Allusive Machines: Encounters with Android Life

Jannik Friberg Lindegaard
IT University of Copenhagen
Copenhagen, Denmark
Jafl@itu.dk

Lars Rune Christensen
IT University of Copenhagen
Copenhagen, Denmark
Lrc@itu.dk

ABSTRACT
On the basis of an ethnographic field study among artificial life researchers, this article proposes the concept of *allusive machines* to describe how technical systems variously allude people into shaping their own beliefs. The concept of allusive machines is inspired by previous research on *persuasive technology,* which defines technologies as instruments with the explicit purpose of changing human attitudes and behaviours, and the notion of *theory machines*, which refers to how objects in the world stimulate new theoretical formulations. We particularly introduce the concept of allusive machines to the analysis of how robot technology operates allusively to hatch new ideas and knowledge about life, for both designers in the laboratory as well as general publics during demonstrations. Focusing on Alter, an android based on artificial neuronal networks, we show how the concept of allusive machines is useful to rethink the relationship between designers and users analytically by showing how technical systems, like Alter, become *allusive* to human thinking and acting.

Author Keywords
Allusive machines; persuasive technology; theory machines; robotics; androids; artificial life; diffraction; allusion; ethnography

ACM Classification Keywords
K.4.3 [Organizational Impacts]. H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
In this paper, we propose the concept of *allusive machines* to describe how technical systems – material apparatuses and computational things - allude people, in various ways, into fabricating and modifying their own beliefs. In more basic terms, the analytical device of allusive machines refers to specific technological assemblages, such as computers or robots, that work to allude people to think in new and innovative ways. We develop this concept on the basis of previous studies on persuasive technology [3, 10], which are often tethered to a concern about designing effective persuasive systems [3] by refining the manipulative tactics of persuasion itself [3, 22]. Moreover, previous research on persuasive technology has generally tended to target *users* as the subjects of persuasion, not the designers [3]. Inspired by persuasive technology, we here seek to think of allusive machines, as a concept that describes technical systems, which, during the design process, also modify the beliefs of its *designers*. However, to do so, we draw inspiration from the notion of *theory machines*, which refers to how objects in the world stimulate theoretical formulations [11], allowing us to reconfigure the one-way relationship between user and designer. By coupling insights from persuasive technology to the concept of theory machines, we unpack how technical systems thus operate *diffractively* - drawing in both designers and users - to allure, compel and entice them into fabricating new ideas, beliefs and convictions.

With the introduction of allusive machines, we seek to offer an alternative reading of the intricacies of unwinding to which effect technical systems and technological forms operate to stir up and reshape people's ideas, beliefs, attitudes, and behaviours. While the concept of persuasive technology inspires us, we simultaneously seek to reconsider the strong discourse on persuasion, often articulated as a deliberate act carried out by designers in direct relation to users. To a large extent, the discourse of persuasive technology hinges on the idea that persuasion can be subjected to a refractive logic, i.e. that persuasion occurs exclusively through a one-way relay between designer and user, often understood in a linear sequence. Besides inviting readers to discuss this discourse openly, we propose to read technologies as allusive, meaning that they work to call things to mind, which is to pass reference to new possibilities and fresh conceptions, allowing the subjects of allusion to be active in reshuffling different ideas and to form new idea sets.

Essential to this process, we hold, are allusive machines, as those material things and technological assemblages we often encounter in lab settings or in everyday life, such as robots, computers, or even petri dishes - things that stir up our imaginations and modes of acting and thinking. We thus ground the concept of allusive machines on the idea that allusion signals a conjectural way of *calling attention to* or *hinting at* new spaces of possibility, motivating people to modify, change and reshuffle ideas, convictions, attitudes, beliefs or behaviours in indefinite and open-ended ways. Allusive machines incessantly pass and pit references between and against new propositions and existing forms of knowledge, drawing both designers and users into their allusive force fields, thus operating *diffractively*. They are diffractive in the sense that they allude both groups to reimagine, rethink, reconfigure and take action upon the advent of new possibilities. In short, allusive machines function both linearly *and* circularly in the sense that their allusive capabilities make fluctuations between new propositions and existing forms of knowledge, reaching both

users (general publics) *and* invert on the designers (artificial life researchers) themselves, calling attention to new habitual modes of acting upon and knowing the world.

