

MATERIAL EXPLORATIONS

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Clemens Thornquist, 2019

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Introduction

In practice, most product-development processes in design and engineering start with an understanding of user or market analysis. Following this is the step of defining the issue and ideation in order to generate an interesting product. Prototyping and materializing the idea and then testing and revisiting it for defining details continue the process. Finally, implementing the idea through production and sales wraps up the procedure. Selection of materials comes at the end of the design process once the stages of identifying with the user and defining the problem and ideation have taken place. From a more theoretical perspective, the domination of this type of design process may be attributed to the theoretical and institutionalized separation between form and material, as well as the separation of modeling, analysis, and fabrication – theory and practice – which has been deeply rooted in modernist design theory and its philosophical foundation. A typical example of this way of thinking about the design process – of prioritization of form over material – can be found in the development and design of CAD programs for design development and generic geometric-driven form generation [1][2][3].

Over the past two decades, however, the interest in materials before form has grown and developed remarkably in the field of design, perhaps not only to challenge institutionalized knowledge or to submit a critique of design engineering that tends to oversimplify problems and their suggested solutions, but also to articulate global environmental concerns. In practice this means that material selection is carried out at the beginning of the process as a source of innovation in product development or that material and form generation is integrated as in computational materials, for example. Parallel to this development in the theory and practice of design is the opportunity to explore materials and discover their potential both in the development of new material as well as to check out the transformative potential of traditional materials for new design possibilities in the early phase of design processes [4][5][6].

The shift from prioritizing material over form or looking into material, structure, and form together not only suggests a shift in the order of steps in a design process, but it also presents a shift from material selection to material exploration. For example, in a form-focused design process, materials selection is an analytical procedure that occurs after a well-defined context and formalized criteria based on the use and manufacturing of a mature product has been reached. If, on the other hand, one considers materials at the beginning of a design process, the idea of discovery shares more similarities with the openness and abstract of scientific discovery in basic research – often anything but analytical – and works to find and define new possibilities that for itself may present new products, business strategies, and user needs [7][8].

While the idea of material-driven processes is not new and the publication list of theories and models is not short, this book on material explorations in design aims to jump-start your curiosities and desire to push material boundaries through fundamental research. Considerations required in this process of exploring materials design – those that will provide some direction in the research process – demand both confidence and stamina, especially in relation to persistent questions of usefulness, as one conceptualize your own approach or open up fresh thinking about alternative approaches. The number of approaches to material research presented in this book is not to be understood as a complete inventory; in fact the list could probably be longer. Methods are abundant, and these suggestions simply demonstrate the wide field of possibility for divergent thinking in materials research for new aesthetics – both functionally and expressively and in combination.

Cf.

[1] Bramston D. 2009. *Material Thoughts*. Lausanne: Ava Publishing.

[2] Karana, E., Barati, B., Rognoli, V., and van Der Laan, A. 2015. *Material Driven Design (MDD): A Method to Design for Material Experiences*. *International Journal Of Design*. 9(2), 35–54.

[3] Innna, A., and Lupton E. 2010. *Exploring Materials: Creative Design for Every Day Objects*. New York: Princeton Arquitectural Press.

[4] Pati, L. 2012. *Using Material Exploration and Model-Making as an Approach for the Development of Concepts in Design Project Courses*, *Proceedings of the 14th International Conference on Engineering and Product Design Education (EandPDE12) Design Education for Future Wellbeing*, Antwerp, Belgium.

[5] Oxman, N. 2010. *Material-based design computation*. Cambridge: MIT. Dept. of Architecture. <https://dspace.mit.edu/handle/1721.1/59192> [Retrieved 20190820]

[6] Swisher, K., and Ito, J. 2019. MIT Media Lab director Joi Ito on the problem with tech people who want to solve problems. *Recode Decode*. [Retrieved 20190715].

[7] Ashby, M., Bréchet, Y., Cebon, D., and Salvo, L. 2004. *Selection Strategies for Materials and Processes, materials and design*, 25, 51–67.

[8] van Bezooyen, A. 2014. *Materials Driven Design*. In *Material Stories* in Rognoli, V., Karana, E. Eds. *Materials Experience: fundamentals of materials and design*. Oxford: Butterworth-Heinemann, pp. 277–286.

Content

Material distortion

Material thinking

Material juxtaposition

Material technology

Object material

Displaced material

Disobedient material

Ephemeral material

Material interaction

Discussion material

Material intersections

Material transposition

Ornamental material

Material assemblage

Machine material

Embodied material

Material transformation

Mono material

Responsive material

Material abstraction

Material anthropomorphism

Material efficiency

Pneumatic material

Material perversion

Material suspension

Bioplastic material

Microbial material

Seasonal material

Molding material

Camouflage material

Digital material

Algorithmic material

Material meaning

Biomimetic material

Material argumentation

Nude material

Material augmentation

Speculative material

Hybrid material

Dressed material

Information material

Material memory

Sensuous material

Biomechanical material

Situated material

Material Culture

Material distortion

Idea

To investigate alternative material expressions by applying technologies that distort the qualities of one material by another.

E.g.

Explore the physicality of matter to create more conscious human-material interactions by,

- sowing plants to grow out of metals,
- letting a mirrored structure negative itself,
- constructing a curtain out of stones,
- developing transparent concrete,
- distorting a material with heat,
- fabricating a new version/concept of non-woven,
- stiffening a fluid material in spontaneous or defined ways through various coatings or composites,
- adding hair extensions to, shaving, or spraying color on, a hairy material,
- using glass in the same color tone/imagery as a body or a particular content (room) or landscape,
- etc.

I.e.

When a material is distorted, its original shape (or characteristic) is altered. The form and magnitude of the distortion depend on several different factors, such as material structure and geometry and material type as well as what materials, techniques, and tools are used for the distortion [1].

To enhance the qualities of an existing or a new material, human-material interactions and distortion of expected realities may present a possible design approach. Kengo Kuma, for example, argues that “[s]omething real has a little bit of mutability. Reality is only truly perceived in the presence of some unreality. If it is a little unreal, there is a little bit of a surprise. If there is no surprise with something, it is not real because it goes unnoticed. It might as well not exist” [2][3:42].

Cf.

- [1] Ashby, M., and Johnson, K. 2002. *Materials and Design: The Art and Science of Material Selection in Product Design*. Oxford: Butterworth-Heinemann.
- [2] Brownell, B. 2012. *Material strategies: innovative applications in architecture*. New York: Princeton Architectural Press.
- [3] Kuma, K. 2011. Interview. In Brownell, B. ed. *Matter in the Floating World*. New York: Princeton Architectural Press.

Material thinking

Idea

To investigate typical qualities and concepts of a material or a material type in a different material or a different type of material.

E.g.

Explore,

- textile qualities in non-textile materials through manipulation of the material; for example, laser-cut wood sheets in ways that makes them fluid and bendable,
- metal qualities in textile materials,
- wood that has been woven,
- lightly felted material with alternative structure, thickness, surface, texture, and density,
- architectural structures – such as walls and ceilings typically made solid and rigid materials – in ephemeral or soft or stretchy materials,
- soft tiles,
- a textile table top,
- an environment built of inflatables,
- beaded textile structures in different material combinations and for other uses,
- digital material as a material without properties, or with the properties of a particular material,
- software as an instrument to consider aesthetically; for example, for sound and musical composition,
- etc.

I.e.

As new materials are developed by science and engineering, designers are faced with new challenges and opportunities, such as those presented by the development of plastics. One way to face this challenge is to conceptualize the material with fluid properties or without any properties [1]. Digital material has been viewed as a material without properties because of its flexibility [2], which in turn in creative processes could be conceptualized with tangible properties to compensate [3].

The work of Dahlqvist illustrates this type of exploration. In his work *Now or Näver*, Dahlqvist looks

into ways of applying a textile thinking in birch bark, using the technique of laser cutting. Through processes of material manipulation with a focus on contrasting the inherent properties of the birch bark with conventional textile notions such as tactility, softness and flexibility the goal is to find new qualities within the material that could be discussed as textiles [4].

Cf.

- [1] Doordan, D. P. 2003. On materials. *Design Issues*, 19(4), 3–8.
- [2] Löwgren, J., and E. Stolterman. 2004. Thoughtful interaction design: A design perspective on information technology. Cambridge: MIT.
- [3] Döring, T., Sylvester, A., and Schmidt, A. 2012. Exploring material-centered design concepts for tangible interaction. *CHI'12 Extended Abstracts*, May 5–10, Austin, TX, pp. 1523–1528.
- [4] Dahlqvist, E. 2019. *Now or Näver*. Stockholm: Natur and Kultur.
- [5] Bertelsen, O., Breinbjerg, M., and Pold, S. 2007. Instrumentness for creativity mediation, materiality and metonymy. *Proceedings of the 6th Conference on Creativity and Cognition*, Washington, DC, June 13–15, pp. 233–242.

Material juxtaposition

Idea

To investigate alternative material expressions by positioning unlike materials side by side.

E.g.

Explore,

- combining cork and plastic, steel and leather,
- fusing a technique with crisp detail with a material handled more softly,
- merging a smooth modernist concrete structure or a sharp glass structure with an old weather-worn sandstone house,
- placing non-conventional or historical materials in unusual situations or extreme environments,
- creating a collage of plywood sheets swathed in a classic 1960s-type printed dotted fabric using colored duck tape,
- erecting a mobile phone in concrete,
- joining wooden structures with florescent plastics,
- weaving a completely ridged and hard surface,
- bringing together traditional structures for floral patterns with images or graphics of contemporary urban technology,
- intermingling woven textile fabrics with insulating sealing foam,
- arranging aggressive graphics next to an area of very controlled shading,
- uniting shiny silver survival foil with heavy tartan weave,
- binding a delicate lightweight silk-like jersey fabric with ridged duck tape,
- using high-bond tape fixed to the base of construction structures to combine otherwise difficult-to-join materials,
- layering different types of foam and porous materials with fabrics or other materials,
- laminating glass with different materials,
- casting modules or panels that include 3D objects captured in clear polymers,
- coupling transparent plastics with wood debris [1][2],
- etc.

I.e.

Juxtaposition refers to the act of placing two or more things side by side, often to compare or contrast or to create an interesting effect. In addition, the term denotes the combination of formal elements, and it also refers to the effect, the concept, and the meaning that this more formal combination creates. A typical example of juxtaposition in design and art is the "Object," - a teacup, saucer, and spoon purchased from a department store and lined with Chinese gazelle fur by Meret Oppenheim in 1936. Oppenheim was invited by André Breton to contribute to an exhibition of Surrealist objects, and she decided to act upon a conversation she had recently had with Pablo Picasso and his then-companion Dora Maar when Oppenheim had commented on a fur-covered bracelet that she had made for Schiaparelli, Picasso noted that one could cover just about anything in fur. Oppenheim responded: "Even this cup and saucer" [3]. On a similar note is the placement of Jeff Koons's shiny Balloon Dog in a room at the Chateau de Versailles, and its resulting criticism [4].

Cf.

[1] Eklöf, A. 2014. Expressions of Tape. MA Thesis. Borås: University of Borås.

[2] Putput. 2019. PUTPUT. <https://www.putput.dk> [Retrieved 20190610].

[3] Oppenheim, M. 2017. Oppenheim: Object (One on One) New York: The Museum of Modern Art.

[4] Davis, L. 2008. Descendant of Louis XIV tries to ban exhibition. <https://www.theguardian.com/world/2008/dec/27/france-jeff-koons-art-exhibition> [Retrieved 20190625].

Material technology

Idea

To investigate alternative expressions and functions by developing new or alternative tools for design.

E.g.

Explore,

- tweaking an existing extruding machine or building a new one for a different scales or different materials,
- adapting an existing grinder or building a new one to crush different types of materials into small pieces (granulate),
- building a large-scale wrapping machine to envelop enormous objects and architectural structures,
- developing a 3D loom-weaving machine by inserting and attaching homemade warp bar(s) for different warp layers,
- developing screen-prints with new types of frames for screen printing,
- developing a rotating tailor's mannequin for new types of non-woven textiles and garments,
- constructing jumbo knitting needles on the scale of a built environment,
- testing different materials in a metal injection molding machine,
- building a large-scale 3D sculpture for 3D draping of the body,
- combining three existing machines of the same kind that together constitute a new machine,
- etc.

