

The aesthetics of re-functioning: *The Trons* robot garage band.

Abstract:

The Trons are a Lo-Fi robot-garage-band constructed from discarded and redundant materials, including Meccano, aluminium foil salvaged from food wrappings and automotive solenoids. The central hub of their operation comes from a computer, made obsolete in the mid-nineties, which feeds signals to flimsy materials whose inefficiencies and 'errors' add another layer of processing to the sound. The use of discarded materials as processing agents are discussed in this paper as DiY (Do-it-Yourself) strategies which embrace inefficiency and *error* as active agents in the production of sound. The indeterminate performance of sound, enacted by the Lo-Fi robotics used in *The Trons*, is viewed in this paper as an example of a strategy which emerges from a deep engagement by the practitioner with the materials of construction.

Through an observation of studio practices and interview, material engagement is revealed as a way of generating embodied knowledge, a form of craft practice which situates the DiY practitioner as being entangled within the material environment, with the work evolving as a shared, reciprocal, exchange between human and material.

In this article, material engagement is defined as a two-way process in which practitioners and technological materials form an extended network of agency, displacing the human as the exclusive centre of process.

Keywords: Craft and materials, error and material agency, material engagement, DiY, Do-it-Yourself culture, Lo-Fi craft, re-use, aesthetics of re-functioning.

The aesthetics of re-functioning: *The Trons* robot garage band.

The construction of *The Trons*, a robot garage band made from recycled materials is discussed in this article in terms of a DiY (Do-it-Yourself) ethos of material engagement.

Through re-functioning discarded technologies, DiY practitioners engage in the kinds of 'tinkering methodologies' (Hertz & Parikka, 2012) which define craft as an experimental, process-driven exploration of the engagement between the human and material environment. By engaging with materials and redundant technologies the DiY practitioner explores the possibilities of re-functioning found objects, so that new and often unexpected uses can emerge.

The role of everyday objects in producing meaning through music is a theme explored by Arnold Pacey who looks at 'the way [that] some machines intended to serve more mundane functions take on a musical role' (Pacey, 1999, p.17), to 'interpret the world and give it meaning' (p.17). Pacey identifies the way that technology can be re-functioned to influence the aesthetics of music produced, so that:

The clickety-clack of power looms in cotton mills made Lancashire clog dancers want to tap-dance the pattern of their rhythms [...] The motion of ships has contributed to the lilt of sea shanties, and of trains to boogie-woogie (p.18).

In this way, the characteristics of the material environment exert a form of agency over the aesthetics of the work produced. In the same way, *The Trons* robot garage band, examined in this article, are part of a similar process whereby the aesthetic form of the artwork is influenced by re-configuring the functions of the technologies and materials used. These DiY practices of re-functioning are connected with the idea of upcycling, a craft-based practice of 'reusing an object in a new way without degrading the material it is made from' (Goldsmith, 2009: utilising the material characteristics of discarded objects. In this sense, re-functioning is a craft practice, creating hand-made solutions from readily available and discarded objects and materials: creating a counterpoint to the use of new technology as a means of providing solutions.

The DiY ethos of re-functioning discarded objects is examined in Amy Spencer's depiction of the Do-it-yourself attitude of: 'using whatever resources are available to you [... and] not trying to seek out new technology' (2008, p.187). For Spencer, the re-use of redundant objects is a Lo-Fi practice, 'subverting the term Hi-Fi' (2008, p.14), and questioning the participatory role of new technology by demonstrating what can be done with less complicated resources. This is part of a DiY ethos, as discussed in this article, of disrupting the dominant discourse of new technology as a consumer product. Just as hand-made items go against the flow of mass-produced factory items, the DiY tinkering with technologies and materials discussed in this article also resist the seduction of new technology. This attitude to resist the efficiency of new technology can be seen in the strategy of embracing of the faults and errors of materials: processes involved in the construction of *The Trons* which allow a re-functioning of objects from their original purposes through the inclusion of material agency.



<Figure 1: The DiY robot band *The Trons*, shown in their natural environment of their lounge room (Reprinted with permission from Greg Locke, 2012).>

The Trons are four computerised mechanical ‘robots’ which play ‘live’ music to an audience. They were created by an engineer, Greg Locke, working in a garage-workshop in the small farming town of Hamilton, New Zealand. Since 2008 *The Trons* have played over 80 ‘live’ performances in New Zealand, Australia, Germany, Czech Republic, Singapore and Malaysia. *The Trons* have also influenced a series of robot rock bands, although most of these bands have used the more recent Arduino technology (Flatley, 2009; Hicks, 2011), rather than re-function redundant technologies to allow musical instruments to be played.