With reference to five months of ethnographic fieldwork among artificial life researchers at the Ikegami Lab, University of Tokyo, Japan, we provide an example of how allusive machines work to allude researchers and publics into rethinking what life is and how it works. We specifically inquire how robot technology - the android Alter - created by research teams at the University of Tokyo and Osaka University, operates as a concrete instantiation of an allusive machine. Alter is an upper-body android, based on artificial life principles, designed to explore relations between concepts such as control, free will, agency, life, body, mind, appearance and motion, to name only a few. But notably, to the research team at the University of Tokyo, Alter is also designed to query perennial questions about what constitutes life and under what conditions life might emerge. With Alter, as an embodied agent physically present in the *real world* – as opposed to the digital and virtual domains - they seek to stage an unexpected encounter with life in attempts to render life visible, audible, tangible, knowable and believable. In other words, they seek to make life available as a phenomenon apprehensible to the human qualia and human thinking, hoping to hatch new ideas about what life is. Taking our starting point in the laboratory setting, looking over the shoulders of those who seek to reconsider life through robot technology, we follow Alter from laboratory experiments into public demonstrations to describe how technical systems become *allusive* to the to the minds of designers and users alike.

Unlike the personal computer or a tape recorder, Alter may be described as a somewhat strange and unfamiliar entity, occupying an unstable ontological domain, presenting itself as a rather abstruse case. Although in some aspects familiar, taking on a human form, Alter is an incarnation of artificial life, offering a counterpoint to nature and natural organisms made of flesh and blood, referencing itself as a probable embodiment of *possible* life. Upon encountering Alter, noticing its porcelain-white face and synthetic body, it alludes its observers (designers and users alike) to juxtapose and rethink what they already know exists in nature: living animals, plants, cells, genes, by referencing itself as a case of an inorganic and abiotic thing, a form of artificial life. In this way, observers are invited to experience an unexpected encounter with life, emerging between the known and the unknown, the familiar and the unfamiliar, shaping our perception of life as something *more* than the biological. While we may not always be persuaded or convinced, Alter, nonetheless alludes us into rethinking the category of life by reengaging with questions about what life is, what it might look like, what it might sound like, how it might feel like and so on. Unlike the tactics of persuasive technology, which often rely on the tools of social psychology, premised on a one-way relay of communication between designer and user, allusive machines include the element of diffraction, which redistributes sensible, allusive gestures towards both parties, making designers and users alike active in rethinking conceptual categories, such as life, against what they know already. Alter is, to put it more bluntly, disruptive to our thinking.

The paper is structured as follows: first, we review prior research on persuasive technology and the notion of theory machines to form a basis for the concept of allusive machines. Next, we introduce the concept of allusive machines in more detail. We then go on to describe the empirical setting and methods used during fieldwork, proceeding to provide two empirical examples showing how Alter works as an allusive machine, both in relation to its designers in the lab, but also in relation to the general public encountering it at a demonstration. Following from our empirical descriptions, we discuss how the concept of allusive machines offers a new capacious reading of technology, which we hope may open new research pathways for the future. In conclusion, the significance of allusive machines lies in the moment of the *encounter*, which summons the conditions of possibility for users and designers to rewire relations between the known and the unknown, producing a momentary space of novelty. Such characterisation, we think, broadens our understanding of the relations between humans, technology, materiality, persuasion, and allusion, during and after design. Thinking about technologies as diffractive and allusive, we hope, offers a modest reading of how both users and designers grasp, engage, perceive, use and interact with technologies as material vectors that do not necessarily persuade or convince, but rather allude and inspire our thinking.

