



Deposited via The University of Leeds.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/132723/>

Version: Accepted Version

Article:

Stones, C (2019) Putting the 'me' in mechanical: lessons from the mechanical men of health 1928–1948. *Medical Humanities*, 45 (4). pp. 361-370. ISSN: 1468-215X

<https://doi.org/10.1136/medhum-2018-011453>

© Author(s) (or their employer(s)) 2019. No commercial re-use. See rights and permissions. Published by BMJ. This manuscript version is made available under the CC BY-NC 4.0 license <https://creativecommons.org/licenses/by-nc/4.0/>

Reuse

This article is distributed under the terms of the Creative Commons Attribution-NonCommercial (CC BY-NC) licence. This licence allows you to remix, tweak, and build upon this work non-commercially, and any new works must also acknowledge the authors and be non-commercial. You don't have to license any derivative works on the same terms. More information and the full terms of the licence here: <https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

Putting the 'me' in Mechanical: Lessons from the Mechanical Men of Health 1928-1948.

ABSTRACT

During the interwar years health exhibitions and pavilions were commonplace in Europe and the U.S. Within these exhibitions were a small number of life-sized or over-sized mechanical men used to represent physiological processes. Though they received significant press attention at the time, little academic analysis exists to-date. These mechanical men, I argue, all provide important insights regarding the way design could be used to heighten the appeal of physiology and crucially, in the formation of a new term - the Accessible Body.

Firstly, this study re-introduces three mechanical men of health to an academic audience, identifying provenance and unearthing key details of their performance and visual appearance. I argue that there is much to be gained by their analysis in comparison to the more notorious body representations that they orbited. Through detailed analysis of their forms, the three mechanical men are shown to challenge the dominant notions of the Ideal Body and Fordist Body embodied in the Dresden Transparent Man (1930) and 'Der Mensch als Industriepalast' (1926) respectively. The study examines and classifies these mechanical men as a new type of body – the Accessible Body. This term refers to representations that embody a sense of consciousness, the re-appropriation of popular culture and engagement with humour and visual appeal.

The study concludes with discussion about the Accessible Body in contemporary health education. What tropes and approaches may remain significant today? By leaning on contemporary thinking about linguistic rather than visual metaphors in health this study concludes with provocations for the alignment of other appropriate metaphors within a mechanical man and Accessible Body framework. Ultimately I call for a re-shifting of man/machine visual metaphors as a means of re-engaging the audience today.

INTRODUCTION

During the first half of the twentieth century a plethora of health exhibitions were displayed throughout Europe and the U.S.[1-5]. The interwar years, in particular, saw a range of commercial and governmental interventions designed to improve the health of its people, driven by the need for a strong workforce and healthy society. There was an enormous economic investment ploughed into exhibitions and fairs in the interwar years, particularly in the UK, Germany and the U.S.[6]. The rise of modernism, and its attempts to optimistically rebuild society through new architecture, design and new health discourses, was also vital in shaping attitudes to health education and representations of healthy bodies[7]. This was particularly the case in Germany and Central Europe. Within 1920s Britain a shift from infectious to chronic disease and the perceived need to promote personal action in response to public health issues saw a rise in new health-focused councils and societies (such as the Health and Cleanliness Council[8], the Central Council for Health Education[9] and The New Health Society[10]). Health education aimed at the lay audience became more widespread during the Interwar years with the proliferation of health-related publications, films and exhibitions[9,10].

The general visual richness and pervasiveness of the health exhibitions during this period have been well documented and discussed[1,2,6,11,12]. Less analysed in detail, are the three dimensional, life-sized or over-sized animated men that populated the exhibition space alongside the visitors.

This paper examines how these mechanical figures were used to represent physiology in the interwar years, identifying their provenance and how were they received in the popular press. Three mechanical men were identified as a basis for new academic analysis and discussion. They were identified as follows: Rupert (1928-1930, UK), who was most prominently shown at the Schoolboys Exhibition in 1928 and 1929, The Marvellous Mechanical Man (1933, USA), shown during the Chicago World Fair, and Godfrey (1938-1948, UK) who was displayed at various exhibitions in the UK and the New York World's Fair. All three mechanical men were designed to be viewed by a lay audience (given the non-specialist nature of the exhibitions in

which they were displayed) and were designed to communicate the workings of the human body with particular foci on digestion, nerves and the brain. They were also designed to promote healthy diet and exercise, in line with health education at the time more broadly[9,10]. They were selected for study due to the significant press coverage they received during their display, their shared performativity and their classification within popular texts as 'mechanical men' of health education. The three exhibited mechanical figures were classified and named as male by the organisers and journalists of the period, thus establishing the male dynamic body as the norm, in this particular genre at least.

The central argument in this paper is that an alternative approach to representing physiology emerges from the study of these three mechanical men, beyond the already recognised tropes outlined below. Through detailed description and subsequent analysis of their forms, it is argued that the three mechanical men offer a new type of body image from the interwar years for the scholar to consider afresh – the Accessible Body.

The Ideal and the Fordist Body

In order to understand how the conceptual representation of the exhibition body is extended by the three mechanical men, it is vital to first outline the mechanical men's more renowned contemporaries. There were two notable and dominant physical models of the body displayed during the interwar years in Europe and the USA: The Dresden Transparent Man (1930) and Fritz Kahn's large scale image 'Der Mensch als Industriepalast' (illustration (1926) and mechanical model (1935)). Scholars recognise these models as significant visual representations in twentieth century health communication[2,5,11,12,13,14,15] and the works' dominant body-tropes are easily identified from other scholar's interpretation. These tropes are identified here as the Ideal Body and the Fordist body.

The emergence of the Ideal Body in mechanical health exhibitions can be attributed to the International Hygiene Exhibition in Dresden, Germany in 1911[11]. The healthy body as an ideal visual form was not a new trope – see, for example, the muscular perfection evident in drawings published within Giulio Cesare Cassari's anatomical treatise of 1627. In Dresden however, health exhibitions began to feature more novel and accessible displays whilst, importantly, simultaneously striving for sanitised perfection. The transparent organs that were displayed in the 'Man' section of the International Hygiene Exhibition were particularly influential. Whilst no entire 'man' was visible, the array of smaller compartmentalised movable body models, set in neat rectangular frames, were setting the standard in engaging health displays[4]. Vogel describes these developments in the following terms: "These novel processes and models offered the layperson a means of understanding the interior of the human body. They were the antithesis of the anatomy room, which had a tendency to affect the senses more than the intellect. Free of bodily, sensual and transient emotions, these carefully designed models bore witness to a faith in the possibility of attaining a state of health and well-being"[11]. Vogel positions these early exhibits as offering aspiration to the viewer, partly through their perfectly preserved and aesthetic sensibilities, and inevitably the removal of the 'flesh'[11].

A breakthrough in terms of the application of transparency was evident in the display of a full Transparent Man in 1930, at the Deutsches Hygiene Museum. This life sized exhibit was formed from transparent plastic that enabled the encasing of a real human skeleton with casts of veins and arteries on display. The result was a dramatic celebration of man, without obvious metaphor. Though the transparent man didn't move, as such, he was electronically driven, using light timers and sound to bring the body to life.

