency’ (2014: 8). The idea of a web or network is quite important in new materialism, coming from diverse origins; for example, the concept of the rhizome that connects at random and across many directions in Deleuze and Guattari’s A Thousand Plateaus ([1980] 1987) or the network that connects human and non-human actors in Latour’s actor–network theory (2005). New materialists perceive things, people and society as co-producing one another in ‘complex networks’ (Boradkar 2010: 9).

In an earlier anthropological approach, Arjun Appadurai’s seminal volume The Social Life of Things pleaded to ‘follow the things themselves, for their meanings are inscribed in their forms, their uses, their trajectories’ (1986: 5). The idea that a thing, a dress or a pair of jeans, may have a social life is indeed illuminating, particularly in light of the distinction between what Appadurai describes as the social history of things, pertaining to longer-term shifts and larger-scale dynamics, and what Igor Kopytoff in the same volume calls the cultural biography of a specific thing accumulating a particular narrative (Kopytoff 1986: 64). For both Appadurai and Kopytoff to trace the cultural biography of a thing entails the unravelling of the specific value that it has acquired in the course of its life. This explains how the social practice of dressing endows a garment with affect and hence with particular memories and psychological importance (Jenss 2016b). Wardrobe studies (Downing Peters 2014; Woodward 2007), studies of a particular garment like jeans (Miller and Woodward 2012; Lewis 2015) or of a specific fabric like denim (Miller and Woodward 2011), show how practices of dressing weave experiences and memories through wear and tear into the objects that have become part and parcel of our social life.

The idea of ‘thingly’ agency can be pushed much further when following different trajectories of thought such as science and technology studies (Latour 2005; Law 2010), philosophy of science in its feminist inflections (Haraway [1985] 1991; Barad 2003) or Deleuzean philosophy (Ingold 2007; Barrett and Bolt 2013; Braidotti 2013). In these perspectives, material agency entails displacing the anthropomorphic notion of human exceptionalism, i.e. the idea that only humans possess agency. The most fundamental reconfiguration of agency outside human intentionality or subjectivity has occurred in the feminist philosophy of science. Donna Haraway was among the first to make this shift in her well-known cyborg manifesto ([1985] 1991). She deplores the narcissistic tendency of humans to underestimate the degree to which the boundaries between human, animal and technology have been thoroughly breached. She warns: ‘Our machines are disturbingly lively, and we ourselves frighteningly inert’ (Haraway [1985] 1991: 152). In her latest book, she argues that deep interconnectedness is the only way to defy human exceptionalism,
Haraway (2016) also abounds in textile metaphors throughout her book, for instance ‘plucking out fibers’, ‘following the threads’, ‘tying off the threads’, ‘undoing the fabric’. One of her case studies is Navaja weaving (2016: 89–97) as a ‘cosmological performance, knotting proper relationality and connectedness into the warp and weft of the fabric’ (91). It may be interesting to pursue why theorists and philosophers take recourse to textile metaphors when they try to think beyond the usual confines of conventional discourse.

Tim Ingold (2010), too, understands agency not as an act that is performed by an object (which would amount to an anthropomorphic view) but rather as an emergent flow that is inherent in an open-ended process of becoming. The material world, he reminds us, is made up of ‘things’ – a thing being ‘a certain gathering together of the threads of life’ (Ingold 2010: 4). Interestingly, Ingold uses metaphors taken from the world of cloth and textiles, like ‘threads’ (4), ‘woven fabric’ and ‘the tracery of lace’ (12), in order to argue that ‘things’ are made up of ‘knots’ and ‘entwinements’ (4). For Ingold (2010), things are gatherings of materials and forces (Toussaint and Smelik 2017). The echoes of Deleuze and Guattari are not far away when he writes about the life of things, the flow of materials, the transformation of matter (Ingold 2010). In a similar vein, Coole and Frost poetically write: ‘For materiality is always something more than “mere” matter: an excess, force, vitality, relationality, or difference that renders matter active, self-creative, productive, unpredictable’ (2010: 9).

**Figure 5: Iris van Herpen, Seijaku, F/W 2016, detail of folds. Photo and copyright by Peter Stigter.**
This dynamic view of the material world may help to better grasp van Herpen’s designs. Rather than developing a sci-fi aesthetic, she often finds inspiration in a natural phenomenon, using cutting-edge technologies to ‘catch’ immaterial processes like dreams, sound waves and magnetic fields, or organic forms like waves of water, wisps of smoke, a spiderweb or a butterfly wing, in the smart materials of her 3D-printed dresses: ‘With 3-D printing, I am very much drawn to the organic [...] because in organic structures such as fossils, for instance, you have structures that you can’t easily replicate by hand’ (van Herpen cited in Bolton 2016: xvii). Elsewhere, she has referred to her sculptural designs as ‘organic futurism’ (Bloemberg 2011: 13). She believes that in the future ‘people could be dressed in such things as smoke, drops of water, coloured vapour or radio waves. Clothes could have the same body language as the wearer, moving with the body rather than restricting it’ (van Herpen cited in Quinn 2012: 50). While the first 3D-printed designs of fractal folds are still stiff and hard, for example in *Capriole* (2011) or *Escapism* (2011), van Herpen has further developed the technology of 3D printing and made the garments gradually more flexible. In the videos of her shows, this development towards increasing flexibility and fluidity can easily be traced.\(^{13}\)

*Voltage* (F/W 2013) shows the first flexible 3D-printed dresses. The designs look like they have been struck by lightning as the familiar folds and loops point outwards in ever-moving spikes or tentacles. In *Wilderness Embodied* (F/W 2014) she has managed to make 3D-printed material look like soft feathers, and in *Biopiracy* (F/W 2015) the garments are flowing around the bodies of the models.