RELATED RESEARCH

In recent years, technology has increasingly been harnessed in efforts to persuade people in various ways, both collectively and individually [14]. Under the headline of *persuasive technology*, which refers to a particular group of technologies that have the explicit purpose of changing human attitudes and behaviours [10, 9], technologies are now used to convey and apply principles and categories commonly found in social psychology (credibility, respect, trust, reciprocity, cooperation, authority and so on), in order to influence and/or manipulate people in positive and/or beneficial directions in terms of attitude, behaviour, motivation or intention [6, 10]. While we may speculate when exactly technology became persuasive, let alone what it means to persuade, it was not until the 1990s that persuasive technology was first articulated and discussed as a separate research field when B.J. Fogg [10] characterized computers designed to persuade as the 5th major wave in computing[1] [10].

Nowadays, persuasive technology has come to encompass an entire range of technologies and technical artifacts, which

[1] B.J. Fogg also refers to persuasive technology as the field of "captology"

include persuasive product designs, video games, computer programs, robotics, architectural designs, and so on [3, 12, 13]. Conventionally, persuasive technology privileges and emphasizes the interactive qualities of technology, which in contrast to more "inert" technologies, such as present-day urban infrastructures (not including experiments with so-called "smart cities"), enable user-sensitive and user-adaptive responses, allowing persuasive messages to be directed towards the targeted user [15]. Concomitantly with the mass distribution of personal computers on a global scale, computers have commonly been considered to be ideal sites for conveying and enforcing persuasive messages, as well as dispatching intentions, exemplifying a type of interactive technology and design capable of generating specific behavioural results through the strategic deployment of friendly cues [4, 22]. The idea of persuasive technology seems to owe much of its existence to the enabling capacities of the personal computer itself, as they provide the backdrop and conditions of possibility to think of them as persuasive in the first place, perhaps themselves alluding us to believe that persuasion was originally conceived to reside in the domains of language, text and rhetoric?

However, to qualify as *persuasive*, technologies may not be harnessed to use force, intimidation, coercion or misinformation to deceive, or delude target users [15]. Thus, the qualifying criteria for persuasive technologies designate only certain forms of technology and technical artefacts (ideally computers) that are mobilized to *shape, reinforce, or change behaviours, feelings, or thoughts about an issue, object, or action* [10]. This idea, we think, is rooted in the assumption that human behaviours and attitudes may be influenced and/or manipulated through technology, rhetoric and the theoretical nomenclature of social psychology. Therefore, to be genuinely persuasive, designers need to tailor their objects with the *intentional* purpose of *manipulating* end users toward a *desired* attitude or stance, strategically considering the *event* of persuasion to *achieve* the desired behaviour of the end user [3, 14]. This discourse hinges on a linear relation between designer and user, where the user is intended to change according to the intentions of the designer. Persuasive technologies are thus routinely imagined to be persuasive instruments, engineered and operationalized to convince and persuade their target groups in a sequential manner: designers design systems that in turn persuade target users. The efficacy of persuasive technology, then, is tethered to the idea that technologies and technological artifacts may act as means or mediums of persuasion to achieve certain objectives and goals upon an understanding that persuasion is amenable to be coded in a linear sequence. Needless to say, and unfortunately beyond the scope of this paper, imagining persuasive technology through this lens begs the question of ideology, power and interest (whose interests do persuasive technologies really serve?), as well as calling attention to the strained relations between governor and governed, manipulator and manipulated and so on.