The Dresden Transparent Man (DTM) represents an Ideal Body – unblemished through sophisticated modelling techniques and perfectly proportioned internally and externally. What made the DTM particularly idealistic was its reference to an iconic image from the past. The DTM was based on the statue 'Praying Boy' created by Boedas, son of Lysippus, 400 B.C. which was more than 2,000 years old[16]. The DTM's arms were widened and head raised to heighten drama. Its form created a tension between biological fact, religious fervour and political discourse given its objective rendering of the internal body, subjective gesturing and subsequent alignment with the Eugenics movement of the Nazi regime[17].

The rhetoric that accompanied the DTM at the time was celebratory in nature highlighting the wonder of man. In an account of its display at the 1935 Health Exposition in Berlin, Kleinschmit[18], an American author, described the transparent man's display within a special room as a "a sanctuary" whereby the viewer can appreciate "the sheer beauty of the human body". The figure was also accompanied by a quotation by St Augustine claiming that of all the wonders of the world, man is the most wonderful[12]. Today as then, it physically remains, thanks to its transparency and perfect proportions, untouched by its time aesthetically. It is form robbed of fashion. It is also, to some extent, a highly veristic body, though sanitised and indeed romanticised through use of colour and dramatic lighting. Due to its evocative form it was commissioned repeated across the world and it is still on show in various locations today.

As an alternative to the Ideal Body, a Fordist Body, was embodied in 'Der Mensch als Industriepalast' (1926), a notable image of physiology also from Germany. In 1926 Fritz Kahn published an almost life-sized poster of 'Der Mensch als Industriepalast' (known subsequently here as 'Der Mensch') as a supplement to the final volume of this book series 'Das Leben des Menschen'. It was designed by Fritz Schüller[5,14]. Kahn's previous books featured varied visual metaphors and styles for representing physiological processes[5,14]. 'Der Mensch' however presented a large-scale and unified vision of the machine body. Its novelty stemmed from an immaculate visual rendering of the staged action of miniature people (or homunculus [5]) operating machinery within the body. Man ultimately remains at the centre of the image, positioned as creator of the machine-parts that, in turn, creates the body machine. See Sappol [5] for more on this particular paradox. The version of 'Der Mensch' from 1926 would be widely reproduced, translated and commercially available from the early 1930s. A second version, a commercially available wall chart of 'Der Mensch', (1928) designed by Ottomar Trester [14] was much simplified, presumably for more public display. For the purposes of this study, the original version from 1926 will be used for later analysis since this was most likely of larger influence given its translation.

'Der Mensch' stands as an exemplary example of a Fordist Body, to use Emily Martin's term[19]. Though Martin[19,20] herself never applied the Fordist Body term to 'Der Mensch' it is difficult to imagine a more visual pre-cursor of Martin's term. The Fordist Body was defined by Martin as a body whose organisation was based "around principles of centralized control and factory-based production"[19]. She argued that the positioning of the body as one that aimed to produce a standardised product (him/herself) through the use of standardised parts and processes was ethically problematic in the late twentieth century. The label of the image itself - "Man as Industrial Palace" or 'The Human Factory (in the English Translated Version, 1931)' reflects a Fordist origin and the careful construction of the factory (or chemical plant) ensures that every vital 'station' is manned and monitored. Sappol[5] also clearly makes a connection between the positioning of factory work at the time and how this image would be viewed as affording a utopian vision of the body in Germany. Reflecting the Fordist ideal – the utopian vision of efficiency – Sappol[5] observes how Kahn's image is a highly idealised version of the factory avoiding an suggestion of potential accident, grime, grease or the stench manifest in the harsh realities of factory life. This sanitisation could be very much seen as echoing the efficient factory metaphor applied to the digestive system by Pavlov in 1894 [21]. This Fordist Body is a form of Body Ideal, but one very much situated in a particular time and place (the post-World War One Weimar Republic).

These two well-known and well-discussed visual models of physiology represent two key visual tropes. On the one hand, the DTM aligns the brightly lit internal organs and upward posture of the body to notions of perfection, wonder and aspiration from a heavenly source. On the other, 'Der Mensch' likens the body to a factory of efficient production. These two bodies have excited scholars partly due to their political and social resonance though I argue, in the following paper, that there are equally novel, relevant though hitherto neglected mechanical men that orbited DTM and 'Der Mensch' that offer a further body trope.

Analytical Context and Structure

This study is very much situated within the field of Material Culture. The underpinning premise of Material Culture is that objects reflect, consciously or unconsciously, directly or indirectly,

Figure 1. Illustration of Rupert the Mechanical Man, 1928 © Illustrated London News Ltd/Mary Evans

Rupert was first displayed between December 29th 1928 to January 5th 1929 at the Schoolboy's Exhibition at the New Horticultural Hall in London (see Figure 1) [25]. A second version, with slightly altered innards, Rupert II was shown in the same exhibition the following year from December 1929 to January 1930[26].

The Schoolboy's Exhibition (also known as the Schoolboy's Own Exhibition) was a regular exhibition that focused on educating boys about science and technology and broader topics such as sport and leisure[27]. The exhibition was designed for the "interest and amusement" of boys aged 6-18[28] and existed for several decades into the 1960s, with various title changes. It was a significant educational event for British children, was well documented by news agencies such as British Pathe and later would tour to other major cities in the UK. Cecil Stratham Schofield, the organiser of the exhibition, described Rupert as an attempt to express physiology in a way that boys are familiar with – the steam engine[29]. As such the exhibit represented an early attempt at implementing a tailored and novel health communication method specifically for children.

The exhibit itself consisted of a steel outer shell that had the appearance of a primitive robot featuring rectangular eyes, mouth and frame rejecting, in entirety, the rhetoric of the flesh. A hinged door situated within the chest revealed a set of mechanisms that mimicked (albeit crudely) a human body at work[30]. A pump worked two 'lungs' that moved up and down, which in turn, triggered mechanical action throughout the chest region[31]. The exhibit experience consisted of a brief introduction and a demonstration performed by Major RM Cartwright[29]. Despite press photographs at the time suggesting that schoolboys themselves could operate or be close to the robot[32,33], Rupert was designed to be demonstrated behind a barrier. Externally the robot had a crude appearance with little detail, though inside, the chest moved at great pace with many moving parts. British Pathe footage[34] reveals a frenetic and somewhat chaotic sight.

The vivid representation of nerve functionality must have appeared particularly novel. An article in the Observer newspaper outlines its functions - "Then to explain the system of nervous energy and muscles, the demonstration will show how the brain acts. Every action is initiated in the brain, as the Robot will illustrate. A plug in the switchboard of the brain will be placed in the right spot, and the arm or the leg will be automatically lifted by an elaborate network of cables and pulleys"[25]. Through physical interaction with the model the demonstrator therefore was able to describe a range of physiological processes to the audiences.

There is also evidence to suggest that the robot demonstrated not only physiological principles alone. Much of the coverage of Rupert stated that both biological information and health information were combined, claiming that the robot could help people to learn about looking after their health. An article in the Observer stated that Rupert was "contrived with the object of making young men and boys interested in keeping their bodies clean and fit, and showing them how easy it can be both to upset the delicate mechanism of the human frame and to maintain it in good working order"[25]. Another article reported how the machine helped boys understand how should "look after their fitness"[30] though it is unclear how implicitly or explicitly this was undertaken.