I.e.

When you make your own tools, not only do you have a chance to solve problems in new ways, but you are also able to create new expressions, functions, and perspectives. In our DIY-culture and with environmental issues, a typical example of developing one's own tools is a DIY-machine for converting household plastic waste into a material resource through CNC shredding and cutting and reforming the shreds through pressure into solid blocks.

Cf.

- [1] Högberg, E. 2017. A Border Between. MA Thesis. Borås: University of Borås.
- [2] Alvarez, A. 2019. Anton Alvarez. <http://antonalvarez.com> [Retrieved 20190610].
- [3] Hakkens, D. 2016. Precious plastic. <https://preciousplastic.com> [Retrieved 20190610].
- [4] Jönsson, J. 2019. Deep Impression: Exploring the dimensional possibilities of knit in relation to body and space. MA Thesis. Borås: University of Borås. [Retrieved 20190615].

Object material

Idea

To investigate different objects as material.

E.g.

Explore ways of shifting from an object for itself to material for itself, by:

- repositioning an object or structure in ways that its function is abstracted, and the objects become abstract expressive matter for new conceptions,
- turning a structure upside down or on the side; for example, a whole house or an interior,
- flattening a wig and inserting it in a generic white frame with glass,
- folding a classic steel-frame folding bed randomly so that its mattress and mattress-cover are disorderly and then hanging it all in a sculpture on the wall,
- rearranging ordinary objects or objects of a particular situation into a physical sculpture/ assemblage,
- organizing landscape elements according to color,
- fastening a piece of clothing to the wall,
- cutting a figurative print in tiles or patterns,
- deconstructing a laptop or a car and sculpting it in an abstract way,
- collaging a series of code according to categories,
- considering the materiality of a product; for example, analyzing a typical cycling team jersey by deconstructing its different materials elements like texture, prints, colors, density, and volume in a series of propositional new artifacts with more abstract and programmatic qualities,
- etc.

I.e.

An artful being, the artful production, holds an openness, which primarily means that it holds open the Open of the world. It liberates, so to speak, the freedom of the Open and establishes this freedom in becoming truth. One has therefore to submerge herself in work-being, in the process of truth, since the thing cannot in itself reveal the truth merely through what it has become. In the case of that which is set forth

and erected, that which has come into being, it only brings about the openness of being when what has been set forth is a work [of art]. Such an act of setting forth the whole into un-concealedness and held therein is creation, according to Heidegger, "The rock comes to bear and rest and so first becomes rock; metal comes to glitter and shimmer, colors to glow, tones to sing, the word to speak. All this comes forth as the work sets itself back into the massiveness and heaviness of stone..." [5:46].

Cf.

[1] Tate. 2017. Materials and Objects. <https://www.tate.org.uk/visit/tate-modern/display/materials-and-objects/explore-materials-and-objects> [Retrieved 20190610].

[2] Beier, N. 2017. Nina Beier: Cash for Gold. Milan: Mousse Publishing.

[3] Rivling, B-A. 2019. Bat-Ami Rivlin "Untitled (BEDFRAME)". <https://batamirivlin.wordpress.com> [Retrieved 20190610].

[4] de Quincey, C. 2002. Radical nature: rediscovering the soul of the matter. Invisible Cities Press.

[5] Heidegger, M. 1971. Poetry, Language, Thought. New York: Harper Colophon.

Displaced material

Idea

To investigate object as material by repositioning an object with a particular function as a material in a wearable construction.

E.g.

Explore,

- a wig or a shirt as lampshade,
- a bucket as a hat,
- a container as a house,
- a chair as a cardigan,
- three retired Boeing 747s as a park or landscape,
- blankets and beddings as coats,
- a pair of loaves of bread as a pair of loafers,
- plastic stools taped to your feet as platform shoes,
- a folded air mattress as a poncho/coat,
- a desk as a skirt,
- a cushion as a hat,
- a kayak reconfigured into a bike,
- a sofa cushion flipped upside down with a lamp on it, and the semi-transparent non-woven backing used for light diffusion,
- etc.

I.e

To displace somebody/something, suggests the act of letting something/someone take the place of someone or something synonym, to move something from its usual or proper position or to remove something/someone from its agency or status [1][2]. In art an design this way of working to shift meanings and functions of material is also a common strategy [3][4][5][6].

Cf.

[1] Merriam-Webster. 2019. Displace. <https://www.merriam-webster.com/dictionary/displace> [Retrieved 20190715].

[2] Oxford Dictionaries. 2019. Displace. <https://www.lexico.com/en/definition/displace> [Retrieved 20190715].

[3] Rivling, B-A. 2019. Bat-Ami Rivlin: Untitled (SEATS, LED, BALLAST, SPRINGS). <https://batamirivlin.wordpress.com> [Retrieved 20190610].

[4] Wurm, E., Barlow, G., and Golonu, B. 2004. Erwin

Wurm: I Love My Time, I Don't Like My Time. Ostfildern-Ruit: Hatje Cantz.

[5] Fransen, M. 2017. Maaike Fransen: Stages of Grief <https://www.maaikefransen.com>. [Retrieved 20190610].

[6] Brinkman, T. 2019. Thorsten Brinkman: D'IRON, Pilloni, Van Barr. <http://thorstenbrinkmann.com> [Retrieved 20190610].

Disobedient material

Idea

To investigate and design materials/objects that do not behave as commonly expected.

E.g.

Explore,

- constructing a landscape where the ground tilts in different directions or becomes an undulating terrain,
- erecting a mirror that does not reflect correctly,
- designing a dress mannequin that does not work according to regular construction methods,
- putting together a house or a more open space where the walls move around at random,
- manufacturing a sofa that is uncomfortable or has armrests so outsized that you have to squeeze in to it,
- creating a textile pattern on a tablecloth that suggests a particular placement but slides off the table by itself,
- fabricating the neckline or button placement so a garment falls off the body,
- designing a hot cellphone or a freezing cold house,
- etc.

I.e.

What a person does or how she behaves with an object or product is often learned and cultivated socially and culturally; this includes the arrangement, movement and gestures of the object or product. These preconceptions about objects in person-object relationships make one “use” a particular object in a particular way. By exploring objects that ignore the common understanding of and expectations about them, one can open up new design possibilities for particular material objects.

Cf.

[1] Dunne, A. 1999. *Hertzian Tales*, Electronic products, aesthetic experience and critical design. London: The Royal College of Art.

[2] Anderson, J.W. Ed. 2017. *Hepworth Wakefield. Disobedient Bodies*. [Retrieved 20190610].

[2] Victoria and Albert Museum. 2014. *Disobedient Objects*. <http://www.vam.ac.uk/content/exhibitions/>

disobedient-objects/ [Retrieved 20190610].

[3] Worbin, L. 2005. *Textile Disobedience*. When textile patterns start to interact. *Nordic Textile Journal*, pp. 51-69.

Ephemeral material

Idea

To investigate expressive dynamic possibilities in transient material-object interactions.

E.g.

Explore,

- temporal changes in natural materials,
- plants, or elements of plants, as design and building material,
- products in water-soluble paint,
- powder, soap bubbles, or fog as design and architectural material,
- smoke as a design material for landscape, architecture, or clothing,
- light and/or shadow as material,
- materials in PVA, or partly in PVA,
- materials that gradually dissolve in humidity or in certain temperatures,
- ephemeral digital interfaces,
- etc.

I.e.

Expressive possibilities in ephemeral materials and objects may be thought of as merely an expressive interest but may also have functional and economic consequences.

Cf.

[1] Hess, B. 2019. Bart Hess. <http://www.barthess.nl> [Retrieved 20190610].

[2] Storey, H. 2019. Wonderland, 2004- <http://www.wonderland-sheffield.co.uk> [Retrieved 20190610].

[3] Eklöf, A. 2016. The temporary and spatial body. <https://www.bodyandspace.com/the-temporary-and-spatial-body> [Retrieved 20190610].

[4] Thornquist, C. 2017. Body and space: experimental and performative studies of dress. In Lind, T. Ed. Artistic research yearbook. Stockholm: VR, pp. 82-93.

[5] Döring, T., Sylvester, A., and Schmidt, A. 2013. Ephemeral user interfaces: Valuing the aesthetics of interface components that do not last. *Interactions*, 20(4), 32-37.

Material interaction

Idea

To investigate the expressive potential not only of the interaction of color, but of the interaction of material, space, and/or body for new perspectives and expressions.

E.g.

Explore,

- a set of differently colored semitransparent fabrics with a body. Start with a single layer test with the same body and gradually expand with multiple layers and different bodies,
- a set of differently colored semitransparent materials in an architectural structure. Start with a single layer test with the same space and gradually expand with multiple layers and different spaces,
- different color patterns on transparent materials in different combinations to create spaces for itself,
- a set of multiple materials, different in color and in degree of transparency, in different arrangements with different bodies, objects, and/or spaces,
- etc.

I.e.

In visual perception, Albers demonstrates, “a color is almost never seen as it really is as it physically is. This fact makes color the most relative medium in art. In order to use color effectively it is necessary to recognize that color deceives continually. To this end, the beginning is not a study of color systems” [1:IV-1].

Cf.

[1] Albers, J. 2006. Interaction of Color. New Haven: Yale UP.

[2] Kleine, S. 2019. Interaction of Color and Form. Cologne: Ungers Archiv für Architekturwissenschaft. <https://www.ungersarchiv.de/index.php/news-reader/interaction-of-color-and-form.html> [Retrieved 20190615].

Discussion material

Idea

To investigate material meanings by responding to verbal questions.

E.g.

Explore material ideas based on questions like:

- What mistakes have you made?
- As a child you wanted to be like... ?
- Can objects make us happier?
- Does self-censorship exist?
- What have you forgotten?
- Do you have pseudonyms?
- What do you appreciate most about your friends?
- What do we have to give up for happiness?
- What else would you like to say? [1],
- etc.

Continue the investigation, using only material names or descriptions in,

- a dialogue,
- a discussion,
- a debate,
- a controversy,
- etc.

I.e.

In the sense that it is a meeting of people face to face, an interview is worthwhile when exploring materials, especially when consulting about something or evaluating qualifications [2][3]. In addition, a debate may also be a productive way of exploring materials, especially when it is "a formal discussion on a particular matter in a public meeting or legislative assembly, in which opposing arguments are put forward and which usually ends with a vote" or when it is "an argument about a particular subject, especially one in which many people are involved" [4].

Cf.

[1] Obrist, H. U., and Feldmann, H. P. 2009. Interview. Köln: König.

[2] Oxford Dictionaries. 2019. Interview. <https://www.lexico.com/en/definition/interview> [Retrieved 20190615].

[3] Merriam-Webster. 2019. Interview. <https://www.merriam-webster.com/dictionary/interview> [Retrieved 20190815].

[4] Oxford Dictionaries. 2019. Debate. <https://www.lexico.com/en/definition/debate> [Retrieved 20190615].

Material intersections

Idea

To investigate the aesthetic possibilities in combining traditional materials with new technologies.

E.g.

Explore,

- running a 3D print on traditional textile materials,
- combining green screen product parts with non-green screen parts for augmented VR,
- merging digital print and brick work,
- shaping memory alloys and solid wood work,
- vacuum-forming hand-embroidered materials,
- embroidering with conductive threads,
- impressing 3D print on soybeans or concrete,
- creating new graphics based on solar cells,
- constructing magnetic tiling,
- developing soft textile sensors,
- fabricating heated textiles based on integral connections and copper/silicon wiring,
- etc.

I.e.

Exploring new technology in a cutting-edge field is challenging. One way to overcome this hurdle is to frame the new technology in existing and classic material and techniques to move forward from existing knowledge.

Cf.

- [1] van Dongen, P. 2019. A Designer's Material Aesthetics Reflections on Fashion and Technology. PhD thesis. Eindhoven: Eindhoven University of Technology.
- [2] Nachtigal, T. Forthcoming. Materializing Data for Ultra-Personalization; A scaffolding of craftsmanship and technology. PhD thesis. Eindhoven: Eindhoven University of Technology.
- [3] Lewis, E. Forthcoming. Electromagnetic Expressions in Textiles. PhD Thesis. Borås: University of Borås.
- [4] Dunne, L. 2010. Smart Clothing in Practice: Key Design Barriers to Commercialization. Fashion Practice. 2(1), 41–65.