Yet, essential to proponents of persuasive technology is that persuasive sequences are reduced to the writing of code. In programming a persuasive sequence, one major challenge is the issue of timing, that is, how and when to deliver the persuasive message at the right time, at the right place, in the right way to gain full "impact". Generally, three interrelated obstacles concern the issue of timing: the first is that the target user, who is subject to persuasion, has to be receptive to the end goal, i.e. susceptible to adopt the desired behaviour intended with the particular persuasive technology at hand. Second, the persuasive message, not the end goal, needs to be delivered at a time where the recipient is attentive towards it while remaining ready to take action upon it, if required [8]. Finally, variation may occur in the way persuasive requests are framed in the tension between the means and the end goals, that is, even though the goal may remain the same, the means to achieve it may differ substantially [3]. The timing issue, then, is essentially imagined to be a design problem curbing efforts to determine the right time, message, and approach, without necessarily knowing the specific contexts in which their target users are situated. Instead, as a design problem, designers can only anticipate the specifics of a social situation in which persuasive technologies are embedded. Some studies, however, have come up with solutions to the timing issue and emphasized the notion of *adaptive persuasive systems*: systems that calibrate and synchronize timing by drawing on the multiple types of information to attune to the specific situation of the target user [18, 17]. Adaptive persuasive systems, in other words, merely multiply and extend the efficacy of the original notion of persuasive technology by consolidating disparate sets of information to refine the persuasive sequences to be more precise. Albeit drawing on more sources, these systems are cast in the same linear trajectory that guides the thinking about persuasion, aiming at producing the same result to persuade target users. In sum, it runs in one direction: designers design adaptive persuasive systems that in turn persuade end users.

A substantial body of literature has been produced on persuasive technologies that demonstrate the feasibility and efficacy of different technologies that become appended to the prefix "persuasive." Previous empirical studies in Human-Computer Interaction (HCI) have shown how persuasive technologies work in various contexts, as well as for different purposes, scientifically and ideologically, for instance, in the promotion of healthy or pro-social behaviours [1, 5], in advancing efforts to reduce energy consumption [2, 3, 7, 23], in optimizing persuasuive features in robots [12, 13], or in warning people of the risks of being influenced by machines and artificially intelligent systems [24, 26]. Common to the study of persuasive technology, whether about pushing ideological agendas or refining the tactics of persuasion within the field of persuasive technology itself, is the notion that technologies themselves can be enlisted to become more persuasive than their human counterparts [10]. Further empirical investigations in HCI, to which persuasive technology most often adheres, have enforced the notion that humans tend to "anthropomorphize" technologies by interacting with, and responding to, them in similar ways as they do with other humans [10, 9]. Contrary

to humans, these studies suggest, computers are experienced to be more persistent, *always on*, and sometimes even lifelike [9, 25], thus harbouring the potential power to become effective silver-tongues. What matters to persuasive technology is mainly how to exploit this.

While persuasive technology is generally grounded in the idea that technologies may be exploited or taken advantage of to persuade users, the notion of theory machines [11] points to the idea that certain technological objects in the world stimulate new theoretical formulations. Whereas persuasive technologies work to incite desired behaviours, theory machines work to assist researchers (or designers) in their thinking, as tools *of* and *for* thinking. Theory machines, in other words, are epistemological auxiliaries built upon the idea that we find metaphysics in machines and machines in metaphysics, revealing that thinking and materiality are inextricably linked. Theory machines specifically refer to more or less concrete objects or machinations through which people become able to think between abstraction and concreteness. For instance, Albert Einstein used networks of electro-coordinated clocks at European railway stations to think about simultaneity, actively assisting him in formulating the theories of relativity [11]. In this particular case, the interconnectedness of somewhat concrete material objects, such as networks of electro-coordinated clocks, became essential to Einstein's thinking and theorizing. Yet, we may still ponder whether such objects are are also generative of ideology or political agendas (or, as with persuasive technologies, simply objects in the world taken advantage of)? Nonetheless, theory machines have usually been described in terms of their enabling capacities as epistemological objects, not as objects for promoting specific creeds. From persuasive technology, we take on the premise that technologies carry capacities beyond their technical setup, simply the capacity to evoke images in people, but what we shall try to do here, however, is to think persuasive technology and theory machines together to explore how they might work to think of technologies as *allusive*, as material things that call attention to new ideas and certain modes thinking and acting.

In what follows, we thus attempt to synthesize insights from persuasive technology with the idea of theory machines to constructively advance the idea that technological forms may operate to allude people to transform their modes of thinking. We, therefore, believe that the concept of allusive machines occupies a space between persuasive technology and theory machines, allowing us to think of technologies as things that may also work to allude us into thinking in new ways. The concept of allusive machines, we maintain, does not go against persuasive technology or theory machines, but is rather an alternative reading of technology, inspired by persuasive technology and theory machines.