Horlicks, a UK-based drinks manufacturer, displayed the robot on their exhibition stand[34] and released details of its appearance and functionality to the press prior to the opening event[35], attended by Lord Baden Powell[34], leader of the British Scout movement and a significant figure in Britain at the time. Horlicks were regular exhibitors at a number of public exhibitions in Britain and often aligned their product with health benefits in print advertisements including the enhancement of sleep and digestion[36]. Tellingly, the digestive focus of Rupert became widely reported. One article, for example, stated "it is from the stomach that we derive our energy"[37]. Thus Rupert's commercial and educational functions were subtly intertwined. The placement of product promotion within health education material was commonplace during this period in Britain. Exhibitions organized in 1928 and 1929 by the New Health Society for instance featured many commercial stands by the likes of Hovis bread and Grape Nuts breakfast cereal[10] and many food manufacturers were aligning their

products with health benefits (also see Welshman's[9] account of the 1927 'Better Health' Magazine and the advertising claims for a wide range of food products).

In April 1929, a Popular Science article reported that the robot was made by schoolboys[38]. Given the complexity of the mechanism it seems unlikely that the boys themselves were the initial designers of the system and if it was made by them, it is likely to have been made under the direction of a mechanical engineer or someone with high technical expertise. A close-up image[30] of the robot reveals a multitude of parts and a complex system design. The inventor of Rupert was cited in only one British news article[39] as Mr W. Russell, described as a 'modest young man'. Further information regarding Russell remains elusive with no reference to the robot or the inventor located in the Horlicks archive.

Rupert was displayed in London just months after the debut of Britain's first and most famous robot, Eric, was unveiled at the same venue. Rupert, given his didactic nature and mostly young audience at the time, was somewhat overshadowed by Eric in terms of press coverage and future 'career' (Eric toured the U.S. in 1929 and was recently remade for an exhibition in the Science Museum, London, 2017). In an article in Modern Mechanix magazine[37], the two robots were confused together with Rupert being misidentified as Eric. This has, in turn, led to subsequent misunderstandings within other texts (see[3] for an example of mistaken identity).

The robot appeared to be a flexible exhibit that could reflect a range of interests including Sheffield steel, health, or Horlicks promotion to a wider audience than school children. Rupert II appeared at further UK venues in Sheffield (Sheffield Week)[40,41], Horsham (Horsham Health Week)[42] and Kingston (World Fair of Domestic Aids and Appliances)[43] in 1930. These local shows occurred in commercial properties such as large department stores (e.g. Bentalls of Kingston-upon-Thames) or shop windows (in Horsham). Press articles at the time have necessary diverse emphasis. The article for the Horsham Health Week[42] provides extensive descriptions of the health analogies found within the exhibit. In contrast, the article to promote the display at Kingston[40] underplays any health content, instead choosing to promote the experience of viewing the robot (accompanied by a robot line-drawing *without* his insides displayed) and the promise of a free Horlicks drink for attending.

Rupert received positive regional, national and international press coverage at the time[25-27, 29-35, 37, 39-45]. His novelty aided impact beyond the exhibition hall and he was one of the most reported aspects of the exhibition as a whole, described as a "Wonderful Steel Robot"[45]. Most notably, Rupert was featured in a full-page illustration that accompanied his launch in 1928. The illustration of the robot, drawn by GH Davies, was featured in the Illustrated London News[35] on December 22nd 1928 (see Figure 1). GH Davis was an illustrator best known for his cut away illustrations for the Illustrated London News. He was by no means a conceptual illustrator and the illustration appears to be very much based upon descriptions and a photograph of Rupert provided by Horlicks[35]. The Illustrated London News described Rupert as "one of the most novel exhibits"[35] and thus the robot acted as a useful promotional vehicle for the exhibition as a whole. Rupert's breadth of press coverage demonstrated the potency of presenting physiology in a robot form at the time.

Vitality, the illustration was also known to Fritz Kahn in Germany, having been located in Kahn's personal archive of documents[46]. As author of 'Der Mensch' and a significant figure in medical education and visual communication during the interwar years, Kahn's interest was likely due to the overall conceptual resemblance of the two pieces as well as the notable addition of the third dimension and its reference to a fully functional machine. It is not currently known however whether Kahn visited the Schoolboy's Exhibition in London or whether any further contact was made with either the illustrator GH Davis or the inventor but it provides a rationale of why the two 'images' can be very much viewed together. They not only share a similarity of analogies but they are also bound by publicity shared between London and Germany in 1928[35]. In 1935, a model directly based on 'Der Mensch' with moveable parts and lights was shown at the Hall of Man at the Buffalo Museum of Science[5]. Moving pistons simulated the action of the heart combining the concepts of Kahn in three dimensions with clear echoes of Rupert's physical mechanisms. This further increases Rupert's significance more broadly and invites subsequent further analysis of the robot from a Kahnian perspective later in this paper.

B. The Marvellous Mechanical Man (MMM), Chicago World Fair, (1933)

The second newsworthy mechanical man to represent physiology was displayed in 1933 at the Chicago World Fair (in the Chemistry Section of the Hall of Science)[47,48]. This fair also witnessed the American debut of the famous DTM and the Deutsches Hygiene Museum provided several exhibits to the Hall of Science[47]. According to the Chicago Tribune[49] the man was known as the “marvelous mechanical man” (MMM). No human nomenclature was attributed in this case. Described as a “lecturing and animated robot” it was 10 foot tall and made of metal[50]. In terms of provenance it was reported to be made by German scientists “who were not inclined to talk about their handiwork”[49] suggesting that the Deutsches Hygiene Museum team may well have been responsible for its construction though this requires further corroboration.

The robot would ‘speak’ for 20 minutes, relaying information on digestive processes. Its functionality consisted of speech, the movement of the head, lips and of four-foot-long arms. Its most novel feature though was an animation projected on the body itself, in the position where the organs would be found[50]. The robot would point to its projected organs as it spoke[48,51]. It began the demonstration by pointing at elements around itself and then gestured as if eating. The projection would then display the food being digested via an animated display on this chest in full view of a seated audience. An illustration from Popular Science vividly highlights this functionality, revealing the back light of the projector and an audience[48] staring upwardly in wonder. Like Rupert, the MMM presented a spectacle of the body, by exploiting movement and robotic functionality. Also, like Rupert, the MMM was reported not just to highlight how the body worked but how the audience may care for their body. The MMM was surrounded by food items labelled with their vitamin content, chemical constituents and beneficial properties. Logan Clendening described the robot as being a complete demonstration of both digestion and nutrition including dietetics[52].

The MMM received significant attention and praise at the time. Eben James Carey (an American Anatomist who developed some of the exhibits on show) estimated visitors to the Hall of Science numbered 19 million people and a photograph of the visitors to the robot lecture[47] shows a large room of adult men and women mostly filled to capacity. In this document Carey visually juxtaposed this image of the lecturing robot with a strikingly similar photograph of crowds around the Dresden Transparent Man on the same page. In a promotional leaflet the robot was listed as a No.6 highlight amongst hundreds of exhibits[53]. Similarly the doctor-journalist Dr Logan Clendening, writing in 1933, described how “the [man] most advertised is the least interesting” (referring to the Dresden Transparent Man) and continues to lavish praise on the new robot – calling it “vivid and a complete lesson in the physiology of digestion”[52]. He describes how the lecture room was crowded every time he attended. Muskat [51], a visitor to the exhibition in 1933, described the MMM as unique at the time and also recounts the experience of seeing both The Dresden Transparent Man and the MMM at the same time. The quest for biological perfection was highlighted in contemporary articles heavy with rhetoric. Officials were quoted as calling the MMM “The most perfect mechanical man ever design”[50]. According to the Chicago Tribune [49] crowds gathered in the room and the public showed “amazement” as a moving picture appeared on the chest as it spoke. It also described how some people wanted to stay and rehear the lecture “saying they have learned more physiology in a few moments from the robot than they could in weeks of ordinary classroom study”[49]. There was also a lighter tone in some of the press articles using headline words to dramatic effect such as “Perfect Chicago Man’s Nothing to Rave about Girls”[50] or describing the MMM as “handsome”[54].