Material transposition

Idea

To investigate new material possibilities by reimagining the name of a material.

E.g.

Explore,

- bioplastic as living-flexible or true-fake material
- composite as multipart material or combined material,
- cinder blocks as spark skunks,
- teddy as toy material or figurine material,
- sequenced as instruction material or stability material,
- lace as mix material or tie material,
- veneer as appearance material, layer material, or surface material,
- plaster as bandage material,
- steel frame as brace-edging material,
- knits as joint material,
- etc.

I.e.

Transposition refers to the transfer of any term of an equation from one side to the other with a corresponding change of the sign, to change word order in the language, style, or manner of expression of an alternate language, or to write or perform (a musical composition) in a different key.

Cf.

- [1] Merriam-Webster. 2019. Transpose. <https://www.merriam-webster.com/dictionary/transpose> [Retrieved 20190615].
- [2] Oxford Dictionaries. 2019. Transpose. <https://www.lexico.com/en/definition/transpose> [Retrieved 20190615].
- [3] Tortora, P. 2009. Fairchild's Dictionary of Textiles. New York: Fairchild.
- [4] Thompson, R., and Thompson, M. 2017. The materials sourcebook for design professionals. London: Thames and Hudson.
- [5] Deplazes, A. 2005. Constructing Architecture: Materials, Processes, Structures; A Handbook. Basel: Birkhäuser.

Ornamental material

Idea

To investigate the possibilities of a motif, pattern, or ornament as material structure.

E.g.

Explore,

- the structural possibilities of a decorative motif in/on a material, such as a portrait, a flower, or geometrical figure. If the motif is in a large enough scale, work with the motif directly, looking at lines, points, and colors to develop structure. If the decorative element is too small, deconstruct the motif and scatter its parts over a material large enough for its intended purpose, such as clothing, interior structure, or architectural construction, and reconstruct the motif, allowing the in-between fabric to create new shapes,
- the expansion of your findings in a series of variations on the first motif or explore the form possibilities in more complex motifs in or applied to various materials,
- fractals as a self-similar pattern for modeling small- or large-scale material structures based on expanding symmetry or unfolding symmetry, such as snowflakes, for example, where similar patterns recur in progressively smaller scales, and in part describe random or chaotic phenomena such as crystal growth and galaxy formation [1],
- etc.

I.e.

In his introduction to *The Fractal Geometry of Nature*, Mandelbrot points out that “[c]louds are not spheres, mountains are not cones, and lightning does not travel in a straight line. The complexity of nature’s shapes differs in kind, not merely degree, from that of the shapes of ordinary geometry, the geometry of fractal shapes.” In an overview of the fractal geometry of nature, Mandelbrot demonstrates how a fractal is a never-ending pattern in infinitely complex patterns and similar across different scales. As such, fractals are created by the repetition of a simple process over

and over again in a continuous feedback loop. Driven by recursion, fractals are dynamic systems and the geometrical structure of many natural elements, such as trees, leaves, mountains, clouds, seashells, rivers or hurricanes. Abstract fractals can also be generated by the repeated calculation of a simple equation [2]. In another approach to motif and structure, found in the work by Arnbert, for example, the main objective is to explore possible alternatives to the traditional ways in which designers often work with print and textures secondary to form. In her work, she illustrates how figurative motifs and decorative material can be the starting point and foundation for the design process where form-giving is interrelated directly to texture and decoration. In this way the work presents a method of working where both material and form are simultaneously in vital connection and where form is a product of the construction and placement of print motifs. The result is form that is dependent on print and in turn, print which is dependent on form [4][5].

Cf.

- [1] Addison, P-S. 1997. *Fractals and Chaos - An Illustrated Course*. Bristol: Institute of Physics.
- [2] Mandelbrot, B. 1982. *The fractal geometry of nature*. San Francisco: Freeman.
- [3] Arnbert, C. 2017. *Scattered Print – Gathered Form*. MA thesis. Borås: University of Borås.
- [4] Racinet, A., and Dupont-Auberville, A. 2006. *The world of ornament: complete colored reprint of L’Ornement polychrome [1869-1888] and L’Ornement des tissus [1877]*. Köln: Taschen.
- [5] Grünbaum, B., and Shephard, G. 2016. *Tilings and patterns*. New York: Freeman.

Material assemblage

Idea

To investigate assemblage and collage as construction methods for materializing components into new designs and new material expressions.

E.g.

Explore,

- invented new techniques to assemble different materials – old and new, familiar and unfamiliar – including salvaged and repurposed materials,
- collaging and assembling standard material modules, such as pieces of textile fabrics, plywood or metal sheets, etc. and fusing them based on their own properties, adding adhesive between them if needed. Leave non-fused areas for the body to enter and interact with or for other functions like ventilation, entrance, or other interior or building,
- synthethizing different types of material modules in the form they are found or delivered, previous to specification into a desired form or product design,
- etc.

I.e.

In various art practices, different forms of collage techniques are often found to be the constructive and expressive methods in the artwork itself [1]. In design, however, collage is more often used solely in ideation processes as a way of exploring ideas that later undergo further refinement.

As an alternative, Elfvik, among several others, has explored collage as a construction method in the creation of finalized product design for new functional and expression possibilities. In her work she suggests collage techniques for bringing material and construction closer together in the design process as well as bringing the sketch closer to the final result by sketching directly on the material. The potential of incorporating material development in all steps of the design process, Elfvik argues, is that it creates a greater relationship between the material and shape [2].

Cf.

- [1] Manco, T. 2012. Raw + Material = Art : found, scavenged and upcycled. New York: Thames and Hudson.
- [2] Elfvik, E. 2015. Cut and paste: exploring two-dimensional material collages for the use in clothing. BA thesis. Borås: University of Borås.

Machine material

Idea

To investigate the possibilities for a specific machine commonly known/used for producing a particular material or object.

E.g.

Explore a machine in an abstract way, "as it is," for example,

- on its mechanical movements as "actions" and not "performance" or "intention",
- its possibilities for other materials and textures,
- its possibilities for different scales,
- etc.

Consider,

- how many different things could the rotating drum of a washing machine be used for?
- how many different things could a cnc milling machine be used for?
- how many different things could an extruding machine for plastic be used for?
- is it possible to create 3D weaving structures in a traditional jacquard weaving machine?
- is it possible to complete fully shaped products in machines that are used for material production only? [1],
- is it possible to add non-traditional inlay materials in standard production machines? [2],
- etc.

I.e.

In the musical piece *Die Kunst der Fuge*, Bach explored in-depth the expressive possibilities of a single musical technique, the fugue--a compositional technique and polyphonic procedure that involves a group of parts developing a single subject, which is exposed in each voice and gradually transformed as the work develops. At the outset, the work presents a subject in alternative ways and through this, demonstrates different relationships in terms of new ideas developed from the existing idea and in counterpoint with it. New subjects are introduced, which set the primary subject in perspective. In what may be described as a conversation or a discussion, punctus contra punctum,

acknowledging the other part of the main subject, the leading subject is turned upside down, mirrored, set in different tempos, and even mixed with new subjects, all designed to confront and sustain elements of the primary subject, just as if it were a critical discussion. As a result, the piece is not merely a systematic demonstration of contrapuntal theory; it tests and presents the aesthetics possible in a particular technique – functional and expressive Its rigorous and systematic exploration presents texture, mood, rhythm, sonority, and emotion, framed and contextualized in a systematic and autonomous multi-part performance [3][4].

Cf.

[1] Dekhla, L. 2018. Weaving Dress: Exploring whole-garment weaving as a method to create expressive dress. MA Thesis. Borås: University of Borås.

[2] Dekhla, L. 2018. Inlay. BA Thesis. Borås: University of Borås.

[3] Wollf, C. 2000. Johann Sebastian Bach, the Learned Musician. Oxford: Oxford UP.

[4] Black, G. 1986. The Art of the Fuge. http://www.ignaciodarnaude.com/textos_diversos/Bach,The%20Art%20of%20Fugue,Gavin%20Black.pdf [Retrieved 20190615].

Embodied material

Idea

To investigate the material relationship between the body and material, not only through form but also in material movement as temporal form.

E.g.

Explore,

- material movement expressions by interacting subtly with a dressed body part; study the changes in material expressions,
- how movement activates the materials,
- material that activates the body,
- material qualities such as weight, elasticity, and inertia with the body,
- intuitive movement based on a dress or space material expressions or functions,
- interactive body-material processes of moving-thinking-feeling,
- textural interactive changes and interaction in body-material movement interaction,
- etc.

I.e.

A possibly strong convergence exists between movement, material, and body, caused by the close interaction of body and material, a synergy of material and movement that successfully translates simple motions into abstract bodily articulation. This is the case, for example, in everyday dress. As Bågander notes, “the nude arm performs the same movement as the dressed arm. Dress not only provides social reference, form, and color, but it also provides a layer of expression to movement. The shirt is fixed at the neckline and the hand expressing the twist between these points” [1]. This structuring of body-material relationships forms a fundamental potential for body-material expressions. On a similar note, Larsen’s work also shows how artifacts can inform and direct movement, and in turn how movement may inform and contribute to the development of artifacts [2]. In other words, these examples experimentally explore Noë’s notion of perception as not something that happens to a person, but as

something a person does. Perception and perceptual consciousness, Noë argues, “depend on capacities for action and thought—that perception is a kind of thoughtful activity. Touch, not vision, should be our model for perception. Perception is not a process in the brain, but a kind of skillful activity of the body as a whole. We enact our perceptual experience” [3].

Cf.

- [1] Bågander, L. 2019. Body of movement: (in)forming movement. Licentiate thesis. Borås: University of Borås.
- [2] Martin-Larsen, U. 2016. Dressing Wearing: Movement Directed by Dress, Dress Directed by Movement. PhD thesis. Borås: University of Borås.
- [3] Noë, A. 2004. Action in perception. Cambridge: MIT Press.

Material transformation

Idea

To investigate the possibility for structural change of a material.

E.g.

Explore,

- unique structural possibilities by breaking down the material modules and recreating them into new types of structures different from their dominant form,--
- thermal treatment to change the structure of industrial material,
- thermo-mechanical treatments to change the structure of industrial material,
- surface treatments to change the structure of industrial material,
- composite structures based on a material to change the structure of industrial material,
- filling or inflating material for new structures,
- laser sintering of different materials,
- partial alteration or partial reinforcement of a material, such as with textile fibers,
- bundling textile rags tightly together into a self-supporting chair structure,
- etc.

I.e.

Microstructural changes can be induced in almost all engineering materials to alter their mechanical properties. This is usually achieved through thermal treatments involving heating and cooling under controlled conditions. The treatment temperatures and processing conditions vary according to the nature and composition of the material. Sometimes combinations of mechanical and thermal treatments (i.e., thermo-mechanical treatments) are used to produce properties that cannot be obtained in any other way. In some cases, different properties are desired in bulk rather than in the surface of a part. In these instances, specialized thermal treatments involving surface diffusion or surface (differential) heating are used [1].

The project TWOOD explores the possibilities of extending the lifecycle of denim fiber with a new innovative recycling technique. The result is a new “denim” material with properties more similar to wood than traditional textile, which explains the label TWOOD. This innovative recycling technique has the potential to scale industrially and have a positive impact on the environment [2]. In another project, Norrsell explored the potential of a particular machine, a 2D jacquard weaving machine to create 3D structural possibilities by changes in weaving structures and explorations of alternative materials [3].

Cf.

[1] National Research Council. 1995. Structure-Change Processes. In National Research Council Ed. Unit Manufacturing Processes: Issues and Opportunities in Research. Washington, DC: The National Academies Press, pp. 67-78.

[2] Sjöberg, L., and Lidström, A. 2017. Twood ST-201 TWOOD. <https://smarttextiles.se/projekt/st-201-twood/> [Retrieved 20190615].

[3] Norrsell, L. 2019. Self-supporting woven textile – connecting to create forms. MA Thesis. Borås: University of Borås.

Mono material

Idea

To investigate the functional and expressive possibilities of a single material to increase its potential for design.

E.g.