THE CONCEPT OF ALLUSIVE MACHINES

As it might have become clear already, we hope to offer a revitalized and capacious reading of persuasive technology through the notion of theory machines. As such, allusive machines do not adhere or conform to the concepts and principles of social psychology or the discourse of persuasive technology itself. Instead, we seek inspiration in the term *diffraction*, borrowed from theoretical physics, which is a physical phenomenon by which a beam of light is spread out as a result of passing through a narrow aperture, typically followed by interference. We use the term in contrast to refraction, which denotes a linear process of deflecting light obliquely through an interface from one medium to another, on a one-to-one basis. While diffraction effectively disperses light in multiple directions, refraction only redirects it in one direction. Thinking about allusive machines through the concept of diffraction (perhaps ourselves using diffraction as a theory machine to think about allusive machines), we conceive of them as diffractive in two ways: 1) by embroiling more than users and 2) by incessantly passing and bridging references between new propositions and existing forms of knowledge, continuously working to create fresh ideas and new insights. To this end, allusive machines can be understood both literally and metaphorically, singly and collectively, as machines that diffractively generate alluding gestures towards users and designers, simultaneously reverting the refractive relationship between them.

We take the concept of *allusion* itself as a device that *calls attention* to *new possibilities* through the work of reference. In other words, the making of an allusion is a conjectural way of *calling attention to* or *hinting at* new spaces of possibility that stir our imagination. We think of *machines*, both technically and metaphorically, as a device that converts energy into force or motion to perform particular tasks, both understood as those real tangible objects and machinations that physically exist in the world, engines, and as a metaphor for the assemblage of technical and non-technical things required for conveying allusive gestures. Allusive machines are affective and emodied, operating through hints, suggestions, and propositions that implicitly invoke references to new possibilities against forms of knowledge. The *encounter* with an allusive machine is the critical moment, whereby new propositions are invoked and juxtaposed with the existing forms of knowledge of those who are engaged in the encounter (i.e. those who encounter allusive machines in various ways: users, designers, etc.). In the encounter, allusive machines actuate and impel the juxtaposition between suspended forms of knowledge (what users and designers already know; for example, that life is a natural kind) and new propositions (that life is more than a natural kind, artificial life is viable). Thus, the encounter is a drawing together of new propositions and already existing forms of knowledge. Importantly, however, allusive machines drive us not to become aware of the falseness of our knowledge (that life is a natural kind), but of its partiality (that life is not *exclusively* a natural kind), constantly and incessantly displacing and rearranging what we thought we knew already. The encounter with allusive machines, we hold, may lead to a transformation of habits or practices upon the partially self-imposed realization that something new is possible or attainable (for instance that life is viable as something fabricated artificially outside the biological currents of natural reproduction and evolution).

SETTING AND METHODS

Figure 1: Alter, an upper-body android

Our study was primarily conducted at the Ikegami Lab, which has been active in the field of artificial life for more than 15 years. Headed by professor Takashi Ikegami, the lab currently holds researchers of all stripes (professors, PhDs, postdocs, visiting scholars, graduate students, etc.) and backgrounds (phycisists, biologists, computer scientists), who collaborate infrequently across different research projects in all areas of artificial life: hard, soft and wet [20]. Having different academic backgrounds, all members work from their specific epistemic traditions but share a general interest in artificial life. As part of their practice, they pose various questions related to the study of life by engaging with the origins of life, open-ended evolution, complex systems, cognitive science, philosophy of mind, phenomenology, artificial neural networks, artificial intelligence, machine learning, art and more, to explore what life is, how it works, and how it is constituted. From an artificial life perspective, it is the only lab in Japan employing an all-encompassing mixture of art, philosophy, complex systems science, computer science, biology, chemistry, mathematics, physics, engineering and robotics in relation to the creation and understanding of life. But while their work encompasses and draws on many fields of research, including artistic conception, our main focus, for the purpose of this article, is how robots and androids are used as particular forms of *hardware* to explore life and its processes. Like computer simulations did in the 1990s, oil droplets and chemicals in the 2000s, androids now operate and perform as particular vectors for examining life up front in new tangible and affective ways.