The lavish descriptions of these mechanical men played a role in inciting excitement (and discussion[55]) prior to the fairs, using the novel exhibits to attract readership and increase desire to attend. Unlike Rupert, whose novelty resided in the blatant display of whirring, mechanical and analogous parts, the MMM used the robotic form as a perfect shell upon which to project a sanitized and literal process of digestion.

C. Godfrey, The Empire Exhibition, Glasgow (1938-48)



Figure 2. Godfrey, 1948 © Illustrated London News Ltd/Mary Evans

The third mechanical man discussed in this study was known as Godfrey (see Figure 2, as shown in 1948). Godfrey was first displayed in 1938 at the Empire Exhibition in Glasgow, UK. He was the centrepiece[56] of the 'Fitter Britain' exhibition at the British Government Pavilion. The Empire Exhibition was significant in size and reputation. It was opened by King George VI on the 3rd May 1938 and in its 6 month run attracted over 12.5 million visitors from around the world (including the Duke and Duchess of Gloucestershire[57]).

An original publicity leaflet[58] presented Godfrey as a highlight, saying "this 11-foot robot-like figure will show all the functions of the body in terms of engineering; a pump for the heart, a camera for the eye, and so on". In terms of functionality he too demonstrated digestive processes, but by 'swallowing' billiard-type balls of different colours[59]. The viewer could then observe these taking different courses through the digestive tract – red for meat, yellow for fat and white for carbohydrates[60]. The pancreas was represented by a set of test tubes[61] and so a mixture of analogous images were used in one body. The seemingly blank area of the brain captured in photographs of the exhibit (see Figure 1) are misleading. When operational, areas of the brain were lit with words such as "I WILL" or "I LOVE" to represent the "seat" of willpower or emotion[60]. Blood was represented by a vivid opaque colour against a black background[62]. Lungs were represented by rotating discs that rose and fell[62] and the interior was "brilliantly illuminated"[63] to create an overall sense of spectacle. The descriptions of Godfrey imply that he himself did not move but he spoke via a record every 15 minutes[64] aiding potential engagement further. Aesthetically a classical-modernist style reminiscent of the work of British designer Eric Gill was adopted[62] - the profile of Godfrey was highly stylised with flat, facial features and oversized head.

Godfrey's provenance is impressive. He was designed by Richard Huws[63], an architect, sculptor and designer, who was most well known for his fountain sculptures at the Festival of Britain in 1951. A second version of Godfrey was made and redisplayed in 1948 and associated with H. Lynton Fletcher[65], a former BBC Director of Recordings, who played a role more in engineering the mechanics rather than its visual design, which stayed similar throughout (bar the addition of visible zone labels in the later version).

Godfrey was the most well-travelled of the three mechanical men and benefitted from being robust enough for transportation and high enough in novelty to warrant overseas attention. In January 1939 parts of the Fitter Britain Pavilion toured more widely[66]. Godfrey was shown in Selfridges Department Store in London[67]. In March 1939 he was shown in Copenhagen (he was mentioned specifically as one of the main features[68] of an exhibition). In 1940, two years after appearing in Glasgow, he was displayed at the re-opening of the New York World's Fair as 'Mac the Mechanical Man' (where importantly, he shared the same space as the Dresden Transparent Man[69,70]). Godfrey also re-appeared in London in 1948 at The Health of the People exhibition where he was viewed by the then Princess Elizabeth during the opening as emphasised by an article and photograph in the Illustrated London News[71] (see Figure 2).

As is the case with the other mechanical men the robot was reported positively in the popular and specialist press, including the British Medical Journal[68]. Words used included "remarkable", "amusing", "stimulating", "extraordinary"[72], "startling" [68], "a scientific sensation"[63] and "the star of the show"[73]. The robotic form of the body once more appeared to capture the imagination and engage reporters, editors and health educators alike.

There is a clear connection between the form of 'Der Mensch' and the conceptual and visual design of Godfrey in 1938. Sappol[5] acknowledged a Kahnian approach manifest in the design of Godfrey. The central nervous system uses the same representational system. Godfrey however employs a much more varied approach. There is little doubt that Godfrey's designer would have been aware of Kahn's approach to visualising the body since the labelling of two prominent dials are identical (breathing and heartbeat). Both Rupert and Godfrey orbited 'Der Mensch' (which was translated into English and published in London in 1931), but what alternative approaches are manifest in their design – does a new type of body emerge?

EXTENDING THE MECHANICAL MAN: THE ACCESSIBLE BODY

The following section discusses the notion of the Accessible Body – a term I propose to characterise key distinctive features evident within the cases presented.

There are 3 key qualities referred to within the term Accessible Body: 1) A sense of consciousness, 2) the re-appropriation of popular culture and 3) a sense of amusement and visual appeal. The term 'accessible' refers to an increased sense of approachability offered to the viewer. All three qualities refer to a sense of being essentially *human* as opposed to a set of *human organs*. In short, they call on a viewers' sense of their own consciousness, awareness of their current society, their positive emotions and their aesthetic sensibilities.

Consciousness

The Accessible Body wasn't a purely didactic ideal body machine – within each of the three mechanical men, resided the *suggestion* of the core of a conscious individual. With a new sense of added consciousness these machines, it can be argued, were designed with subtle touches to reengage an audience situated in difficult economic and political circumstances.

Sappol[5] acknowledged a Kahnian approach evident in the design of Godfrey as stated earlier. However, there are also two striking differences. Firstly there is an important

acknowledgement of emotions that are absent in Kahn's image. Zones in the Consciousness area of Godfrey lit up specific emotions, including love. Godfrey's 'love zone' resided in the upper quadrant of his head, sharing a zone with 'Will'. Such a combination suggested a physiological whole that visually connected emotions to physiology in a new way.

Secondly, Godfrey appeared to have a visual memory made relevant to the viewer. John Macmillan at his Inaugural Address to the Central Council for Health Education[67], relayed how, though Godfrey had an English accent, "his mind is chiefly filled with memories of Scottish Beauty Spots". If Godfrey's memory 'area' displayed pleasant and familiar pictorial content to the Scottish viewer, a direct connection would be facilitated between Godfrey's and the viewer's memory (as well as, perhaps indirectly, promoting the great outdoors). A photograph of Godfrey from 1948[71] shows an image of a crowd of people in his 'mind's eye' - suggesting a meta-awareness of not only himself but himself as an exhibit, mirroring the audience he perceives. In contrast, Kahn's Fordist Body was content free. Whatever the figure perceived externally lacked significance compared with the spectacle of the factory within the body. Content, whether of emotions, of love or a meaningful vision, was instead dominated by bodily processes in the Fordist body.

In addition, Godfrey was creatively designed to reflect some conscious qualities in the way that he spoke and moved. Commentary at the time[71] described how a human first introduced Godfrey, who opened his eye (to "wake"), and then described how Godfrey introduced 'himself' in the first person. Though not fully autonomous (he still required 'waking up') it suggests a new level of independence far removed from the automation embedded in the DTM or 'Der Mensch'. The lack of distinguishable face or hair in 'Der Mensch' and the DTM (the casing in the latter being transparent of course) shows a deliberate neutrality, but in doing so sacrifices a sense of 'being' within the Ideal or Fordist Body.