Musical instruments and orchestras controlled by mechanical means are not an especially new idea, for example, mechanical barrow organs, pianola mechanical piano players and various fairground organs have been around for over two hundred years. These mechanical orchestras are well documented in books such as David Bowers’ *Encyclopedia of Automatic Musical Instruments* (1972), where the history of music boxes, clockwork musical toys, player pianos and orchestrions can be seen as the origins of the types of craft visible in the processes of *The Trons*. *The Trons* divert from this tradition of mechanical music machines through their practices which are situated in a DiY ethos of re-functioning discarded materials and embracing the simple forms of Garage rock to play original songs, rather than in the mechanical reproduction of well-known or traditional songs.

Other robot bands at the time of writing include the German group *Compressorhead* (Compressorhead, 2016) who play a mechanical form of very fast metal/rock and the Japanese group Z-Machines (Suzuki, 2016). Both of these robot groups involve technologies which are vastly complex, compared to that of *The Trons*, enabling extra non-essential movements of the robots to mimic human musicians. *The Trons* differ to these other robot bands since their approach is from a Lo-Fi craft tradition which places value on the more simplified uses of technology, where the mode of production is made visible through revealing the simple processes of sound production without resorting to overly complex technological solutions. Part of this Lo-Fi strategy of revealing the process is for *The Trons* to minimalise movements to functional operations, rather than to mimic human musicians.

The technology and artistic design of *The Trons* represents a unique configuration drawn from a DiY ethos, with Locke working outside of the technical and financial support of an institution

to produce the world's first self-playing 'Robot Garage band'. According to Amy Spencer, the Garage rock genre is part of a DiY musical movement which originates from similar approaches to music as Skiffle and Punk music, 'usually played on home-made or improvised instruments' (Spencer, 2008, p. 187) and influenced by a similar Lo-Fi engagement with technology. Just as Skiffle and Punk movements before, *The Trons* follow in the DiY tradition of the 'independent', in that, they are the sole product of their own *Pie Plate Records* company, retaining control over the rights of their songs, the methods of distribution and production of recordings, and where and when performances occur.

With *The Trons* there is a continuation of the DiY tradition with home-made Lo-Fi robotics made from recycled materials similar to improvised Skiffle-type instruments. The genre of Garage rock is particularly suited to the use of materials in *The Trons*, since it follows the same attitudes towards the use of Lo-Fi technology as Skiffle music, as stated by Locke in point four of his manifesto:

4. Keep the mechanics simple. The genre is Garage rock where many basic three chord songs with simple drum beats and melodies have been hits. There is no need to have every chord possible (Locke, 2011A).

In the context of *The Trons*, one of the defining aspects of Skiffle music was the ad hoc instrumentation crafted from everyday objects commonly found in the 1950's: the wash-board used as a drum with the player wearing thimbles on each finger tip: the tea-chest bass, made from a broom handle attached to an empty wooden tea box with a string stretched between the two (Spencer, 2008, pp.187-194). In following this same attitude, the mechanical and electronic workings of *The Trons* are crafted from components which are relatively common-place objects, re-purposed and placed within different functional contexts. For example: the out-dated computer used in the workings of *The Trons*, the re-purposed solenoids from cars and the disposable tin pie-plate used for the sound of the snare are all objects of equivalent commonality and ubiquity as the wash-board used in 1950's Skiffle music: situating the home-made Lo-Fi robotics of *The Trons* within the craft tradition of earlier forms of music which utilise the re-functioning of commonly found objects.

Art and craft practices which utilise discarded materials and redundant technologies have recently been described as an engagement with 'Zombie media', signifying the ecological

dangers of discarded electronic e-waste as a significant threats for natural ecologies in the future. The use of 'Zombie media' brings to light the flow of toxins leached into the eco-system when e-waste is dismantled, suggesting that technology never really 'dies' but becomes 'part of a wider pattern of circulation' (Hertz & Parikka, 2012). The re-use of apparently 'dead' media, in this sense, highlights dominant discourses of technology as a disposable commodity, with *The Trons* offering an alternative discourse based on a more sustainable attitude to technology. This alternative discourse of technology follows in the same tradition as Amy Spencer's definition of craft practices in *The Crafter culture handbook* as: 'a practical and political reaction against consumerism[...] concerned with the modes of production' (2007, p.9): presented in this article as the DiY/craft ethos which drives the practices and processes of *The Trons*.