Explore,

- a material in different structural forms, such as molded, heat-injected, 3D-printed, knitted, woven, and non-woven, singly or in combinations,
- the material in different structural forms but only in its natural undyed and untreated state,
- different scales, volumes, and forms of the various materials – in combination and in relation to the body and space,
- a different material in relation to a particular artifact, function, or situation,
- etc.

I.e.

Mono-materials have been suggested as a sustainable design approach to facilitate recycling of a product in the future, for it simplifies the material recycling of a product. Aesthetic exploration and strategies for exploring mono-materials may therefore be significant in the development of design thinking and advocacy for its functional and expressive potential for different uses.

Cf.

[1] Vezzoli, C., and Manzini E. 2010. Design for Environmental Sustainability. London: Springer.

Responsive material

Idea

To investigate color-shifting surfaces in and on different materials.

E.g.

Explore,

- self-healing materials,
- Temperature-responsive polymers,
- photomechanical materials,
- chemoresponsive materials,
- electrically heating textiles,
- magnetic structures,
- thermocromic plastic or gels,
- thermocromic pigment in and on different materials or products, interiors, or architectural structures,
- photocromatic dyes sensitive to particular levels of UV light,
- electroluminescent film as an active luminous material; electric voltage is needed,
- color-shifting thermo plastic films,
- color-variable pigments that change color when viewed from different angles in different scales [1][2][3],
- etc.

I.e

A related term to responsive materials are smart materials. Smart materials technology can enable materials to adapt to environmental changes by activating its functions. As such smart materials, or responsive materials, may be described as materials and structures with built-in sensing and/or actuation functions, linked via some form of controller or controlling action. Coupling between the material and its active elements "can range from a classical mechanical coupling of two structures (such as is found in many mechanical structures) down to the level of molecular design. As such, 'smart' composites represent a convenient intermediate level of coupling, which allows one to conveniently design and develop a smart material to be applied in a smart structure [4].

Color-shifting materials is a further example of Smart materials, also referred to as responsive materials that have one or more properties that can be changed through manipulation in a controlled manner by external stimuli, such as e.g. moisture, electricity, temperature, light etc. [5][6].

Cf.

- [1] van Onna, E. 2003. Material world: innovative structures and finishes for interiors. Basel: Birkhäuser.
- [2] Matério. 2006. Material world 2: innovative materials for architecture and design. Basel: Birkhäuser.
- [3] Worbin, L. 2010. Designing dynamic textile patterns. PhD Thesis. Gothenburg: Chalmers.
- [4] C. Boller, C. 2001. Composites for Sensors and Actuators. In Buschow, J. Ed. Encyclopedia of Materials: Science and Technology. Oxford: Elsevier, pp.1376-1382.
- [5] Schwartz, M. 2002. Encyclopedia of Smart Materials. New York: Wiley.
- [5] Bengisu, M., Ferrara, M., and Bengisu, M. 2018. Materials That Move: Smart Materials, Intelligent Design. London: Springer.

Material abstraction

Idea

To investigate and reevaluate basic assumptions about our relationship to built and natural environments.

E.g.

Mediate the gap between fine and applied art using the mediums of architecture, sculpture, photography, painting, and drawing to reframe the ordinary use of materials and nature by:

- straightening a curved tree branch by making cuts in the right places to pull it straight and then inserting man-made wooden wedges in the incision for support,
- creating a weave using tree branches and tree cellulose yarns,
- constructing a chair from cut and lathed wood and natural tree branches,
- designing a kitchen featuring large natural rocks and stone countertops,
- building a house in a dense fir tree forest,
- fashioning weave-insertions using human hair to continue making a man-made form,
- combining camouflage weave/net with tree branches,
- etc.

I.e.

Reconsidering the ordinary use of natural materials can generate new thinking about human relationships to natural resources and present innovative ways of thinking about design and the use and need of artifacts in human cultures.

Cf.

[1] Wexler, A. 2017. Absurd Thinking, Between Art and Design. Zürich: Lars Müller Publishers.

Material anthropomorphism

Idea

To investigate the attribution of human characteristics to materials.

E.g.

Explore,

- the relationship between two materials where one is left indifferent and rigid and the other soft and malleable [1],
- the relationship between an object where a structural material is left firm and insensitive and a material that is animated and with a living character; for example, a sofa where the foam and cushions are worn out and ill-fitting, which looks as if it were exhausted and had eaten too much [1],
- a fur-like material in love,
- the happiness of a material,
- the anxiety of a material,
- the human face of a material,
- a drunken wineglass,
- a wig perched on the end of a mop handle,
- etc.

I.e.

Anthropomorphism is the attribution of human characteristics, emotions, intentions, and behaviors to non-human beings, phenomena, or objects. As a literary device, it is commonly found in children's stories like Alice in Wonderland and Thomas the Tank Engine, where animals and objects have human form and characteristics. When describing an abstract term like organization, people often use anthropomorphic terms as well. Anthropomorphism is currently a popular field for multidisciplinary research in ways to increase human-robot interaction (HRI), particularly in the areas of increasing human interaction and support of emotional bonding [2]. Motivation for this type of research grows out of the premise that human beings tend to be unconsciously attracted to things similar to themselves. Moreover, in uncertainly reduction theory, familiarity plays a crucial role in relationship development among humans and between humans and

devices [3]. As an outgrowth, researchers suggest that designers should consider emotional factors in technology that align with the everyday lives of users; emotionally interactive technologies may enhance loyalty and satisfaction as well as promote happiness and wellbeing [4].

Cf.

- [1] Kingsnorth, C. 2019. My Big Fat Sofa. <http://www.charlottekingsnorth.com/work-1#/new-gallery/> [Retrieved 20190615].
- [2] Li, J., and Chignell, M. 2011. Communication of emotion in social robots through simple head and arm movements. *International Journal of Social Robotics*, 3(2), 125-142.
- [3] Berger, C., and Bradac, J. 1982. *Language and Social Knowledge: Uncertainty in Interpersonal Relations*. London: Edward Arnold.
- [4] Triberti, S., Chirico, A., La Rocca, G., and Riva, G. 2017. Developing emotional design: emotions as cognitive processes and their role in the design of interactive technologies. *Frontiers in Psychology*, 8, 1773.

Material efficiency

Idea

To investigate the efficiency of materials in relation to functions and situations.

E.g.

Explore,

- the least amount of material needed for a product performing its function,
- the total material weight could be reduced for a system of products, such as a wardrobe,
- the least material needed for an appliance like a stove,
- the least material and space needed for a kitchen,
- the least material and space needed for a house,
- etc.

I.e.

According to Shahbazi, “[m]aterial efficiency contributes to reduced industrial waste volumes, reduced extraction and consumption of virgin raw materials, increased waste segregation, decreased energy demand, and reduced carbon emissions, thereby generally mitigating the environmental impact of the manufacturing industry.

However, the area of material efficiency in manufacturing is under-researched, and related knowledge is limited particularly at individual manufacturing sites and lower levels. These levels are crucial to achieve improved material efficiency, as a great amount of material is consumed and waste flows are generated on manufacturing shop floors. There are still gaps in both literature and industrial practice regarding material efficiency in manufacturing, where materials are consumed to make products and great volumes of waste are generated simultaneously” [1].

Lighter weight structures built of composites integrating the performance of two or more materials show superior mechanical performance across material types like concrete and textile [2][3][4].

Cf.

- [1] Shahbazi, S. 2018. Sustainable Manufacturing through Material Efficiency Management. PhD Thesis. Västerås: Mälardalen University.
- [2] Beukers, A., and Hinte, E. 2001. Lightness: The Inevitable Renaissance of Minimum Energy Structures. Rotterdam: 010 Publishers.
- [3] Wille, K., and Boisvert-Cotulio, C. 2015. Material efficiency in the design of ultra-high performance concrete. *Construction and Building Materials*, 86(1), 33-43.
- [4] Ji, Y., Jiao, R., Chen, L., and Wu, C. 2013. Green modular design for material efficiency: a leader-follower joint optimization model. *Journal of Cleaner Production*, 4(1), 187-201.

Pneumatic material

Idea

To investigate pneumatic effects in material systems.

E.g.

Explore,

- inflatable material systems in different scales,
- inflatable material-space expressions,
- inflatable material-body structures,
- adaptable spatial pneumatic installations,
- fan-based inflatables systems,
- body-deformation and reformation based on pneumatic mechanisms,
- pneumatically driven dynamic surface print through colored fluid systems as material fillings,
- etc.

I.e.

Pneumatic refers to the use of gas, such as air or wind, or systems that are moved or worked by air pressure, something adapted for holding or inflated with compressed air; for example, having air-filled cavities.

Cf.

[1] Dezeen. 2019. Inflatables. <https://www.dezeen.com/tag/inflatables/> [Retrieved 20190615].

[2] Glynn, R. 2006. Bubbles – Interactive Pneumatic Environment. <http://www.interactivearchitecture.org/bubbles-interactive-pneumatic-environment.html> [Retrieved 20190615].

[3] Runquist, J. 2015. Change in motion: Investigating how to change a garment's appearance in volume through movement and air with pleating as the main technique. BA Thesis. Borås: Borås University.

[4] Nordberg, J. 2013. FLOW– exploring the expressive and functional potential in the relation between technology and dress. <https://www.bodyandspace.com/flow> [Retrieved 20190615].

Material perversion

Idea

To investigate and evaluate basic assumptions about our relationship to built and natural environments.

E.g.

Explore,

- depriving a particular technology or material of its assumed value by challenging its intention as a tool to liberate life,
- restricting material swelling by binding soft foam with wire,
- looking at visual-haptic perversion of typical materials, where for example the haptic perception is opposite of what the visual traditionally suggests,
- inviting VR to reflect upon itself as a moment of deep kitsch through analogue versions of itself,
- exchanging a well-known brand name's name in a logo for a critical counterpart using the same logo structure and colors,
- examining a hairy building or vehicle,
- using a highly reflective material,
- mixing concrete and lace,
- making a soap of polluted particles,
- injecting polyurethane foam into perforated leather for new textures,
- etc

I.e.

To pervert means to distort or corrupt the original course, meaning, or state of something. While it may not be common to think in terms of perverted materials, thinking about "perverted" products is more widespread [1]. Talco, for example, produces metal tool boxes. In a project exploring the potential of different products, the company developed a bathroom cabinet from the existing product and expanded the company's existing manufacturing capability [2]. A second story reveals a more covert operation: "On a sleepy weekend in early June this year, five designers visited the famous Lloyd Loom of Spalding factory. While the assembly workers were away, the designers, assisted by two of Lloyd Loom's loyal craftsmen, and with no set agenda, helped

themselves to standard components and experimented and reinterpreted. In two intense, frantic days, they came up with thirteen new concepts, which they left in the factory showroom for the staff to find on Monday morning" [3]. Examples of product perversion may also surface from the mistakes made on a production line of identical objects. In addition, it is often argued that power manifests itself in technology when technology serves humanity's inclination to rule over nature and human behavior; in medicine, for example, it also rules over the human body [4][5].

Cf.

- [1] Lozano-Hemmer, R. 1996. *Perverting Technological Correctness*. Leonardo, 29(1), 5–15.
- [2] Clerkin, C. 2003. <http://www.williamwarren.co.uk/2003/10/bathroom-toolbox/> [Retrieved 20190615].
- [3] Clerkin, C., Eckersley, C., Neal, G., Marchant, A., and Warren, W. 2012. *The Elves and the chairmakers*. <http://www.williamwarren.co.uk/2012/11/the-elves-and-the-chairmakers/> [Retrieved 20190615].
- [4] Heidegger, H. 1993. *The question concerning technology and other essays*. New York: Harper and Row.
- [5] Bergmann, S. 2016. *Religion, space, and the environment*. New Brunswick: Transaction Publishers.
- [6] Moon, J. 2018. *PM2.5 Pollutant Soap – Boundary of Beauty and Danger*. <https://www.rca.ac.uk/students/jihee-moon/> [Retrieved 20190815].

Material suspension

Idea

To investigate suspension in material systems or artifacts.

E.g.