At the lab, members work on different projects related to the study of artificial life through exploring and analysing swarming behaviours, collective intelligence, open-ended evolution, and by training and embodying artificial neural networks. A few members, however, are dedicated to the exploration of life and life-likeness through robotics. On an everyday basis, these few dedicated researchers dabble with hardware, computational systems, and neuronal networks, in seeking new ways to construe life, drawing on artificial life's constructionist tradition to fabricate the things they seek to understand [19-21]. The lab members, who are engaged with robotics, deploy various techniques from mechanical and electrical engineering, physics, mathematics, biology, biotechnology, complex systems science and computer science when conducting their research. While these researchers do many other things than dabbling with robotics, we focus here on their particular engagements with robotic media. Despite the fact that the Ikegami Lab is not technically a robotics lab, Ikegami and his team of researchers work somewhat parallel to official robotics labs across Japan in a concentrated effort to construct robots, based on artificial life principles, rooted in an ambition to transpose *life into the real world*, that is, to transfer life from the digital realm of computer simulations into the same physical, four-dimensional space of material and human bodies.

On a general level, members at the lab design, develop, fabricate and experiment with all kinds of embodied agents, which include things like quasi-living *protocells* and the *Mind Time Machine*, to name only a few, and whose allusive capabilities are beyond the scope of this paper. Yet, while the lab works across all established branches of artificial life, it is the only lab in Japan that designs robots, such as Alter, upon what they call *artificial life principles* or *Alife-based motivations*, anticipating robot technologies as yet another propitious medium for exploring life. In their experiments with Alter, they wrangle with questions about how life might emerge, exploring what makes life and its processes tick, by situating and embedding Alter in complex and highly dynamic environments, i.e. in the *real world*. But they do so not only at their own lab at the University of Tokyo, but also at various sites across the city of Tokyo and Japan. In exposing Alter to volatile situations, members of the lab thus consider the orchestration of experiments and public demonstrations as dynamic infrastructures of complex human-nonhuman interactions to be studied in their own right. For them, exploring life is not just an analysis of Alter's performance, but an exploration of the social complexities conjured in the encounters between humans and machines. They make no clear distinctions between research, experimentation and demonstration; the real world, they believe, *is* the laboratory, a material site *to stage an unexpected encounter with life*.

Alter was conceived from a chance encounter between

Takashi Ikegami (University of Tokyo) and Hiroshi Ishiguro (Osaka University), who, together with their respective research teams, designed Alter as an upper-body, lifelike android, capable of generating lively, spontaneous and unpredictable behaviours on its own. Initially, Ikegami and Ishiguro shared a mutual puzzlement about what would happen if top-down-inflected approaches of artificial intelligence (AI) converged on the bottom-up-inflected notion of artificial life. As a result, Alter came about, as an experimental testbed. Alter's body is partially covered by patches of silicone skin – its arms and face covered - exposing some of its mechanical parts in between. It is deliberately designed to be *neutral* in the sense that it is supposed to appear ageless, genderless and uncultured; a tabula rasa artificial being to be apprehended in its own right, suggesting that it might belong to the machinic phylum [16] outside conventional biological taxonomy. As part of the overall physical design, Alter also has a voice expressed through its mouth in accordance with the volume of the base sound, scraping the frequency in responsive relation to its physical movements and bodily exercises. The basic idea is that Alter's voice is generated in real time in accordance with its movements and informational inputs, meaning that it is not remote-controlled or programmed to exhibit any particular goal-oriented behaviour.

Technically, Alter is powered by two air compressors and receives sensory information from its surroundings through an adjacent *autonomous sensor system*. The sensor system is based on artificial chemistry principles, which is coupled to two internally autonomous dynamic systems: a *central pattern generator* and a *neural network*. The sensory system itself is comprised of multiple sensor units encased in transparent boxes in front of Alter itself, actively providing Alter with visual, sonic, thermal and haptic inputs. When information is received by one or more of the sensor units, they mutually share and transmit that sensory information between one another. This shared cluster of information is transmitted to the central pattern generator and the neural network, actively processing and transducing the "chaotic dynamics" of the environment, condensed in its local milieu, to spontaneously create rhythms (like an internal metronome) generating motion. The neural network then makes variations of action, perturbing the central pattern generator, which is then put in locomotion to create the spontaneous and unpredictable movements and ambient voice of Alter.