Similarly examples of the first person can be found in sections of scripts relayed by the MMM. For example the phrases "Now Ladies and Gentlemen, I will swallow" and "watch my stomach contract to churn up the food"[49] were used. This sense of consciousness was not limited of course, to only these mechanical men. 'The Talking Tooth'[74] exhibit on show also at the Chicago World Fair in 1933 exploited story-telling techniques in the first person to strong effect. The MMM though would also move his head and mouth and point to representations of his animated biological 'reality'. This gesturing suggests mastery within his external environment and his internal body and offers a means of inviting the audience into his biological world.

Both the MMM and Rupert, it could be argued, facilitated a connection with the audience through a direct and outward gaze. Rupert's eyes were permanently lit and outward facing, reminiscent of more recent Hollywood depictions of the cyborg - an electrically lit eye signifying life. Unlike the DTM, 'Der Mensch' and Godfrey, the GH Davis illustration of Rupert's face is positioned frontally. Challenging the functional and passive profile view usually adopted, this mechanical man looks out the page at the viewer with a fixed gaze. It subverts the tradition in anatomical drawings of the dissected or 'revealed' subject to look elsewhere (see for instance images by Vesalius, Van de Spiegel or Casseri). Given the lack of emphasis on cognitive processes, both Rupert and the MMM were able to face the audience (pragmatically afforded by no need to isolate, say vision from hearing in a profile view). Instead they could apply the frontal gaze in an attempt to gain audience engagement.

Given these various visual and oral devices the three mechanical men, it is argued, all could be construed as representing a conscious body – conscious in themselves and conscious to the audience. The experience of viewing the DTM, or 'Der Mensch' would have been very different. Since the focus for both was situated much more on the parts rather than any aspect of characterisation, an important element of accessibility and relevance, I argue, was subtly denied. This consciousness and related autonomy in the Accessible Body increased the potential for both audience and press engagement (leading to human nomenclature for example). This consciousness may also represent an embodied sense of individual responsibility for health behaviour (for food choice in particular in the case of the MMM). It may also relate to the responsibility of the individual manifest in the adoption of psychoanalysis in health education across Europe and the US during the 1920s[75]. This

emphasised the role that free-will played in all aspects of life including health and afforded the individual a new concept of autonomy[76]. Further, Armstrong[77] has argued that during the first half of the Twentieth Century the discourse surrounding 'health behaviour' as a term developed both in the U.S. and the UK attributing agency and indeed malleability to the individual. Zaretsky[76] has argued that psychoanalysis freed the individual from a traditional notion of dominant power (the family) to allow for a personal life. Consciousness, then, is suggested in relation to the mechanical men not in a Freudian sense of consisting of layers of the subconscious but as a means of reinforcing personal health awareness. If the DTM and 'Der Mensch' are interpreted as bodies controlled by God or routine systems of labour respectively, the Accessible Body appeared to represent a greater sense of choice and personal responsibility within each individual mechanical man and indeed, the viewer.

The Re-Appropriation of Popular Culture

The accessible body appeared lighter and looser than its counterparts and aimed for audience appeal by relating digestion and other bodily functions to familiar images and objects.

Rupert represented human physiology in three dimensions in direct relation to popular culture of the time – in this case, the robot. It is not indicative of a Fordist Body (though one might argue a Fordist element here given increasing fears about automated workers). Instead more potently, it is a body that extends well-established man/machine metaphors by reinventing them explicitly in relation to contemporary cultural references. The exactitude of the metaphor freezes this particular 'man' in time without the universality of classicism found in the Ideal Body. The foundational concept of Rupert may be philosophically positioned, as may Kahn's, as a three dimensional re-enactment of the discourse of Vesalius, Descartes or Baglivi's alignment of man with machine in the 16th and 17th centuries[78]. Rupert may also offer a human physiological alternative to the automata of Vaucanson and Moore from the 18th and 19th Century respectively[79]. We may however interpret the primitivism of Rupert as representing a critical stance between man and machine that rejects the idealism found in the DTM and indeed the Fordist Body of 'Der Mensch'. Morus has articulated how a man/machine analogy provides "a way of making technological society appear as a natural extension of the human body itself"[80] though there is little reference to a naturalisation of technology in the visual manifestation of Rupert. A clear close up of Rupert's interior[44] reveals the grease and the blackening of components from frenetic automation. Through crude facial cut outs the designer made little attempt to naturalise this machine. Rupert literally embodies its time and delights in the difference between man and machine. It encompasses the widespread use of metal artificial limbs after World War 1[81], emerging robots in various art forms (such as Capek's play 'RUR' in 1920 and the film Metropolis in 1927), and importantly Britain's first robot, Eric, demonstrated to large audiences for popular entertainment in 1928. As such Rupert was thoroughly contemporary and challenged the audience - children and adults alike – to relate their bodies to the new realities of science fiction manifest in the robot form. Rupert allowed them to marvel at their own complexity whilst still feeling entertained as he whirred, wobbled and wheezed through the demonstration.

Equally it is impossible to consider the MMM in 1933 without relating its form to the popularity of the movie cinema at the time. The body became quite literally a filmic canvas on which to project educational information. As a theatre curtain may pull apart, his shirt revealed a projection screen. Godfrey too, used a range of materials to tell his story – familiar materials such as billiard balls were dropped down tubes to represent digestion and everyday photography was used to depict vision. His overall appearance resembled modernist British sculptures that adorned architectural friezes at the time and thus his body also embodied familiar territory.

Carey, organiser of many of the exhibits on show at the Hall of Science in Chicago, stated in 1936, that "an unfamiliar exhibit has a popular appeal if the unknown was presented in easily grasped stages of the known"[47]. Here it is the use of that 'known' within popular culture that played a vital role in bringing the Accessible Body to a wider audience, particularly through

alignment of the body with popular arts/entertainment. It is not a 'niche-known' from the medical examination room or the chemical factory but a 'known' based on popular cultural references. The Accessible Body as a whole consumed, reflected and transformed popular and familiar cultural objects of the time.

Amusement through visual appeal

The mechanical men of health featured small details to amuse the audience revealing a lighter approach to physiology than was evident in the Ideal or Fordist Body. John Macmillan, with reference to the 1938 Fitter Britain exhibition in its entirety declared: "if health education is a pill it could not be more pleasantly coated than it is in the Fitter Britain exhibit"[67]. Such a statement reflects the new ethos of health museum design in the period[5]. As Rydell[1] and Ganz[82] discuss more generally, these exhibitions played a vital role in lifting a society experiencing severe economic depression.

There are several instances of humour inclusion worthy of note. The MMM, for example, re-enacted moments of affection in the first person. He was reported to conclude his lecture with the words "From the bottom of my mechanical heart I thank you all for your attention and I wish you all a good afternoon"[49]. The bottom of a mechanical heart is a paradox and shows care in the light-hearted scripting to attempt engagement through to the end of the demonstration. The designers included small moments within the dialogue to lighten what, particularly in the case of the MMM, was detailed physiological information (see Logan Clendening's article from 1933[52] for a comprehensive outline of the information disclosed during the lecture). Godfrey in London also made headline news through his humorously apologetic to Princess Elizabeth at his inability to bow and his use of the wink instead, which he hoped wasn't 'misunderstood'[71].