In the following section I will examine creative processes which engage with the material agency of objects and the way in which the aesthetic form of the artwork is influenced through these processes, a line of investigation similar to Arnold Pacey, when he says:

If we wish to understand what technology means to those who invent, tinker with, build, or just use its products, we must investigate how the aesthetic is intertwined with the practical; how the giving of meaning is related to building and making (Pacey, 1999. p.18).

By examining the craft practices the craft processes of *The Trons*, the suggestion is that the aesthetic and the practical are 'intertwined' through the DiY processes of re-functioning, revealing material agency as a significant factor in the craft process.

Aesthetics of re-functioning

An important aesthetic element of *The Trons*, is the re-use and re-purposing of discarded materials. Locke's use of 'garbage' can be seen in the re-functioning of the aluminium pie-dish in the 'records' released by *The Trons*, as seen in Figure 2 below:



<Figure 2: Lathe-cut record of 'Sister Robot' using a discarded aluminium pie-dish (adapted with permission from Greg Locke, 2008).>

The grooves of the record have been cut into the aluminium of the pie-dish using an antique vinyl lathe-cut machine by Locke's own 'pie-plate records'. The copy of the record I have is playable, although it is advised that the sound does deteriorate after several plays. By recycling materials from garbage, Locke is engaging with characteristics of the material of the pie-plate, allowing the re-functional potential of the material as discarded matter.



<Figure 3: Still image from the video *The Trons' Theme* (image by author, 2008).>

The above image, Figure 3, is taken from a music video of the song *The Trons' Theme*, showing some of the aesthetic style which emerges from the functionality of the mechanical processes used to generate music. *The Trons' Theme* was the first music video made as a collaboration between the researcher and Locke in 2008. The video was to allow the viewers more detailed close-up shots of the mechanics of *The Trons* to provide concrete evidence that they were actually playing their instruments rather than miming to the song. From the above image it is evident that the appearance and form of *The Trons* is heavily influenced by functionality, so that mechanical processes become visibly incorporated into the aesthetic. For the practitioner it is an important part of the aesthetic that every component of *The Trons* is functional:

The horn is an interesting visual piece but it actually does sing out of it... it's actually got a purpose... it's actually for real, that's where the sound is coming from, and it's being... open... transparent... it's being honest, presenting everything [that is actually] there (Locke 07 December 2012 interview).

The strategy of revealing the mechanics behind the making of sound is central to Locke's design of the appearance of *The Trons*, indicating the importance of functionality over form when he says: 'it's not just for aesthetics it's actually got a purpose... it's actually for real, that's where the sound is coming from' (Locke 07 December 2012 interview). In this sense, the process of material engagement determines the material form of *The Trons*: the functioning of materials is an active agent in determining the specific *configuration* of *The Trons*.



<Figure 4: Still image from *The Trons*' theme music video (image by author, 2008).>

Figure 4 shows the Meccano 'fingers' of the keyboard player. In this image one can see the mechanics of the car solenoids connected to the levers of the fingers which play the keyboard. For me, the Meccano and the visibility of the connecting cables creates an impression of a transparency of mechanical operation: a prototype construction which reveals the re-functional potential through the contingent, unfinished appearance of the mechanical fingers. Rather than present a finished product, the malleable prototype qualities suggest an approach to technology which remains open to alteration.

The visible processes of the prototype is a central theme of Locke's, when he says: 'I sort of gave myself a rule that every action has got a musical reason for it [...] that each movement is related to [...] where the sound is coming from' (Locke 07 December 2012 interview), meaning that the appearance and movements of *The Trons* are directly linked to functionality. This placing of functionality as a central agent is also stated in number eight of Locke's Trons manifesto: 'All movements of the band must be functional, directly making or modifying the sounds' (Locke, 2011A), suggesting that the form of the material configuration (the aesthetic appearance of *The Trons*) emerges from some aspect of Locke's engagement with functionality and materials.

In terms of materials affecting the eventual appearance of the crafted artefact, there are reasons for the inevitable anthropomorphic shape driven by the form of the technologies used, as Locke states:

The robots weren't the aim [...] the anthropomorphation (sic) just comes automatically, because the instruments are made for people to play them, so when you design the mechanics to play the instruments they almost, sort of, take on a human looking form anyway because they were designed [for fingers] (Locke 07 December 2012 interview).