Explore,

- possible expression by interrupting, swinging, and hanging material,
- material expression by temporary removal,
- support of the outer part of a material on the body by a wearable system of devices (such as springs),
- material rhetoric where the principal material is deferred to the end of a form or longer unit,
- material where particles are dispersed in the bulk of a fluid,
- expressional or functional discord made by prolonging elements of a material into a following material,
- temporal mechanical suspension and pause in material volume of texture, abstract or in an object,
- etc.

I.e.

In chemistry, to be suspended in something means to float in liquid or air without mov-ing, but suspend somebody (from something) can also mean to prevent somebody from performing a certain action. In physical terms to be suspended suggest to hang so as to be free on all sides except at the point of support or to keep fixed or lost [1][2].

Cf.

[1] Merriam-Webster. 2019. Suspend. <https://www.merriam-webster.com/dictionary/suspension> [Retrieved 20190615].

[2] Oxford Dictionaries. 2019. Suspend. <https://www.lexico.com/en/definition/suspension> [Retrieved 20190615].

Bioplastic material

Idea

To investigate the expressive potential of bioplastics as a design material.

E.g.

Explore, the following basic recipe:

– A

10 ml. distilled water,
0.5–1.5 g. glycerol,
1.5 g. cornstarch,
1 ml. of white vinegar,
1–2 drops food coloring.

Add all the ingredients to the saucepan and stir until you get rid of most of the lumps. Place the saucepan on the stove set to medium-low. Stir continuously. Bring the mixture to a gentle boil. As the mixture heats, it will become more translucent and begin to thicken. Remove the mixture from the heat when it becomes clear and thick. (Total heating time will be around 10–15 minutes.) Lumps may begin to form if the mixture gets overheated. If you would like, add one–two drops of food coloring at this stage. Spread the heated mixture on a piece of foil or parchment paper to let it cool. If you would like to mold the plastic into a shape, it must be done while it is still warm. Remove any bubbles that you see by poking them with a toothpick (not necessary). Allow the plastic to dry for at least two days. Depending on the thickness of the plastic, it may take longer. If you make one small thick piece it will take longer to dry than a thinner large piece. Leave the plastic in a cool dry place for this process. Check the plastic after two days to see if it has fully hardened [1].

– B

Vary the recipe for different flexibility by:

Recipe	Brittle		.. > Flexible	
glycerine (g)	0	5	10	20
water (ml)	80	80	80	80
cornstarch (g)	1.6	1.6	1.6	1.6
vinegar (ml)	15	15	15	15 [2][3].

– C

Consider,

- combinations of bioplastic and other materials such as textile knits or weaves,
- assess bioplastic juxtapositions such as an orange juicer made from orange peel,
- etc.

I.e.

A bioplastic is a polymer, a type of plastic derived from a biomass, such as plant starches or gelatins/agars found in leftover foods. In many recipes, glycerin is used. It works as a plasticizer that links polymer chains together and allows them to slide past each other. Vinegar helps the cornstarch fully dissolve because starch dissolves better in the presence of electrically charged ions. Instead of vinegar, ordinary table salt can also be used to make the cornstarch dissolve and provide free ions [1][3]. Although bioplastics may have a lighter environmental load than synthetic ones, the base material they are made of is of no small importance to both environmental and ethical concerns [4]. Bioplastics behave like glue and will stick to wood. For casting, it is best to pour onto a nonporous surface like glass or plastic. As bioplastics are thermoplastics with low melting points, they can be unformed by long periods of sun exposure. Bioplastics are not water resistant either. They will unform if they are exposed to rain or get wet. To improve water resistance, add wax to the bioplastic solution. Fibers, minerals, or food waste can also be added to bioplastic recipes to create a biocomposite [2][4].

Cf.

[1] wikiHow Staff. 2019. How to Make Bioplastic. <https://www.wikihow.com/Make-Bioplastic>. [Retrieved 20190616].

[2] Pistofidou, A. 2018. Bioplastic Cook Book. https://issuu.com/nat_arc/docs/bioplastic_cook_book_3 [Retrieved 20190616].

[3] Pilla, S. 2011. Handbook of bioplastics and biocomposites engineering applications. New York: Wiley

[4] Cecchini, C. 2017. Bioplastics made from upcycled food waste. Prospects for their use in the field of design. The Design Journal, 20(1), 1596–1610.

Microbial material

Idea

To investigate the potential of microbial leather/
bacterial cellulose as a design material.

E.g.

Explore, the following recipes:

– A

1 kombucha culture,
200 ml. apple cider vinegar,
240 g. granulated sugar,
2–3 bags of black or green Tea
3 L. water.

(1) Sterilize the container/lid with alcohol. (2) Brew 2 L of tea for fifteen minutes. Add sugar and stir until dissolved. (3) Pour the hot liquid into the container and add one more liter of cold water. Add cider vinegar and stir. Let the liquid cool to room temperature. (4) Add the Kombucha. Cover the container with the cloth and store in above 19° C and dark area. Fermentation begins after 48–72 hours, when a thin skin/bubbles appear, and the culture will rise to the surface. (5) Use sterilized gloves to avoid contamination, check the container weekly. Once the mat reaches two centimeters in thickness (in three to four weeks), take it out of the container and gently wash it with cold, soapy water. (6) Dry the sheet on a porous surface like wood, wire mesh, or felt. In about a week or two, when dry, it is like any other fabric. (7) To grow larger sheets, adjust the proportions accordingly [1][2].

– B

3760 ml. distilled water,
9 tea bags, organic green tea,
540 g. granulated cane sugar,
632 ml. white vinegar (5 % acidity),
ca 100 g. SOBY, organic starter.

(1) Adjust the room temperature to 27–30 °C. (2) Immerse tea bags in about 300 ml. boiled distilled water. Brew for ten minutes. (3) Add the tea, the rest of the water, and the other ingredients in the container. (4) Add the SCOBY. (5) Cover the the container with muslin and secure with clips. (6) Let stand for ca four weeks at room temperature [3][4].

– explore coloring or waterproofing microbial leather with beeswax, coconut oil, chitosan, gelatin polyaniline, polyethylene glycol, aloe vera gel, montmorillonite, silver nanoparticle palladium, hydroxy apatite, carbon nanotubes, or other treatments [5][6], – etc.

I.e.

Biomaterial refers to a regenerative material created by living organisms, in contrast to materials that must be mined or extracted, or require high energy inputs from fossil fuels. Kombucha is a symbiotic community of bacteria and yeast, and kombucha leather is the dried form of the thickened layer that forms over fermenting liquid kombucha [4]. The material can be treated in the same way as traditional textiles are [1].

Cf.

- [1] Kretzer, M. 2018. Microbial Leather. <http://materiability.com/portfolio/microbial-leather/> [Retrieved 20190616].
- [2] Chua, J., and Lee, S. 2015. Grow Your Own Microbial “Leather” in Your Kitchen. <https://inhabitat.com/ecouterre/grow-your-own-microbial-leather-in-your-kitchen-diy-tutorial/> [Retrieved 20190616].
- [3] Lee, Y. 2016. Case Study of Renewable Bacteria Cellulose Fiber and Biopolymer Composites in Sustainable Design Practices. In Muthu, S., and Gardetti, M. Eds. Sustainable Fibers for Fashion Industry edited. Singapore: Springer, pp. 141–162.
- [4] Parsons Healthy Materials Labs. 2018. <https://publiclab.org/notes/liz/01-26-2018/grow-kombucha-leather-parsons-healthy-materials-lab> [Retrieved 20190616].
- [5] Shah, N., Mazhar, U., Khattak, W., and Park, J. 2013. Overview of bacterial cellulose composites: A multipurpose advanced material. *Carbohydrate Polymers*. 98(2), 1585–1598.
- [6] Silva, J., Andrade, F., and Gama, F. 2013. Bacterial cellulose surface modifications. In Gama, M. Gatenholm, P., and Klemm, D. Eds. *Bacterial nanocellulose: a sophisticated multifunctional material*. Boca Raton: CRC Press, pp. 91–111.

Seasonal material

Idea

To investigate material expressions and modifications created by natural processes or related to seasons.

E.g.

Explore,

- seasonal properties in different material layering,
- seasonal fluctuating of material functioning as an expression,
- a piece of material or a product deliberately placed in the sun, with or without parts covered,
- materials buried in sand or soil for a few month or more,
- materials submerged in the ocean from one to five months,
- materials and different bacteria buried together,
- etc.

I.e.

Biological systems are intimately connected to seasons, climate, and location. Pinecones, for example, respond to changes in the weather: "A change in the relative humidity causes a closed, tightly packed cone to open gradually" [and] "the mechanism leading to cone opening when dried (and closing when wetted) relies on the bilayered structure of the individual scales that change conformation when the environmental humidity is changed." It is the scales – composed of two layers, which expand and contract – flex and bend in response to rising humidity. This type of modular process, known as pinecone effect, have been recreated in textiles to manage temperature and humidity [1]. An interesting example of this is the project by Maison Martin Margiela, where a number of garments were treated with different strains of bacteria, yeast, and mold to vary colors and textures over the course of time [2].

Cf.

[1] Reyssat, E., and Mahadevan, L. 2009. Hygromorphs: from pine cones to biomimetic bilayers. *Journal of the Royal Society, Interface*, 6(39), 951–957.

[2] Margiela, M., and Maison Martin Margiela. 1997.

Exhibition, Museum Boijmans Van Beuningen, Rotterdam, 11 June–17 August]. Rotterdam: Museum Boijmans Van Beuningen.

[3] Talman, R. 2019. Changeability as a quality in textile design. Licentiate Thesis. Borås: University of Borås.

Molding material

Idea

To investigate the aesthetic possibilities of molded textile materials.

E.g.

Explore,

- creating your own molds to study different shapes in relation to the body,
- different DIY fixatives providing various results; for example, 100% wood glue, 50% wood glue, 50% wallpaper glue, 50% wood glue, 50% wall paint, 100% wall paint, 50% wall paint, and 50% wallpaper glue,
- adding colors; for example, 50 g. (50% wood glue and 50% wallpaper glue) plus 5 g. pigment [1],
- design possibilities in molding leather with water,
- design possibilities in vacuum-formed clothes,
- spraying fibers on/into a form [2],
- using a pneumatic gun to drive a yarn from a cone to be sprayed on a form,
- etc.

I.e.

In architecture and furniture design, the molding process is a common technique, which spans various techniques and materials and is appreciated for its possibilities for standardized expressions and outlines for design [3]. In regard to textiles, they are usually made with a high percentage of synthetics with thermoplastic properties, which respond well to heat and pressure, as well as for ultrasonic joining, laser welding, or heat bonding [4].

Cf.

[1] Nordberg, J. 2014. The Act of Molding: Exploring the expressive potential in moulding of archetypical garments. MA Thesis. Borås: University of Borås.

<https://www.bodyandspace.com/the-act-of-molding>
[Retrieved 20190615].

[2] Torres, M. 2008. Fabrican Ltd. www.fabricanltd.com.
[Retrieved 20190610].

[3] Swift, K. 2013. Manufacturing Process Selection Handbook. Oxford: Butterworth Heinemann.

[4] Stückenbrock, K. 2003. Chemical Finishing. In Albrecht, W., Fuchs, H., and Kittelmann, W. Eds. Non-woven Fabrics: Raw Materials, Manufacture, Applications, Characteristics, Testing Processes. Weinheim: Wiley-Vch, pp. 421-459.

Camouflage material

Idea

To investigate camouflage materials, physically and socially.

E.g.

Explore,

- how materials can aid in the process of assimilation and adaption to our surroundings,
- how materials can provide a forms of connectivity/mediation between people and environment,
- how materials can encourage engagement, connectivity, identification, and belonging,
- materials used to disguise and to mislead,
- materials used to conceal the existence or presence of something/someone,
- action/movement behavior as an artful skill in material to deceive or hide,
- camouflage material as inscriptions in space [1],
- etc.

I.e.

In his book *Camouflage*, Leach writes about how human beings are governed by the urge to conform and blend in with their surroundings. For example, consider how collectively we follow fashion, “[w]e become part of cultures of conformity—religious communities, military groups, sports teams; we take on corporate identities. Likewise, we seem to have the capacity to grow into our built environment, to familiarize ourselves with it, and eventually to find ourselves at home there. We have a chameleon-like urge to adapt, and, given the increasing mobility of contemporary life, we are constantly having to do so. The desire for camouflage is a desire to feel connected—to find our place in the world and to feel at home” [2].