Methods

We primarily refer to five months of ethnographic fieldwork among researchers at the Ikegami Lab, University of Tokyo, Japan, and secondarily to studies carried out at the Ishiguro Lab, Osaka University, Japan. Over the course of five months, we have collected various types of empirical data extracted through participant observation, field observations, written sources, scientific articles, and interviews. Our methodology has generally involved participation in everyday activities among researchers actively working in both labs, including thorough readings of written materials, produced by the Ikegami Lab and the Ishiguro Lab, with relevance to our specified object of study.

However, we primarily focus on the Ikegami Lab, where we have participated in everyday activities and conversations, attending lab seminars, workshops, and experiments. Although we turn attention to Alter, as our specific object of study in this paper and the collaborative project between the University of Tokyo (Ikegami Lab) and Osaka University (Ishiguro Lab), the android was at the time of our study based in Tokyo, which prompted us to stress ethnographic focus on the Ikegami Lab. From Tokyo, the Ikegami Lab is responsible for conducting hands-on experiments with Alter, as well as being responsible for organizing public demonstrations and exhibitions at various locations around Japan. The bulk of our data stems from the Ikegami Lab. Fieldwork was, however, frequently extended to Osaka to interview key persons at the Ishiguro Lab, who have at some point participated in the Alter-project. From February 2017 to June 2017, we consistently conducted 20 audio-recorded interviews, and 2 non-recorded interviews, both semi-structured and structured, in Tokyo (19) and Osaka (3), organized and participated in 4 workshops in both Tokyo (2) and Osaka (2) (Tokyo workshops in collaboration with the Department of General Systems Science, University of Tokyo, and Osaka workshops in collaboration with the Department of Anthropology, Osaka University), which includes field observations at both locations. Underpinning our empirical data, we have collected various documents, texts, and scientific articles produced by key researchers working in both Tokyo and Osaka to contextualize and support our empirical findings.

ALTER AS AN ALLUSIVE MACHINE

In the following sections, we refer to two specific empirical instances in which Alter comes to operate as an allusive machine. While we recognize that these instances may be thought together, as Ikegami and his peers do not necessarily distinguish between research, experimentation, and demonstration, we, for the sake of convenience, make two separate sections. First, we show how Alter works to allude Ikegami and his team into thinking about life as emergent patterns of complex phenomena, meaning that life potentially emerges through human-machine interactions, during lab experiments. In the following instance, we show how Alter works to allude publics into reflecting on the viability of artificial life during a public event in the city of Tokyo. Even though both instances can be conceived as experiments – or rather allusive moments - we specifically want to emphasize how the particular encounters between Alter and its human audiences (artificial life researchers and publics) reveal how people are generally alluded into rethinking what they thought they already knew about life, yet without any positive assurance that their observations, ideas and interpretations are exhaustive, correct or definitive.