In this sense, the configuration of *The Trons* is determined by the shape necessary to hold the guitar and also that some form of mechanical 'fingers' are required as interfaces between the machine and the musical instrument. This displays a form of indirect material agency, in which the materials of the instruments drive the appearance of the machines to play them: indirectly because human form intervenes as an agent involved in the shaping of the musical instruments for whom they were originally intended to be played by.

A similar aesthetic appearance, where the process is utilised as a visible element, are Jean Tinguely's automatic music machines which are mechanical sculptures made from everyday materials such as bicycle wheels, bath-tubs and industrial waste. Tinguely's 'self-destructing machines', seen in the 1960 performance *Homage to New York* and known as 'sabotage technology' (Tinguely, 2016) also employ similar processes of using error and malfunction as *The Trons*: both makers utilising the failure of mechanical processes as part of the aesthetic, so that material agency becomes involved in the artwork. Accident and 'hazard' in Tinguely's

works can be seen in the 'drawing machines [which] produce abstract sketches whose parameters are partly determined by the machine [... in which] details are the product of hazard' (Museum Tinguely, 2016). Locke visited the Jean Tinguely museum in Basil in 2008 but has been recognised for many years as an influence on the construction of *The Trons*. Locke's version of 'hazard' is the use of *error* as an active component of the robots, error defined here as a diversion from exclusively human intention.

Error and material agency

A person who works with a machine quickly gets to know its characteristic sounds and takes unusual notes or rhythms as a warning of malfunction (Pacey, 1999 p.23).

Rather than attempt to fix 'unusual notes or rhythms', part of Locke's craft practice is situated in the relationship between the human practitioner and the re-functioning of 'characteristic sounds [...] of malfunction' into valuable aspects of the sound.



<Figure 5: Pie-plate used as part of the drum sound (adapted with permission from Greg Locke, 2011).>

Figure 5 shows the bass kick-drum of *The Trons*. The sticks on the left side of the drum are made to move via the Meccano mechanism situated on the rim of the drum. One stick hits the bass drum whilst the other strikes the crumpled tin pie-plate which has been attached to the skin of the drum, seen in the image above as the large silver disk above the lettering. The sound of the pie-plate being struck produces a rattling treble sound similar to a snare drum. However, in practice, the fragility of the pie-plate causes the aluminium to distort and flex with each strike, exploiting the uncontrollable nature of the material being used so that, as Greg Locke says: ‘the randomness [comes] from the sticks not always hitting it correctly [... it] means that every time they hit [the sound is] slightly different’ (Locke 07 December 2012 interview). In this way, the material characteristics of the pie-plate, in the form of error, are given agency and incorporated as part of a process to generate variations in sound.

Integrating errors into the process suggests that materials are permitted an active role in the emerging sound of *The Trons*, indicating that agency is extended from the human practitioner to include the agency of the material environment. *Error* in this sense, means a diversion from an exclusively human source of agency, suggesting that the artefacts emerge from a material engagement acknowledging the dynamic processes which occurs between the craftsperson and the material environment.

Lambros Malafouris uses the example of the potter's wheel to explain agency as a dynamic negotiation between the human and the nonhuman, so that intention is linked inextricably with action:

Agency is not a matter of private thought and imagination but of actual practice and being-in-the-world... if an association between agency and intentionality can be made, it has to be with the type of intentionality here called 'intention-in-action' (2008, p.30).

This means that agency is more than just exclusively human intention, but instead, exists in practices and action so that, 'for example, an agent may act differently or even in a manner contradictory to his prior intentions' (Malafouris, 2008, p.30). In this fashion, the potter works with the material of the clay as a collaborative exchange of intention and practice.

For Malafouris, agency is neither a human or nonhuman quality, but lies in the 'grey zone' *between* the human and the material:

There is no way that human and material agency can be disentangled. Or else, while agency and intentionality may not be properties of things, they are not properties of humans either: they are the properties of material engagement, that is, of the grey zone where brain, body and culture conflate (Malafouris, 2008, p.22).

Material engagement is therefore more than the human engaging with the nonhuman material but instead a two-way process, where the human is entangled with the materials they work with and agency emerges from the configuration of human and material.