Cf.

- [1] Oxford Dictionaries. 2019. Camouflage. <https://www.lexico.com/en/definition/camouflage> [Retrieved 20190616].
- [2] Leach, N. 2006. *Camouflage*. Cambridge: MIT Press.

Digital material

Idea

To investigate the design possibilities in digitally fabricated materials.

E.g.

Explore,

- development of complex 3D knitting or weaving structures that can accomplish tasks that are not possible to do manually,
- creation of a new machine language for a knitting program to develop new forms,
- digital projections and VR-environments in interaction with live bodies to develop motion-based visual imagery,
- digital fabrication by exploring structure in an experimental weaving machine that is not possible with a digital programming of industrial electronic machines,
- digital filters for material manipulation,
- hacking graphic prints, pattern repeats, or patterns/structures for prints and knits; for example, rename the JPG print/pattern file to a TXT file and open it with a program like TextEdit. Scroll down a bit past the first section of code that deals with actions in relation to the file, and then start to take out, insert, and experiment with text additions, subtractions, re-arrangement, for example. Then save, and rename the file JPG again and open it in a bitmap-program,
- volume, texture, and other material expressions from above; for example, film interactive expressions and functions of individuals and groups with a drone. Analyze in analog and digitally to render interesting findings for further warble developments,
- motion capture to explore mechanical structures for new thinking in garment constructions,
- 3D scans to capture different bodies, abstraction of bodies, augmented bodies, and other sculptural forms, to use as models for a design or design programs,
- a one-person perspective in design using a head mounted go-pro-camera,
- a coat-speaker that amplifies base sounds in the body or other forms or similar forms of sonic/wave materials,

– media-mediated material realities, or qr-coded materials (clothing) for direct social-media interactions.

I.e.

Digital fabrication often refers to different types of manufacturing processes where the machine used to construct is controlled by a computer program. Common forms of digital fabrication are CNC, 3D-printing, and laser cutting. In architecture, complex textile structures as well as knitted structures have also been explored as digital fabrication. From a production perspective, digital fabrication also means reliability in production quality as well as simplicity for repeated global production.

Cf.

- [1] Johansson, E. 2014. Motion Blur. MA thesis. Borås: University of Borås. <https://www.bodyandspace.com/new-project-21> [Retrieved 20190619].
- [2] Randestad, S. 2018. Hybrids. MA thesis, Master of Fine Arts in Fashion Design. Borås: University of Borås.
- [3] Landahl, K. 2015. The Myth of the Silhouette: On form thinking in knitwear design. PhD Thesis. Borås: University of Borås. <https://www.bodyandspace.com/the-myth-of-the-silhouette> [Retrieved 20190619].
- [4] McCann, J., and Bryson, D. Eds. 2009. Smart clothes and wearable technology. Cambridge: Woodhead.

Algorithmic material

Idea

To investigate new logic as methods for developing new material qualities.

E.g.

Explore,

- materials by creating a set of rules for a series of operations or altering the set of rules of a known step-by-step procedure.
- simple rules in predefined processes,
- using simple subtraction,
- turning things upside down,
- changing instrument roles,
- doing the last thing first in a given process/recipe,
- deciding against the better alternative,
- using only one element of each kind,
- using filters [1],
- etc.

Consider,

- the set of rules as an instrument that cause a slightly different effect than one others might choose,
- other interpretations/adjustments you would add to a step-by-step recipe that creates a particular signature,
- etc.

I.e.

An algorithm is a step-by-step procedure to solve logical and mathematical problems. A recipe is a good example of an algorithm because it tells you what you need to do step by step and how to take inputs and produce an output. An algorithm can be described informally as a list of steps, which can be written in ordinary language; in computing, an algorithm is a precise list of operations [2]. A simple example is an algorithm for sorting cards with colors (input) into piles of the same color (out-put): (1) Pick up all of the cards, (2) Pick a card from your hand and look at the color of the card, (3) If there is already a pile of cards of that color, put the card on that pile, (4) If there is no pile of cards of that color, make a new pile of just this card color, (5) If there is still a card in your hand, go back to the second step, (6) If

there is not still a card in your hand, then the cards are sorted. You are done [2].

An interesting example of algorithmic software to simulate a cognitive process of drawing is the software program AARON created by Harold Cohen in 1973. The idea generating the program objective was that AARON would be able to simulate the cognitive process of drawing like a human, but without human influence, by using a complex set of computer instructions. In practice, as Cohen explains, "AARON makes drawings of whatever it knows about without requiring any further instructions for the making of a particular drawing – and, indeed, without possessing any mechanism through which it could take instructions" [3:855].

For Cohan, AARON is unaware of the existence of aesthetic principles like harmony and balance, and since its drawings are aesthetically satisfactory, one may question the relevance of those principles to artistic production. The fuller answer suggested by Cohen is: "I regard 'style' – surely the most difficult word in the entire vocabulary of art – as the signature of a complex system. I regard the aesthetics of AARON's performance as an emergent property arising from the interaction of so many interdependent processes, the result of so many decisions in the design of the program, that it becomes meaningless to ask how much any one of them is responsible for the outcome. If AARON has maintained a consistent aesthetic, a consistent identity, from its earliest endeavors, I have to assume it to reflect consistent patterns of my own in determining its development. If someone else wrote a similar program I would expect it to exhibit a different identity and a different aesthetic" [3:855].

Cf.

- [1] Eno, B., Schmidt, P. 2013. Oblique Strategies: Over One Hundred Worthwhile Dilemmas. Apple: Iphone App.
- [2] Wikipedia. 2019. Algorithm. <https://simple.wikipedia.org/wiki/Algorithm> [Retrieved 20190818].
- [3] Cohen, H. 1988. How to Draw Three People in a Botanical Garden. AAAI, 846-855.

Material meaning

Idea

To investigate and develop new material meanings by rearranging given material systems into new ones.

E.g.

Try the following or similar exercises,

- use a set of cards, which are not selected by you, with different printed materials on them but unrecognizable on the back [1],
- pick three materials without knowing which they are and answer the questions: What is the scenario? the situation? the action? Who is this person?
- eliminate one card by exchanging it for a new one; answer the same questions again,
- explore a series of different material-combinations to form new and alternative social categories based on known material categories but thought of in new ways through reweighting, reordering, adding, or removing materials until you find “worlds” [2],
- introduce an image of body-part to the selection of three materials and discuss again: What is the scenario? the situation? the action? Who is this person?
- explore and propose new genders through new combinations of materials,
- explore and propose new genders by manipulating traditional categorical materials in opposite ways,
- etc.

I.e.

Fashion is often understood as a system of categories because of its function of associating materials and objects with established cultural categories. However, fashion as a way of giving form to our everyday lives does not only work to associate materials and objects with existing cultural categories, it also produces new and alternative cultural categories that lead to new ways of living. In relation to this, particular categories to challenge could be those indicated by statements like: “Textiles are for girls, materials are for boys” or that wool is masculine material and silk is female material [3][4] or what contexts give certain materials certain meanings [5].

Cf.

- [1] Thornquist, C. 2017 What is it? Material systems. System of materials. Material categories. Categorical systems. Volume 1-3. <https://www.bodyandspace.com/what-is-it/> [Retrieved 20190619].
- [2] Goodman, N. 1978. Ways of Worldmaking. Indianapolis: Hackett.
- [3] Wiley, S., Philogène, G., and Revenson, T. 2012. Social Categories in Everyday Experience. Washington: Magination Press.
- [4] Dichter, E. 1964. Handbook of consumer motivations: the psychology of the world of objects. New York: McGraw-Hill.
- [5] Karana, E., Hekkert, P. 2010. User-material-product interrelationships in attributing meanings. International Journal of Design, 4(3), 43-52.

Biomimetic material

Idea

To investigate new material functions, structures, and textures by mimicking biological materials.

E.g.

Explore,

– existing examples in design such as Velcro, lotus-inspired hydrophobia, sharkskin materials, hollow fiber, paper house, skeleton material structures, material geometry and natural fractals, nature's water filter, water cubes, gecko climbing feet, armadillo backpack, robotic climbing three-inch worm [1],

– explore and model novel biological material entities for alternative material functions and expressions,

– etc.

I.e.

Biomimetic, biomimesis, biomimicry, or biologically inspired design, as well as other similar words, imply copying or adaptation or derivation from biology; in other words, the design and production of materials, structures, and systems that are modeled on biological entities and processes. In this sense biomimetics is a relatively young study that embraces the practical use of mechanisms and functions of biological science in engineering, design, chemistry, electronics, and more.

On the other hand, it is also a very old discipline. Humans have observed nature to find answers to problems throughout her existence. A well-known example is Leonardo da Vinci's study of birds flying, which led to the design of some machines, but never to any construction [2][3]. Another area is structural materials. Natural structural materials commonly comprise hard and soft phases arranged in complex hierarchical architectures, with characteristic dimensions spanning from the nanoscale to the macroscale. The resulting materials are lightweight and often display unique combinations of strength and toughness [4].

Cf.

[1] Hennighausen, A., and Roston, E. 2015. 14 Smart Inventions Inspired by Nature: Biomimicry. <https://www.bloomberg.com/news/photo-essays/2015-02-23/14-smart-inventions-inspired-by-nature-biomimicry>. [Retrieved 20190624].

[2] Vincent, J., Bogatyreva, O., Bogatyrev, N., Bowyer, A., and Pahl, A-K. 2006. Biomimetics: its practice and theory. *Journal of the Royal Society Interface*, 3(9), 471-482.

[3] Baumeister, D., Tocke, R., Dwyer, J., Ritter, S., and Benyus, J. 2013. *Biomimicry resource handbook: a seed bank of best practices*. Missoula: Biomimicry.

[4] Wegst, U., Bai, H., Saiz, E., Tomsia, A., and Ritchie, R. 2014. Bioinspired structural materials. *Nature Materials*, 14(1), 23-36.

Material argumentation

Idea

To investigate ways of making material explorations and developments argue for and contextualize itself.

E.g.

Explore,

- diagrammatic logic and inductive sequence patterns for exhibiting material explorations [1],
- a formal exchange of diverging or opposite views on one or more materials,
- each aspect of the material development in one example each and exhibit them in a sequence or pattern,
- testing the demonstrative power of material developments in multiple pieces but only in one color,
- testing the demonstrative power of material development by coloring materials in the trendiest colors and color combinations possible, regardless of the foundational depth of material developments,
- installing the example material demonstrating the material development in the context of state-of-the-art materials built to argue for the particular factors that have been developed,
- etc.

I.e.

Inductive reasoning is a logical method in which multiple premises are viewed as supplying evidence or arguments for a specific conclusion. In contrast, in deductive logic, where the conclusion is certain, the “truth” of the conclusion of an inductive argument may be probable (feasible, possible), based upon the evidence (examples) given. As such, inductive reasoning, or “inductive demonstration” could also be described as the derivation of general principles from specific observations, although this may not always be the case [2][3].

Cf.

[1] Thornquist, C. 2015. Material Evidence: definition by a series of artefacts in arts research, *Journal of Visual Art Practice*, 14(2), 110-119.

[2] Copi, I. M., Cohen, C., and Flage, D. 2006. *Essentials of Logic*. Upper Saddle River, NJ: Pearson Education.

[3] IEP Staff. 2019. *Deductive and Inductive Arguments*. <https://www.iep.utm.edu/ded-ind/> [Retrieved 20190624].

Nude material

Idea

To investigate different notions of power by exploring relationships between nudity and nakedness.

E.g.

Explore,

- confrontations between one and the other through the different aspects of the sexuality, discomfort, and anxiety that the unclothed body may express, trying to eliminating the distinction between the nude and the naked [1],
- relationships between traditional ideas of male power through nudity and the sexuality of female nudity,
- different contexts that make the same person appear naked in one, and nude in the other, or balance between nakedness, still withholding the artifice of nudity,
- the nude as a fixed point for truth in relation to the human body as changeable and transitory,
- etc.

I.e.