Clearly all the designers of the mechanical men strove for a certain level of aesthetic attraction in their visual form. The 'good looks' of the MMM and Godfrey shouldn't go unnoticed. A news article from Birmingham reported "He [Godfrey] is not at all revolting"[73] and, given his classical good looks from the back, "fit to adorn any public hall"[73]. An article in *The Sphere* made a point of saying how his classical looks denied any "frightening aspect"[62]. A further report described him as "not so horrible" as the "german glass man"[52] and praise was given to the designer for their attempts at amusement. The Advertiser[66] waxed lyrically about Godfrey, calling him "a scientific sensation" as well as "amusing and stimulating". The Chicago Tribune described the MMM as having a serious and intellectual face, far removed from the conventional image of a crudely shaped robot[49]. Even Rupert's face lacked any threatening presence being wide mouthed and expressionless. His invitation to shake hands with the demonstrator (evident in the British Pathe news footage[34]) added a human touch and the use of weighted platform shoes gave a comical appearance. As such these mechanical men exploited the potential visual appeal afforded by a human form – be it handsome or humorous.

The mechanical men featured in this paper had finite lives due, in part, to the fallibility of their 'bodies'. The demonstration of Rupert showed not only efficiency but also a vulnerability in the complex whirring of each part. Each part is subject to failure – a jam, a puncture or a 'spanner in the works'. Indeed, given diversity in photographic evidence of the time, both Rupert and Godfrey underwent repairs and upgrades. There was also a vulnerability to any machine composed of several parts. The organisers of the New York World's Fair, for example, initially missed Godfrey's explanatory voice since it wasn't initially shipped from London. Staff feared it may "be lost somewhere in the war"[59]. He was also reworked after World War 2 with additional electronic functions[65]. As such the Accessible Body, as it relates to mechanical men, was also a vulnerable body, subject to physical malfunctions and costly repairs. It was also a vulnerable body in terms of the passing of time. A public's sense of wonder shifts rapidly in respect to technological innovation but also to aesthetic concerns – thus the Accessible Body required periodic reinvention both internally and externally.

CONCLUSION: THE MECHANICAL MEN AS MESSENGERS FOR TODAY

This article has described and analysed features of three mechanical men of health, arguing how they offered an alternative to the Ideal or Fordist Body manifest in the DTM and 'Der Mensch' respectively. This alternative is identified here as the Accessible Body, a term that encompasses a level of body consciousness, re-appropriation of popular culture and a sense of amusement and light-hearted appeal. In many ways this approach is still one based upon ideologies of control and manipulation. Viewing the Accessible Body critically, we could conclude that it is just as problematic as the Ideal or Fordist Body. As Vallone [83] points out, images of giant robots evident in all exhibitions during the period represent notions of ideal masculinity and any use of a mechanical *man* therefore may well be representing covert ideals whether accessible or not. In addition, by embracing attention to scriptwriting, to visual appeal, personality and amusement, the designers of these machines could be viewed as adopting persuasive techniques, perhaps transforming mechanical men into salesmen of health. The Accessible Body therefore is not, ideologically neutral.

It is not difficult to translate many of the ideas evident in the Accessible Body of the past into concepts for present day novel health communication practice. For instance we may employ life-size animated projections on real bodies to represent effects of health behaviours. We may construct more complex 'personalities' or figures with suggested consciousness as means of evoking engagement. We may seek novel interpretations of the mechanical body using today's cutting edge technologies by exploiting ambient or virtual realities. The health communication designer may test the impact on the audience of using positive emotions such as a humour to increase affection towards exhibits or indeed our own bodies, usually reserved only for children today. Towards the end of the twentieth century, Boon reflected on the lack of humour found within science displays generally, wondering whether we had "deprived ourselves of a powerful tool in museum display"[84]. The lighter-hearted touches evident in the mechanical men's descriptions above deserve new consideration today.

McLeray & Toon[2] are critical of the claim that "anatomical revelation" is an effective mode of health education and there is a growing discourse of criticism surrounding novel displays of anatomy[85]. Instead we could argue that health education today demands an anatomical narration in which the machine body has to both function and *malfunction*. During the interwar years the act of malfunction would have created a tension between an efficient body and an efficient museum exhibit and it would have certainly pushed against the utopian vision at the time. Gebhard wrote in 1945 that, in a good health museum, "clarity, beauty and health must prevail everywhere"[16]. Today, however, there is an argument for not only focusing on health but also states of un-health - employing an Accessible Body display that may be damaged or repaired, where possible, through behavioural changes/medical intervention. In doing so its sense of consciousness, reference to popular culture and levels of amusement would all need to be imaginatively reworked.

Perhaps the most vital discussion these mechanical men raise today however is the use of mechanics (or electronics) to represent the body. As already highlighted, the man-machine metaphor has a longstanding history and it has also shifted over time to embrace changing technologies[19,86]. Within our understanding of the body, of illness and medicine the machine metaphor remains prevalent today. The metaphor has worked itself into common language so prevalently that we barely recognise it as a metaphor [87]. There has been much focus on metaphors used in language to express illness. Much of the debate concerning metaphors focuses on the usefulness for patients and doctors, their potential stigmatising effect[88], patterns of usage[89] and different uses of metaphors for different illnesses[89]. The *visual* metaphor has received less attention in health communication research and there is much work still to be done on understanding the potential of metaphorical approaches that may reside in the use of dynamic and three dimensional exhibits (moving-metaphors) or interactive exhibits (doing-metaphors).

Clearly the mechanical representations used in Rupert, 'Der Mensch' and Godfrey are still found in everyday medical language. Weiss found that mechanical metaphors were prevalent when doctors and nurses discussed understanding of and associations with heart disease for instance[89]. Drawings by health professionals, for example, revealed images containing pistons that had stopped working or an assembly line on strike. This metaphor has been

employed more broadly in health-service advertising in Britain. For instance the 1992 campaign for 'The Health of the Nation' initiative in Britain was accompanied by cut-aways showing mechanical parts[90] and the 'Man Manual', that represented the body via a Haynes Manual aesthetic usually reserved for cars, was a notable success when first published in 2002. Bleakly[78], however, is sceptical of the place of the machine metaphor in modern medicine and healthcare, describing it, particularly when coupled with war metaphors as alienating, masculine and overtly dominant in character. Instead he proposes a new series of metaphors based upon are (i) health as balance and imbalance (ii) medicine as collaborative exploration rather than individual struggle, and (iii) illness as a journey. A new Accessible Body must reflect and transform such ideas: it may be one of multiple interactions and multiple bodies or its 'plumbing' more aligned with roads than pipes to represent journeys. With radical repositioning of the body how would viewers respond and where would the journeys lead? Making a bissociation between historical Accessible Bodies and the latest thinking in health metaphor construction could indeed be a powerful force for the creation of innovative and meaningful ways of representing the body to the public today.