Levi R. Bryant has a similar example of agency existing as a material engagement, in which the sculptor's intentions are located within the action of 'encountering' the material (2014, p.50).

The action of sculpting becomes situated as a negotiation between the intention of the human sculpture and the 'wants' of the material:

Take the sculptor working with marble. They might begin with a vague idea of what they want the marble to become and even select specific pieces of marble to execute this local manifestation, yet as they begin to work the marble, encountering its grain and veins, they'll talk about how the marble 'wants' to become something else (Bryant, 2014, p.50).

Here Bryant is suggesting the same 'intention-in-action' (Malafouris, 2008, p.30) as Malafouris' example of the potter and the wheel, where intention is something negotiated between the sculptor and the material of the marble. However, Bryant goes further in saying that the 'marble "wants" to become something else', suggesting a closer material engagement than 'intention-in-action' and indicating a stronger sense of material agency.

This example of the sculptor and the marble is applicable to the creative strategies of Locke, as an involvement of material characteristics which opens the participatory potential of materials to the creative process. In some sense, this means that Locke, too, is displaced as the primary controller of *The Trons*, allowing materiality, *error* and indeterminacy a space within the process, as Locke says of the role of *error* and indeterminacy:

I'm not going to fix that, because... well, that's part of what's going on, and [...] because a lot of times I can't actually [fix it], it's more subtle than you actually hear [...] actually the mistakes are the good parts. I don't want to improve it because I know that often the mistakes sound better than what I was thinking of (Locke 07 December 2012 interview).

For Locke, the 'mistakes' caused by material *error* become 'the good parts' of *The Trons* sound, outcomes that demonstrate the material engagement aspects of the process are something which was not originally intended: 'the mistakes sound better than what I was thinking of'. This implies that Locke's process involves material engagement as Malafouris' 'intention-in-action' (2008, p.30), where agency results from the interactions between human practitioner and nonhuman materials. Furthering the argument that *The Trons* are a result of material engagement is Locke's point that the sound is a result of 'subtle' qualities which are beyond his control, suggesting that the complex functioning of the material is something which exerts its own agency in combination to his own contribution.

This represents an example of DiY engagement with materials or an extended agency which is more enacted than a purely human intention, as Locke identifies:

I soon realised there were many things happening that I hadn't programmed. What's more, often these were the things that sounded the most interesting (Locke, 2011, p.9).

Through incorporating material agency, the complex operations of *The Trons* becomes something which is an emergent function resulting from the characteristics of the materials rather than something that is completely under the control of its human creator. Locke becomes another machine component within the complex assemblage, rather than a central figure controlling agency, as reflected by Locke when he describes the deviation from human intention which occurs when he allows *error* to be part of the building process:

In fact, it was as if the worse I built the machines, the better they sounded. Investigating this revealed that the irregular inaccurate movements were introducing another layer of semi - random sounds over the top of the desired ones. The band was producing its own rhythms and colouring (Locke, 2011, p.10).

This incorporation of *error* means that the 'worse' Locke builds the machines the 'better' they sound, meaning that human intention was only one part of the complex assemblage comprising *The Trons*. Therefore, Locke's practice becomes an engagement with materials in which participation between human and nonhuman actants becomes integral to the functioning of the group. Following this line of thought, *The Trons* becomes a musical group comprised of human and nonhuman agents, co-creating together, so that 'the band was producing its own rhythms and colouring' (Locke, 2011, p.10), semi-independently from Locke's agency.

With this in mind it is now possible to view *The Trons* as an artefact which emerges from material engagement – so that the aesthetic form of *The Trons* is an enactment, or embodiment, of material and human forces.

Craft and materials



<Figure 6: Construction of the Meccano fingers of Fifi, the keyboard player (reprinted with permission from Greg Locke, 2007).>

Locke's choice of materials used in the construction of *The Trons* is influenced, in some part, by the characteristics and expression of material agency. This has initially been viewed in terms of the affect of re-functioning on the aesthetic form, whereby materials and their functioning change the appearance of *The Trons*. In this section the *error* of materials is viewed as an integral part of the process to produce sound.

This can be seen in Locke's practical approach in employing material *error* as part of the ingrained process involving material agency:

I initially built them using whatever I had lying around, expecting to have to build them really well for it to work ok, but realising that the crappy build was actually better... the crappy build seemed to work well and so now I purposefully don't build them good... [I just add] more tolerance.