Both nude and naked mean not wearing any clothes. However, for Berger, “to be naked is to be oneself. To be nude is to be seen naked by others and yet not recognized for oneself. A naked body has to be seen as an object in order to become a nude. (The sight of it as an object *stimulates* the use of it as an object.) *Nakedness reveals itself*. Nudity is placed on display. To be naked is to be without disguise. *To be on display is* to have the surface of one’s own skin, the hairs of one’s own body, turned into a disguise which in that situation can never be discarded. The nude is condemned to never being naked. Nudity is a form of dress” [2:58].

In relation to dress, Jullien, argues that “a depiction of a clothed man is an attempt to show that human being as a person, perceived in his individuality; but in representing a nude body, the aim is to capture an essence. Or rather, whether we like it or not, it is the nude that *constitutes the essence*” [...] “The nude is a paradigm of what the ‘West’ consists of in cultural terms and brings to light the stances that originally

underpinned our philosophy. The question of essence, of the ‘thing itself,’ can be addressed through the nude, which also records its history. The nude brings into play that which is most direct—frontal—and most sensible, thus reopening and making us keenly sensitive to the possibility of ontology” – nude as a complete presence and nakedness a diminished state. Thus, as Jullien further argues, where “the nude man recognizes himself not as a particular existence caught up in the undefined fabric of the universe, but as being a part of “being”: as being “man” and in his destiny as a “being” there is—can be—no such thing as a nude portrait. What the limits of the body, and even the intimacy of the carnal, give access to is a generality; or, to put it the other way around, the flesh of the nude is an embodiment. Here lies the source of its power of effraction: as soon as it comes into proximity with the sensible, it is borne away to a distance, onto an ideal scene [3:128, 130,128].

Cf.

- [1] Borzello, F. 2012. The naked nude. London: Thames and Hudson.
- [2] Berger, J. 2008. Ways of Seeing. London: Penguin.
- [3] Jullien, F. 2007. The Impossible Nude. Chicago: University Of Chicago Press.

Material augmentation

Idea

To investigate body augmentation as cultural material.

E.g.

Explore,

- augmenting existing material qualities, physically and or/digitally,
- augmenting or abstracting the borders between body, dress, and space with skin-colored, transparent material,
- changing body mechanics with prosthetics,
- using your hair as weft yarns to add inlays and weft extensions by merging body hair and man-made materials,
- reforming the body with tape,
- cutting and weaving your own hair into a hat,
- abstracting and mixing skin color and pigments with body-painting,
- abstracting the body in space through colors; for example, coloring the hands completely red with a clear-cut ending,
- using full-scale body imagery in different ways to distort the perception of a live body,
- using large-scale imagery in different ways to distort the perception of a large space or built environment,
- etc.

I.e.

To augment means to make (something) greater by adding to it. Augmentation then is not the reality itself but the perception of the real. Augmented reality also refers to technologies that combine computer-generated images with the real object or scene to form a new combined whole.

Cf.

- [1] Fuhrt, B. 2011. Handbook of Augmented Reality. New York: Springer.
- [2] Logaldo, M. 2016. Augmented Bodies: Functional and Rhetorical Uses of Augmented Reality in Fashion. *Pólemos*, 10(1), 125–141. [Retrieved 20190624].
- [3] Taschen, A. 2005. Aesthetic surgery. Köln: Taschen.

Speculative material

Idea

To investigate possible, plausible, probable, and preferable futures through materials.

E.g

Explore,

- fictional truths that challenge the ideas, values, and beliefs of our society embodied in material culture through hypothetical materials[1],
- additions to digital technology through material combinations; for example, cast objects in transparent plastic reinforced by discarded needles, razor blades, and anti-depressive pills [2],
- transparent polypropylene sheeting in areas where transparency does not exist,
- materials that reflect fundamental realities,
- materials that pervert a fundamental reality,
- materials that mask the absence of a fundamental reality,
- materials that bear no relation to any reality whatever (hyperreality) [3],
- etc.

I.e.

Instead of asking about what is or what is not, Shaviro considers the questions: why is there always something new? For example, Shaviro notes that "Heidegger asks the question of Being: 'Why is there something, rather than nothing?'" but that "Whitehead is splendidly indifferent to this question. He asks, instead: 'How is it that there is always something new?' Whitehead doesn't see any point in returning to our ultimate beginnings. He is interested in creation rather than rectification, Becoming rather than Being, the New rather than the immemorially old. I would suggest that, in a world where everything from music to DNA is continually being sampled and recombined, and where the shelf life of an idea, no less than of a fashion in clothing, can be measured in months if not weeks, Whitehead's question is the truly urgent one. Heidegger flees the challenges of the present in horror. Whitehead urges us to work with these challenges, to negotiate

them. How, he asks, can our culture's incessant repetition and recycling nonetheless issue forth in something genuinely new and different?" [4:x].

Material speculation may be addressed as a form of material philosophizing for the development of new perspectives through material development: "Material speculation emphasizes the material or mediating experience of specially designed artifacts in our everyday world by creating or reading what we refer to as counterfactual artifacts" [5:45]. Although speculation has been under fierce criticism for being something other than just critique, other voices, building on Bloch and Putnam, "(1) the speculative hypotheses we unavoidably use to interpret the world around us inform our political beliefs and actions, and (2) to stifle speculative thinking as that creative and inquisitive enterprise which questions and transgresses the given is not only a 'crime against reason', [...], but also a crime against freedom" [6:1]. In Bergson's words: "The idea of the future, pregnant with an infinity of possibilities, is thus more fruitful than the future itself, and this is why we find more charm in hope than in possession, in dreams than in reality" [7:54].

Cf.

- [1] Dunne, A., and Raby, F. 2013. Speculative everything: design, fiction, and social dreaming. Cambridge: MIT Press.
- [2] Miss Buggs. 1999. Do No Harm. <https://www.artrabbit.com/events/miss-bugs-solo-show-do-no-harm> [Retrieved 20190624].
- [3] Baudrillard, J. 1994. Simulacra and Simulation. Ann Arbor: University of Michigan Press.
- [4] Shaviro, S. 2009. Without Criteria: Kant, Whitehead, Deleuze, and aesthetics. Cambridge: MIT Press.
- [5] Wakkary, R., Odom, W., Hauser, S., Hertz, G., and Lin, H. 2016. A short guide to material speculation: actual artifacts for critical inquiry. Interactions. 23(2), 44-48.
- [6] Moir, C. 2018. In Defence of Speculative Materialism. Historical Materialism, 1-33.
- [7] Bergson, H. 2001. Time and free will: an essay on the immediate data of consciousness. Mineola: Dover.

Hybrid material

Idea

To investigate the possibilities of new material crossed with traditional material in a field of unconventional ones.

E.g.

Explore,

- new structures by joining modules of one material with another material,
- coatings and composites of plaster, concrete, bioplastics, and traditional textile materials/ structures,
- different types of fillings as alternatives to insulations in sandwich constructions,
- combination of various fiber-based or porous materials with organic, growing materials,
- air-filling patterns to create structure in soft materials such as textiles,
- rigid additions to soft materials, or soft additions to rigid materials in order to create semi-flexible structures,
- knitting with garden twine, string, chains, hair, and seaweed,
- yarns made from strips of various materials,
- yarns coated with tubes and other structures,
- print woven with pizo-electric or solar-electric yarns, or knit textile antennas with conductive paint,
- new yarns produced by twining new material combinations,
- shaped memory alloys combined with textile,
- etc.

I.e.

Hybrid materials are combinations of two or more materials or of materials and spaces assembled in such a way as to have attributes not offered by any one material alone. Particulate and fiber composites are examples of one type of hybrid, but there are many others: sandwich structures, lattice structures, segmented structures, and more. These new variables expand design space, allowing the creation of new "materials" with improved property profiles. The number

of possible combinations of matrix, reinforcement, filler, and configuration is enormous [1][2][3][4][5].

Cf.

- [1] Drisko, G. L., Sanchez, C., Buehler., M, Rabu, P., and Taubert, A. 2012 Hybridization in Materials Science – Evolution, Current State, and Future Aspirations. *European Journal of Inorganic Chemistry*, (32), 5097–5105.
- [2] Brownell, B. Ed. 2010. *Transmaterial 3: A Catalog of Materials that Redefine our Physical Environment*. New York: Princeton Architectural Press.
- [3] Keune, S. Forthcoming. *Living Indoors*. Phd Thesis. Borås: University of Borås.
- [4] Zboinska, M., Dumitrescu, D., and Landin, H. 2019. Expressing and Sensing the Hybrid Materiality: Voluminous Interactive Architectural Substance. In *TEI '19 Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction*, p. 483-489.
- [5] Ashby, M., Cope, E., and Cebon, D. 2013. *Materials Selection for Engineering Design*. In Rajan, K. Ed. *Informatics for Materials Science and Engineering: Data-driven Discovery for Accelerated Experimentation and Application*. Oxford: Butterworth-Heinemann, pp. 219-244.

Dressed material

Idea

To investigate the relationships between the exteriority and interiority of a material.

E.g.

Explore,

- a naked and a dressed object through its materiality,
- materials in white, polychrome, or black,
- stylistic and structural materials in their natural, modified, or semi- processed state,
- different materials dressed in other materials,
- different objects dressed in other materials,
- sandwiched materials stripped from their dress/coats, and given a new coating/dress,
- etc.

I.e.

In the book *White walls, designer dresses: the fashioning of modern architecture*, “Wigley follows the trajectory of this key subtext “by closely reading the statements and designs of most of the protagonists, demonstrating that it renders modern architecture’s relationship with the psychosexual economy of fashion much more ambiguous than the architects’ endlessly repeated rejections of fashion would suggest. Indeed, Wigley asserts, the very intensity of these rejections is a symptom of how deeply they are embedded in the world of clothing. By drawing on arguments about the relationship between clothing and architecture first formulated in the middle of the nineteenth century, modern architects in fact presented a sophisticated theory of the surface, modernizing architecture by transforming the status of the surface” [...] “Although the white wall exemplifies the stripping away of the decorative masquerade costumes worn by nineteenth-century buildings, Wigley argues that modern buildings are not naked. The white wall is itself a form of clothing—the newly athletic body of the building, like that of its occupants, wears a new kind of garment and these garments are meant to match” ...” Architecture was understood as a form of dress design” [...] “the white wall is itself a form of clothing—the newly athletic

body of the building, like that of its occupants, wears a new kind of garment and these garments are meant to match” [1].

This polite approach to materiality--where materials and techniques are dressed beyond their functions--may be contrasted with material approaches in vernacular and primitive architecture not characterized by particular stylistic elements but by the spontaneous and continuing activity of diverse human actions resonating in materials [2]. In vernacular and primitive architecture, the interest lies not in the globally athletic body but rather in human creativity in connection with a human’s different modes of life. These are expressed in the human-material relationships conditioned by local climatic conditions, vegetation, and locally available resources [3][4].

Cf.

[1] Wigley, M. 1995. *White walls, designer dresses: the fashioning of modern architecture*: Cambridge: MIT Press.

[2] Rudofsky, B. 1987. *Architecture without architects: a short introduction to non-pedigreed architecture*. Albuquerque: University of New Mexico Press.

[3] Jakobsen, A. 2019. *Radicalsloyd*. <http://www.radicalsloyd.com> [Retrieved 20190625].

[4] Claesson, E. 2017. *Där regnbågen slutar*. <https://www.tidskriftenrum.se/articles/dar-regnbagen-slutar/> [Retrieved 20190625].

Information material

Idea

To investigate the materialization of information.

E.g.

Perform,

– an experiment where one set of material variables is kept constant, while another set of material variables is being measured as the subject of the experiment; the body, for example, can constitute one or several variables,

– a sampled survey mapping out the preferences for a material in a product; for example, ask about texture, structure, color, surface treatment, and print.

Interpret the responses and create the material,

– an in-depth interview to recognize material needs or wants in a particular situation.

Organize,

– a focus group for research and analysis through a guided or open discussion about a material exploration to determine the reactions that can be expected from a larger population,

– participant observations of the qualities of a material by sharing the activities and behaviors of a group or an individual in the interaction with the material,

– a quantitative measurement on the effect of a material for a particular situation or function,

– etc.

I.e.