It is not difficult to discern the direct legacy in exhibitions today of The Dresden Transparent Man. This is evident through the addition of real flesh and diverse body postures found in the radical display 'Bodyworlds' and continued display of transparent men and women throughout the world. Nor is it difficult to see the influence of 'Der Mensch'. It was recently featured in The Wellcome Collection's 'Can Graphic Design save your life' exhibition (2017), its animated and exhibition format is still on display at Buffalo Museum of Science today and an on-line animation of 'Der Mensch' by Henning M Lederer boasts 414K views[91]. There is however much to be gained by uncovering exhibits that escape the sieve of time (to paraphrase Hillary Mantel) once history has been 'poured through it'. Certain dominant figures and their legacy can sometimes academically obscure other exhibits shown at smaller events. There is likely to be evidence of public performances and artefacts related to physiology in other countries remaining in archival state. To collate documentation of them is important if we are to understand the full range of ways physiology has been represented in the past, to help inform and question the design of the body images of the future. By directing sustained academic attention on the iconic representations of the body we miss a myriad of other short-lived though popular creative approaches to representing an Accessible Body. We could consider the Accessible Body the mayfly of the body-display world as it rises and falls freely through time, watched by the steady eye of The Dresden Transparent Man or Der Mensch als Industriepalast. Through their study in relation to each other, we may also learn to re-see the famous examples, much as a visitor to the New York World's Fair in 1940 may have walked from hall to hall, considering the diverse approaches on view. The lesser-known mechanical men brought to attention in this study, it is argued highlight the fluidity of representations of the body during the interwar years. They also provide a framework, albeit a loose one, for considering the physical manifestation of new body metaphors and for questioning continued persistent practice found in the body/machine metaphor. This Accessible Body it is argued, offered a new sense of consciousness, it absorbed and reflected popular culture of the time and it aspired to bring a new sense of pleasure to the audience through humorous touches and attention to detail. As such, it remains thoroughly flexible and relevant to the health communicator today.

ACKNOWLEDGEMENTS

Many thanks to Elias Kupfermann, the late Reuben Hoggett, Julius Schofield and Joanna Bowring for their help in sourcing information about Rupert. The author would also like to thank the reviewers for their useful comments in shaping this paper.

REFERENCES

1. Rydell RW. *World of fairs: the century-of-progress expositions*. Chicago:University of Chicago Press,1993.
2. McLeary E, Toon E. "Here Man Learns About Himself" Visual Education and the Rise and Fall of the American Museum of Health. *Am J Public Health* 2012;102:27-36. <http://doi.org/10.2105/AJPH.2011.300560>

3. Owen H. *Simulation in healthcare education: an extensive history*. Switzerland:Springer, 2016.
4. Gebhard B. Health education in Germany. *Am J Public Health Nations Health* 1934;24:1148-51.
5. Sappol M. *Body Modern: Fritz Kahn, Scientific Illustration, and the Homuncular Subject*. Minnesota:University of Minnesota Press, 2017.
6. Mold A. Exhibiting Good Health: Public Health Exhibitions in London, 1948–71. *Medical History* 2018;62:1-26. <https://doi.org/10.1017/mdh.2017.72>
7. Wilk C. The healthy body culture. In: Wilk C, editor. *Modernism: designing a new world, 1914-1939*. London:V & A Pub, 2008:249-95.
8. Smith V. *Clean: A History of Personal Hygiene and Purity*, Oxford: Oxford University Press, 2007, p. 310
9. Welshman J. 'Bringing beauty and brightness to the back streets': health education and public health in England and Wales, 1890-1940. *Health Educ. J.* 1997 Jun;56(2):199-209. <https://doi.org/10.1177/001789699705600210>
10. Zweiniger-Bargielowska I. Raising a Nation of 'Good Animals': The New Health Society and Health Education Campaigns in Interwar Britain. *Soc Hist Med.* 2007 Apr 1;20(1):73-89. <https://doi.org/10.1093/shm/hkm032>
11. Vogel K. The Transparent Man—Some comments on the history of a symbol. In: Bud R, Finn BS, Trischler H, editors. *Manifesting Medicine: Bodies and Machines*. Amsterdam: Harwood Academic Publishers, 1999:31-61
12. Canadelli E. The diffusion of a museum exhibit: the case of the transparent man. In: Panebianco, F. and Serrelli, editors. *Understanding Cultural Traits*, Switzerland:Springer International Publishing, 2016:61-80. https://doi.org/10.1007/978-3-319-24349-8_4
13. Borck C. Communicating the Modern Body: Fritz Kahn's Popular Images of Human Physiology as an Industrialized World. *Canadian Journal of Communication.* 2007 Jul 1;32(3/4): 495-520.
14. von Debschitz U & von Debschitz T. *Fritz Kahn*. Taschen, 2013.
15. Roberts L (ed), *Can Graphic Design Save your life*. London: Graphicdesign&, 2017
16. Gebhard B. Art and science in a health museum. *Bull Med Libr Assoc* 1945, 33.1:39.
17. Cogdell C. *Eugenic design: Streamlining America in the 1930s*. University of Pennsylvania Press, 2010.
18. Kleinschmidt HE. New Germany teaches her people: An account of the Health Exposition of Berlin. *Am J Public Health Nations Health.* 1935 Oct;25(10):1108-13.
19. Martin E. The end of the body? *Am Ethnol.* 1992 Feb 1;19:121-40. <http://doi.org/10.1525/ae.1992.19.1.02a00070>
20. Martin E. *The woman in the body: A cultural analysis of reproduction*. Beacon Press; 2001.
21. Todes DP. *Pavlov's physiology factory: Experiment, interpretation, laboratory enterprise*. JHU Press; 2002.

22. Prown JD. Mind in matter: An introduction to material culture theory and method. Winterthur portfolio. 1982 Apr 1;17(1):1-9. <https://doi.org/10.1086/496065>
23. Buchli V. The material culture reader, Berg. New York. 2002: 15
24. Hoskins J. Agency, biography and objects. Handbook of material culture. 2006 Jan 5:74-84.
25. *A Robot to teach biology: Novelty at Schools Exhibition*. London: The Observer 1928 Dec 9:25.
26. *Schoolboy's Paradise*. Somerset: Western Daily Press 1929 Dec 30:6.
27. *The Schoolboy's Exhibition*. London: The Observer 1928 Dec 23:13.
28. *An Exhibition for Schoolboys*. The Manchester Guardian 1926 Jan 04:8.
29. *A robot with a brain*. London:Daily Herald 1928 Dec 10:2.
30. *Christmas*. London:The Sphere 1928 Dec 22:11.
31. *The Rising Generation*. Yorkshire Post and Leeds Intelligencer 1928 Dec 29:8.
32. *School Boys See Robot*. The Winnipeg Tribune 1929 Feb 02:3.
33. *Schoolboys looking at Steel Robot used to explain the physiology of the human body*. Hulton Archive, Getty Images. Ref: 106889946. <https://www.gettyimages.co.uk/license/106889946> (accessed 23 Jan 2017).
34. *Take the 'im' out of impossible*. 1929 Jan 03. Pathe News Footage. <https://www.youtube.com/watch?v=yxbj7ppywm8> (accessed 23 Jan 2017).
35. *The Mechanics of Man: A Robot to Teach Physiology*. The Illustrated London News 1928 Dec 22;173/4679:1199.
36. French M. Modernity in British advertising: selling cocoa and chocolate in the 1930s. Journal of Historical Research in Marketing 2017 9/4:451-66. <https://doi.org/10.1108/JHRM-05-2017-0015>.
37. *Eric Robot has Pump for Heart*. Modern Mechanix 1929 May <http://blog.modernmechanix.com/eric-robot-has-pump-for-heart> (accessed 23 Jan 2017).
38. *Boys Build Human Engine in Study of Anatomy*. Popular Science Monthly 1929, Apr:58.
39. *Robot as a Friend*. London:Daily Herald 1929 Dec 29:5.
40. *Sheffield Week at Coles*. Sheffield Daily Telegraph 1930 Feb 01:11.
41. *Initiative! The power of taking the lead*. Sheffield Daily Telegraph 1930 Feb 03:5.
42. *Rupert the Robot*. West Sussex Country Times 1929 Apr 20:8.
43. *Great Exhibition of Domestic Aids and Appliances*. Surrey Mirror 1930 Feb 14:3.
44. *Boys will be boys*. Gloucester Citizen 1928 Dec 28:9.
45. *Schoolboy delights*. Hull Daily Mail 1928 Dec 28:4.