For Locke, the 'crappy build' which Meccano produces is 'crappy' because of the high degree of 'tolerance', meaning that it is not a material which lends itself easily to accurate and precise mechanical operations. So, whilst Locke expected that *The Trons* would have to be re-built using higher engineering tolerances, it was a 'happy accident' (Locke, 2011) which allowed the 'crappy [Lo-Fi] build' to be the better option. This meant that the 'crappy build' was more effective than a precise engineering based on purely human intention, and that there is a particular characteristic of the wider tolerances, or looseness of construction, which diverts

human intention to create something that 'was actually better'. By viewing the 'crappy build' of Meccano as engaging with material characteristics, *error* is defined in this article as a 'diversion from human intention'.

Rather than precision crafted by professional engineers, the *error* characteristics of Meccano construction and its inability to accurately replicate repetitive movements are what interests Locke:

That's why I thought Meccano is good to try, it turned out to be really good because it had the right level of flexibility, of, you know, *error* in the pivots and bearings, there's no bearings, you know, so things just rotate really loosely... I think trying to rebuild it anyway more perfect, might not necessarily make it any more better anyway, I actually think it could make it worse.

This engagement with the *error* characteristics of Meccano, displays a material engagement between Locke and the multitude of actants involved in producing the error. In this sense, the indeterminate '*error* in the pivots' and the 'flexibility' of materials reciprocate to alter the function of the material assemblage of the mechanisms playing the instrument. This form of material agency is the particular function of Meccano which would be impossible to replicate if the mechanisms were 'progressed' from hand-made prototype to fully engineered product. This indeterminate function of the Meccano machine is a specific operation which forms an integral part of the processes involved in the functioning of *The Trons*, so much so, that the materials become an active participant in the process.

This use of *error* came as a surprise for Locke who, given his engineering background, was more accustomed to reducing *error* through accuracy to gain better, more efficient results:

They are quite inaccurate, and they are flimsy, so they are not always doing exactly the same every time, so there's vibrations and play in the sort of, in the pivoting parts, which means that every time they hit the keys or snare or strum the guitar its slightly different.

These slight differences of timing, which occur through the hand-made approach, are of value to Locke who, as an accomplished musician, recognises the expressive qualities of flexible timing to add a unique material agency to the sound.

The combining of material and digital technologies is used to Locke's advantage, in that, he is utilising aspects of the qualities of materials to allow small 'inefficiencies':

I'm embracing the inefficiencies, which I didn't expect to do, to start with, I thought everything would have to be perfectly made... but it turns out that having things a bit wrong... is good.

Through allowing material agency to divert from an efficient, exclusively human oriented idea of agency, Locke has discovered that 'perfectly made' machines produce less interesting sounds than allowing 'things [to be] a bit wrong'. This embracing of material *error* and 'inefficiencies' is a process in which the precision of the digital computer is influenced by a material engagement to create an output which would be difficult to obtain through a purely digital means. This combination of analogue and digital technologies creates a complex assemblage which incorporate *error* and 'indeterminacy' into the production of sound, in much the same way that Skiffle bands of an earlier era incorporated everyday objects to influence the production of sounds which were not within the repertoire of conventional instruments.

Conclusions

The processes of re-functioning in *The Trons* can be seen as both craft aesthetic and DiY ethos: an attitude towards the malleability of function which transforms the functions of everyday objects: the aluminium pie-plate into a snare drum; the tape-deck into an amplifier; a public address amplifier horn for the functional head of the 'singer'; stands made from recycled square tubing; broken discarded microphones for the head of the guitar playing robot; a broken speaker cone for the head of the drummer; and the car solenoid into a robotic component. Each of these materials have been re-functioned from their original design intention to the new functionality which emerges through inclusion of the material into the assemblage of *The Trons*. Material agency, in this way, transforms the functions of the object through their engagement with other materials within the structure of *The Trons*. Material agency, in this sense, emerges from the complex engagement between human and materials through which the form of *The Trons* is expressed.

This type of material engagement means, therefore, that the human is only part of the agency involved in DiY practices. Within this DiY ethos of material engagement, the importance of the material environment increases in value, until it is more evenly matched with the importance conferred on the human. This situates the human as an element within the material environment, neither human nor nonhuman controlling from a central position, and suggests that practices such as these represent a craft paradigm of generating knowledge from the engagement between human and material environment: a philosophical attitude which implies a re-situating of human and material values, challenging the dominant discourses of technology as a disposable commodity.

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