Consider for example a question like: “What would a painting look like if the Swedish people together decided on how it was going to be made?” This is the question Blidö asked himself before performing a nationwide opinion survey for the purpose of determining people’s preferences. Thirteen questions were answered on everything from preferences in painting size, frame, shape, and motif to preferences for figurative or abstract art, painting color preferences, and the feelings you want a painting to communicate. The results from the survey were

carefully organized and interpreted to insure that the translation from number to painting would be as true to the research data as possible. Based on the results, a grid with all the elements arranged and proportionally sized was prepared. Using a computer and projector, the researcher then transferred the accurate information in exact proportion to the paint canvas. The result is “Folkets tavla” [The People’s Painting], which is basically an advanced chart showing the components the Swedish people prefer in a painting [1].

Cf.

[1] Blidö, G. 2009. Folkets Tavla. <http://cargocollective.com/gabrielblido/Folkets-Tavla> [Retrieved 20190624].

[2] Tufte, E. 2006. Beautiful evidence. Cheshire: Graphics Press.

Material memory

Idea

To investigate the expressive possibilities between matter and memory.

E.g.

Explore,

- bodily memories and intimate materials and larger material structures,
- materials as invitations for actions,
- settled tendencies or usual manner of behavior towards materials,
- acquired mode of behavior that has become nearly or completely involuntary,
- material composition or arrangement of materials as material thinking,
- individual aggregation of condensed memories as design material,
- material as an existence placed halfway between the "thing" and the "representation,"
- etc.

I.e.

For Bergson, matter is an aggregate of "images", where "image" refers to a certain existence that is more than what the idealist calls representation, and less than what the realist calls thing [1]. Every concrete perception according to Bergson, is thus a synthesis, a contraction, made by memory of an infinite of pure perceptions, of heterogeneous, sensible qualities. Pure recollection and pure perception are, in the world of Bergson, matter in becoming, the world in becoming. Put differently, Deleuze's alternate interpretation of Bergson concludes: "[t]his infinite set of all images constitutes a kind of plane [plan] of immanence. The image exists in itself, on this plane. This in-itself of the image is matter: not something hidden behind the image, but on the contrary, the absolute identity of image and movement. The identity of the image and movement leads us to conclude immediately that the movement-image and matter are identical" [2:58-59].

Memory is thus understood as a power completely independent of matter; this is why Deleuze calls it virtual. It is the representation of an absent object. Perception, on the other hand, gives us the whole, or at least the essential part of matter – that of choice – since the rest comes from memory and is superadded to matter [3]. Or in other words, as Bergson very elegantly puts it: "Spirit borrows from matter the perceptions on which it feeds, and restores them to matter in the form of movements which it has stamped with its own freedom" [1:233]. For Bergson, it is the oscillating ability to detach from the concrete and material world into the vague world of dreams and then go back again, which constitutes the intuitive act: to be in constant motion, always to stay in the becoming, be it a condensed memory or formed stimuli, a pure recollection, or pure perception.

Following this, Bergson argues that there is only one method of refuting materialism: showing that matter is precisely that which it appears to be. But to do this we must leave to matter those qualities which materialists and spiritualists alike strip from it: the latter that they may make of them representations of the spirit, the former that they may regard them only as the accidental garb of space." This indeed, Bergson continues to argue, "is the attitude of common sense with regard to matter, and for this reason common sense believes in spirit. It seems to us that philosophy should here adopt the attitude of common sense, although correcting it in one respect. Memory, inseparable in practice from perception, imports the past into the present, contracts into a single intuition many moments of duration, and thus by a twofold operation compells us, de facto, to perceive matter in ourselves, whereas we, de jure, perceive matter within matter" [1:80].

Cf.

[1] Bergson, H. 1988. Matter and Memory. New York: Zone.

[2] Deleuze, G. 2003. Cinema 1: The Movement-Image. Minneapolis: Univ. of Minnesota Press.

[3] Deleuze, G. 1997. Bergsonism. New York: Zone.

Sensuous material

Idea

To investigate the sensuous qualities of materials.

E.g.

Explore,

- tactile material expressions and functions on the scale of the body, interior, building, or landscape,
- sonic material expressions and functions on the scale of the body, interior, building, or landscape,
- material expressions and functions of smell on the scale of the body, interior, building, or landscape,
- sound and smell in combination for defining structures on the scale of the body, interior, building, or landscape,
- combinations of tactile, sonic, and smell material expressions and functions,
- dispersion systems, activation, and action-based multimodal materials interactions and qualities,
- aromatic liquids for print as a dispersion for smell,
- sound absorbing or sound filtering/changing material qualities and structures,
- sonic expression through interaction between different materials including the body,
- anti-smell or smell-changing materials or material treatments,
- sexually arousing and pleasurable tactile, smell, and sound materials or a combination of these,
- socially repellent and provocative tactile, smell, and sound materials or a combination of these,
- etc.

I.e.

In art and design, visual aesthetics, stimulations, and perceptions dominate. In addition, many studies suggest that the greater the number of sensory modalities stimulated together, the richer the experiences will be. Stein and Meredith, for example, show that interactions among senses are the most ancient scheme of sensory organization [1]. This is not only limited to design, but also relates to the sensory world in general; materials are basic elements where each material has “a specific set of sensory attributes

that interact with the light, air, and people surrounding it. It tends to trigger a specific set of sensory impressions conveyed by the different sensory modalities” [2:24]. Sound and smell, for example, can have striking emotional effects. In the same way that the feelings of a tactile material through touch is rooted in our memory and perception of the physical properties of that surface, the aesthetic and emotional connotations of sound and smell can be linked to well-defined physical parameters [3][4][5][6].

Cf.

[1] Stein, B., and Meredith, M. 1993. *The Merging of the Senses*. Cambridge: MIT Press.

[2] Schifferstein, H.N.J., and Wastiels, L. 2014. *Sensing Materials: Exploring the Building Blocks for Experiential Design*. In Rognoli, V., and Karana, E. Eds. *Materials Experience: fundamentals of materials and design*. Oxford: Butterworth-Heinemann, pp. 16-24.

[3] Laughlin, Z., and Howes, P. 2014. *The Sound and Taste of Materials*. In Rognoli, V., Karana, E. Eds. *Materials Experience: fundamentals of materials and design*. Oxford: Butterworth-Heinemann, pp.41-48.

[4] Stasiulyte, V. Forthcoming. *Aesthetics of the Invisible: Toward a Sonic Fashion Ontology*. Licentiate Thesis. Borås: University of Borås.

[5] Kapur, V. Forthcoming. *Smells: olfactive dimension for spatial designing*. PhD Thesis. Borås: University of Borås.

[6] Zetterblom, M. 2011. *Textile Sound Design*. PhD Thesis. Gothenburg: Chalmers.

Biomechanical material

Idea

To investigate the material relationship between biomechanical structures and man-made material mechanics.

E.g.

Explore,

- materiality in static systems that are in equilibrium, both at rest or moving at a constant velocity,
- materiality in dynamic systems that are in motion, both acceleration and deceleration,
- materiality in kinematic effects of forces on systems, including motion patterns, linear and angular changes in velocity, position, displacement, velocity, and acceleration,
- developing new biomechanical materials or modifying existing biomechanical materials,
- both fluids and gas in and around biological movement,
- etc.

I.e.

Mechanics is a branch of physics concerned with the motion and deformation of bodies in response to forces. Biomechanics may similarly be described as the mechanical laws relating to the movement or structure of living organisms; for example, in locomotion or exercise. Biomechanical systems then are technical systems designed to interact with biological systems in different ways [1][2][3].

Cf.

- [1] Hamill, J., Knutzen, K., and Derrick, T. 2015. Biomechanical basis of human movement. Philadelphia: Wolters Kluwer Health.
- [2] Blazeovich, A. 2017. Sports biomechanics: optimizing human performance. London: Bloomsbury Sport.
- [3] Ullman, D. 2017. The Mechanical Design Process. New York: McGraw-Hill.

Situated material

Idea

To investigate the circumstances and environment of a material.

E.g.

Explore,

- the surroundings or conditions in which a material lives or operates,
- a material as a whole or in a particular geographical area, and as affected by human activity,
- the aggregate of social and cultural conditions that influence the life of a material,
- the position or characteristic position of the linguistic quality of material in a sequence,
- the way in which a material is placed or functions in relation to its surroundings,
- a particular material as a complex of affairs at a stage in the action of a narrative or drama,
- new human-material possibilities by reimagining existing body-matter relationships,
- etc.

I.e.

Being situated generally refers to having a location, a site, a situation, or a context. A situated perspective emphasizes the qualities a material derives from the environment and the material's interactions with it. In this way, these interactions are defined by a material embodiment. Interactive qualities to consider could for example be if the material exists in a dynamic (rapidly changing) environment, if the material is manipulated or changed through its use, or if the material could sense or perceive in different ways[1].

Jung and Stolterman have argued that “[w]hile form is about design considerations with its three conceptual dimensions of material, shape, and making, materiality is more about the relationship between people (users) and the material artifact in terms of how it is used out in the world.” This may for also include how the material interacts with other artifacts, and in turn, their contexts and their environments, both in terms

of meaning and environments [2:649]. Furthermore, some researchers even argue that what constitutes the materiality of an artifact is not its physical matter, but the artifact's connection to cultural and social relationships and practices that conditions actions related to the material [3]. For example, different forms of craft and handwork are common instances of socially situated – and embodied – materiality related to traditions, but where the practices are conditioned by the physicality of the materials involved [4][5]. Other examples relate to social interactions and gender, which presents new possible strategies. In a 2018 advertisement for swimwear by a global fashion goods retailer, for example, a woman is pictured wearing a bikini in a sparkling golden material. The image was categorized by Hymmen and Hiroi as “glitter breast,” and further translated into a man with golden glitter painted on his chest as a strategy for inducing change in material meanings [6].

Cf.

- [1] Wikipedia. 2019. Situated. <https://en.m.wikipedia.org/wiki/Situated> [Retrieved 20190718].
- [2] Jung, H., and Stolterman, E. 2012. Digital form and materiality: Propositions for a new approach to interaction design research. In Proceedings of NordiCHI'12, October 14–17, Copenhagen, Denmark, pp. 645–654.
- [3] Leonardi, P. M. 2010. Digital materiality? How artifacts without matter, matter. *First Monday*, 15(6).
- [4] Adamson, G. 2008. *Thinking Through Craft*. Oxford: Berg.
- [5] Goodman, E., and Rosner, D.K. 2011 From garments to gardens: Negotiating material relationships online and “by hand”. In Proceedings of the International Conference on Human Factors in Computing Systems, CHI 2011, Vancouver, BC, Canada, pp. 2257–2266.
- [6] Hymmen, A and Hiroi, K. 2017. Remodeling. In Teunissen, J. Ed. *State of fashion, exhibition 2018*. Arnhem: State of Fashion.

Material culture

Idea

To investigate the culture, history and narrative of materials for further material development.

E.g.

Explore,

- narratives that are embodied in, or connected to a material, and return again to the material from the narratives through interpretation or speculation to develop the new characteristics and properties of the material,
- explore the development of a particular material in relation to societal organisation, community development and other necessities of living to find motives for alternative material developments,
- material agency and the effects that a material may have on a person or a particular group of people, and develop versions of this material in dialogue with the person or group of people,
- the meaning of a material, starting with the most intimate framework for contextualising its identity, then moving gradually through different layers of broader and more distant frameworks to rethink the material in order to reform the original material,
- etc.

I.e.

Material culture is often described as the study of different aspect of social reality substantiated in material objects that surround people and that people surrounds themselves with. Typically, this includes the creation, use, consumption, and exchange of material objects as well as behaviors, norms, and other rituals that different objects constitute or are a part of [1] [2]. As a field of study material culture has also been framed to challenge "the historical division between the natural sciences as being the place for the study of the material world and the social sciences as being where society and social relations can be understood", by proposing instead that culture and society should be understood as being created and reproduced by the ways in which people make and interact with objects [3].

Cf.

- [1] Tilley, C. Ed. 2006. Handbook of material culture. London: Sage.
- [2] Sass, L. 2011. The Substance of Civilization Materials and Human History from the Stone Age to the Age of Silicon. New York Arcade.
- [3] Woodward, S. 2015. Material Culture. In Oxford Bibliographies Online. <https://www.oxfordbibliographies.com/view/document/obo-9780199766567/obo-9780199766567-0085.xml> [Retrieved 20190719].