By heeding Ingold’s call to follow the ‘flows of materials’ (2010: 4), we can see how van Herpen’s designs create alliances and encounters between fibres, fabrics and bodies; between craftsmanship and technology; and between materiality and immateriality. In the case of Iris van Herpen’s 3D-printed dresses, the notion of agency foregrounds the fact that the technology
estabhshes interaction between human and non-human entities. Van Herpen
shares this view: ‘I think nanoengineering and metamaterials will probably
create completely new behaviours. As designers, we don’t realize how much
of our designs are dictated by materials and their behaviour’ (van Herpen cited
in Bolton 2016: xix). In contrast to viewing fabric and cloth as passive ‘stuff’,
the fibres and garments acquire a life of their own in the 3D-printed folds,
interacting with the human body in motion. In this article I have taken Iris van
Herpen’s designs as a case study, but there are of course many other conceptual
designers who achieve similar effects, such as Issey Miyake, Junya Wanatabe,
Alexander McQueen, Martin Margiela, Hussein Chalayan, Viktor&Rolf and
Gareth Pugh. Other examples are the designers for wearable technology, such
as the collective Cute Circuit, innovation lab and product development studio
The Unseen, and Dutch designers Pauline van Dongen and Anouk Wipprecht.
Here I wish to return to the notion of assemblage, the human and non-human
actors of fibres, materials, technologies, skin and body that together make up
the open-ended process of becoming in van Herpen’s designs. This process is
about connecting and interacting, and thus about morphing, changing, trans-
forming; not only with other human beings, but also with non-human actors
and matter around us.

CONCLUSION

The claim that we live in an age of new materialism, to paraphrase trend
forecaster Lidewij Edelkoort, holds not only true for fashion designers but
has been long acknowledged by academics. In fact, academics have tried to
explain what it means to live in such an era. In this article, I have explored
how a new-materialist theoretical framework can strengthen fashion studies.
A new-materialist approach aims at undoing dualisms, such as the biological
and the technological, the human and the non-human, the material and the
immaterial. New materialists work from a dynamic notion of life in which
human bodies, fibres, fabrics, garments and technologies are inextricably
entangled. Such a perspective permits an understanding of fashion as materi-
ally co-produced in a complex network of interconnected human and non-
human actors. The post-human framework of new materialism(s) proposes a
non-anthropocentric view by taking the human subject away from the centre
of attention and viewing the world as made up of complex and intensive
assemblages where humans, animals and things connect and interrelate in a
variety of ways (Braidotti 2013). To conclude, let me briefly recap how a new-
materialist framework can facilitate fashion studies.

A new-materialist approach re-appreciates the material and sensory
aspects of fashion in interaction with image, spectacle and representation
(Bruggeman 2017). The key concept here is material agency, which is based
much more on radical insights from science studies than on the humanities.
This means a shift from human will or agency to the very materiality of the
human body as vibrant and intelligent matter. It also entails recognizing some
form of agency in non-human actors – from organic cotton to man-made
fibres, knitted wool to smart fabrics, solar dresses to 3D-printed garments –
bringing the dynamics of fashion to the fore. As fashion is by definition made
for and worn on the human body, it may be particularly difficult, but also
productive, to separate agency from its traditional humanist frame. This means
approaching the human body as an assemblage of material forces, just as
much as nature or things are shot through with material forces.
The insight of material agency is important for acknowledging the pivotal role of technology in fashion design today. From wearable technology to Iris van Herpen’s futuristic designs, technology acquires an independent function beyond the control of the wearer. Van Herpen’s dresses show how agency can be performed by technology in such a way that they can no longer be understood as a strictly human property. The extravagant forms and shapes draw attention to the technology of the designs, showing that materiality is active and productive. The combination of traditional craftsmanship and innovative technologies not only allows van Herpen to focus greater attention on the material aspects of high-performance fibres and smart fabrics, but also opens up engaged and meaningful interconnections with the human body. Her designs consist of hybrid assemblages of fibres, materials, skin and body that are always in the process of becoming.

If matter, in all its manifestations, is an emergent flow that forever changes and transforms, and if technology is an intrinsic component of this flow, then it is imperative to foreground the field of fashion in discussions about new materialism and vice versa. For fashion studies it is highly relevant to analyse human and non-human actors together, given the unsustainable state of affairs in the field of fashion production and consumption abounding in waste. Fashion is not an optional extra, but a fundamental operative principle of contemporary new materialism.

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