46. *Arthur and Fritz Kahn Collection 1889-1932*, Fritz Kahn Collection, Scrapbook, 1906-1934. Box Number: OS 43:111. <http://digifindingaids.cjh.org/?pID=121518#secII-2-C>, (accessed 23 Jan 2017).
47. Carey EJ. *Medical science exhibits: a Century of progress, Chicago world's fair, 1933 and 1934*. Chicago: Century of Progress; 1936.
48. *History's biggest show – 1833-1933*. Popular Science Monthly 1933 07:27.
49. *Mechanical Man at Fair teaches Physiology*. Chicago Tribune 1933 May 31:7.
50. *Perfect Chicago Man's nothing to rave about girls*. News Journal of Mansfield Ohio 1933 Apr 06:1 .
51. Muskat IE. Chemical exhibits at A Century of Progress. *J. Chem. Educ*, 1933 10/7: 387.
52. *Transparent Robot at Fair shows how digestion functions* .The Minneapolis Star 1933, Aug 08:6.
53. *Around the World for 50 Cents Promotional Leaflet*, University of Chicago Library, <https://www.lib.uchicago.edu/ead/pdf/century0141.pdf>. (accessed on Aug 7th, 2017).
54. *Robot teaches Physiology*, Michigan: Battle Creek Enquirer 1933 Jun 01:8.
55. *How Wonderful is Man when He is seen Inside and Out*, Popular Science Monthly 1932 12:12.
56. Macdonald C. Strong, Beautiful and Modern: National Fitness in Britain, New Zealand, Australia and Canada, 1935-1960. Vancouver:UBC Press; 2013 Jan 20.
57. *Tour of Grounds by Duke and Duchess of Yorkshire*, The Scotsman 1938 Aug 09:6
58. *Scotland's Empire Exhibition: more facts about it*. Broadsheet Empire Exhibition no. 3. Glasgow, 1938: University of Glasgow Sp Coll Mu Add. f17.
59. *At the fair: on the rostrum at patriotic rally at fair*. New York Times 1940 May 17:14.
60. *Wonder Robot for Exhibition*. Victoria B.C.:The Daily Colonist 1938 Apr 24:27.
61. A general medical service for the nation. *Public Health* 1937 51:253-55 [https://doi.org/10.1016/S0033-3506\(37\)80111-0](https://doi.org/10.1016/S0033-3506(37)80111-0).
62. *The Robot Mathematician*. London:The Sphere 1946 Dec 21:21.
63. *Robot will show human senses*. Birmingham Daily Gazette 1938 Mar 5:7.
64. Fitter Britain at Glasgow. *Br Med J* 1938 Apr 23:916 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2086292/pdf/brmedj04273-0036.pdf> (accessed on Aug 7th, 2017).
65. *A Camera Abroad*. Perth:Western Mail 1948 Aug 12:5.
66. *What they tell me – Through the portholes*. Gloucester Echo 1938 April 12:4.
67. Macmillan, J. Chairman's inaugural address. *Public Health* 1938:52:1 [http://dx.doi.org/10.1016/S0033-3506\(38\)80106-2](http://dx.doi.org/10.1016/S0033-3506(38)80106-2).
68. Letters, Notes and Answers: British Health Exhibit at Copenhagen. *Br Med J* 1939 Apr 08 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2209291/pdf/brmedj04192-0053.pdf> (accessed on Aug 7th, 2017).

69. Stafford, J. Health IQ Rates High in Tests at New York Fair. *The Science News-Letter* 1940, 37.10:150-151.
70. *The Mechanical Man is Travelling*. Manchester Evening News 1930 Mar 08:3
71. *The Robot Which Closed "His" Eye to Wish Good-Bye to Princess Elizabeth, after Apologising for Being Unable to Bow: "Godfrey," the Mechanical Man at the "Health of the People Exhibition*. Illustrated London News 1948 May 15: 537.
72. *Extraordinary Mechanical Man In "Fitter Britain*. Adelaide: The Advertiser 1938 5 Mar:24.
73. *Exhibition for Fitness*. Birmingham Mail 1939 Jan 10:8.
74. The Progress of Dental Decay as Told by the Talking Tooth, *J Am Dent Assoc*. 1935 22.3:513-15. <https://doi.org/10.14219/jada.archive.1935.0075>
75. Brown ER, Margo GE. Health education: can the reformers be reformed?. *International Journal of Health Services*. 1978 Jan;8(1):3-26.
76. Zaretsky E. Psychoanalysis and the Spirit of Capitalism. *Constellations*. 2008 Sep 1;15(3):366-81
77. Armstrong D. Origins of the problem of health-related behaviours: a genealogical study. *Social studies of science*. 2009 Dec;39(6):909-26.
78. Bleakley A. Force and Presence in the World of Medicine. *Healthcare*. 2017 5.3: 58-66 ; <https://doi.org/10.3390/healthcare5030058>
79. Rossi C. Russo F. Automata (Towards Automation and Robots). *Ancient Engineers' Inventions* 2017: 353-80. Springer International Publishing. https://doi.org/10.1007/978-3-319-44476-5_21
80. Morus IR. *Bodies/machines*. 2002 Bloomsbury Publishing. Dec 1:3.
81. Guyatt M. Better legs: artificial limbs for British veterans of the First World War. *Journal of Design History*. 2001 Jan 1;14.4:307-25. <https://doi.org/10.1093/jdh/14.4.307>
82. Ganz CR. *The 1933 Chicago World's Fair: A century of progress*. University of Illinois Press; 2012 Jan 6.
83. Vallone L. *Big and Small: A Cultural History of Extraordinary Bodies*. Yale University Press; 2018 Jan 9.
84. Boon TM. *Histories, Exhibitions, Collections: Reflexions on the Language of Medical Curatorship at the Science Museum after Health Matters*. In: Bud R, Finn BS, Trischler H, editors. *Manifesting Medicine: Bodies and Machines*. Amsterdam: Harwood Academic Publishers 139.
85. Adkins J. Authenticity in Anatomy Art. *J Med Humanit*. 2017 Jan 12:1-22. <https://doi.org/10.1007/s10912-016-9431-3>
86. Haraway D. *Simians, cyborgs, and women: The reinvention of nature*. Routledge; 2013 May 13.
87. Lupton D. *Medicine as culture: Illness, disease and the body*. Sage; 2012 Apr 4.
88. Sontag S. *Illness as metaphor and AIDS and its metaphors*. Macmillan; 2001 Aug 25.

89. Weiss M. Signifying the pandemics: Metaphors of AIDS, cancer, and heart disease. *Med Anthropol Q.* 1997 Dec 1;11(4):456-76. <http://doi.org/10.1525/maq.1997.11.4.456>.

90. Emslie C, Hunt K, Watt G. Invisible women? The importance of gender in lay beliefs about heart problems. *Sociol Health Illn.* 2001 Mar 1;23(2):203-33. <http://doi.org/10.1111/1467-9566.00248>

91. Lederer HK. *Der Mensch als Industriepalast* 2009 <https://vimeo.com/6505158> (accessed 23 Jan 2017).