Alter in the lab

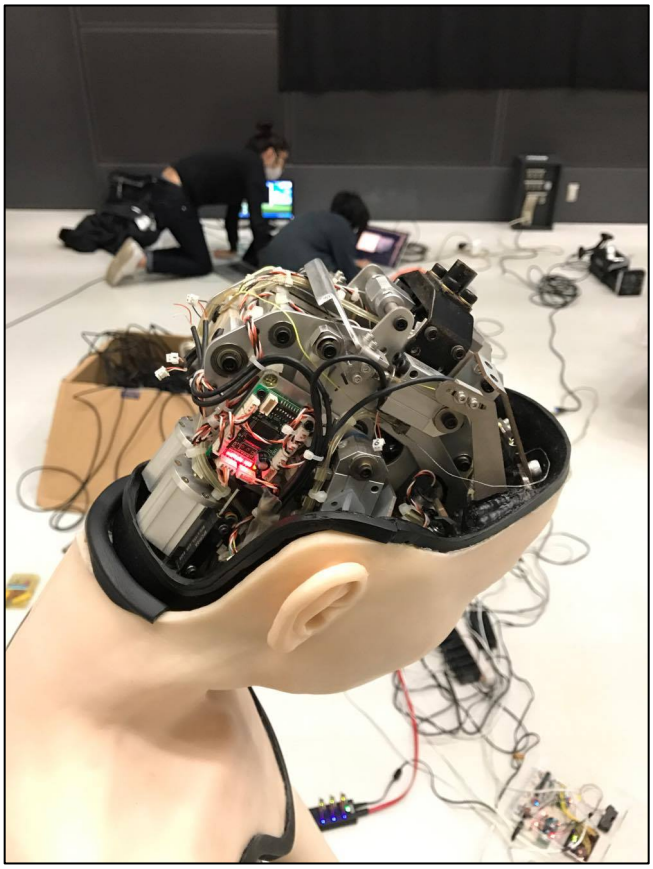

Figure 2: Alter during design activities in the lab

As guests of the Ikegami Lab, we were invited to participate in experiments on Alter, most often conducted at the National Museum of Emerging Science and Innovation (The Miraikan). These experiments, we suggest, reveal moments where technologies (in this case Alter) become allusive in enabling the designers (in this case artificial life researchers) to think about life and vitality without any positive assurance that their observations and interpretations are exhaustive. More precisely, we provide an example of how Alter is one particular instance of an allusive machine that alludes these artificial life researchers into rethinking life as an emerging pattern of complex phenomena, as something potentially emerging through human-machine, rather than biological structures and organic forms, exactly by referencing itself towards the unknown, a space of new possibilities.

To our naked senses, Alter generates strange and unpredictable behaviours. Its fingers twitch, its eyes flicker spasmodically, its voice electronic. Its synthetic body signalizes, pantomimes, gesticulates, blinks, dances, sings, charms, appeals, and, we propose, alludes to us in a tactile way. Alter generates smooth, sometimes jerky, yet beguiling movements and sounds, emulating apparitions of liveliness, which fill the featureless hall, where its designers flutter over wires and cables, tacking back and forth between laptops, air compressors, sensor units, lunch wrap and empty plastic bottles. In this spectacle, Alter adjusts to its moving surroundings, attuning its body to ours, phonemically reacting to our blubbering, adapting according to the heat of our bodies. From immersing ourselves in these experiments, it became clear to us that Alter was more than a visual, auditory and sensible spectacle.

As we observed how the lab members would hover around Alter, making gestures, blocking its sensors with their feet, positioning themselves relative to its body, they were anticipating its reactions to adjust their programming accordingly. Each adjustment was tried and tested to explore changes in its movement and behaviour. Most of the time during experiments, the designers were suspended in travel between Alter and their laptops, looped into Alter's internal systems, shuttling back and forth between Alter, its sensors, and their laptops. In between, they would briefly instruct each other to move to different locations in front of Alter's sensors, before returning to work on their laptops. From our observations, and through talking to the designers, we found that this "dance" made Alter into an object for thinking about life by anticipating and reacting to changes in its behaviour, based on adjusting sensor sensitivities, numerical values, and so on. Particularly, it became clear that Alter served to ground their thinking about life, both during experiments and more generally, by becoming a reference to life, not as a form or a structure, but through observing its moving body as an animated display of life-likeness, a pattern of complex phenomena, as something potentially emerging through their tweaking interactions with Alter itself. In turn, this pattern, brought about by Alter's spontaneous and unpredictable movements, could potentially be discerned to suggest that life is *relationally constituted through the entangled movements of human and machinic bodies*. The point is that Alter alludes to new ways of thinking about life that are not necessarily right or wrong, but rather speculative, as Ikegami, who would sometimes participate in the experiments, notes:

[…] *Maybe life exists in the communication between human beings and Alter … I mean, the way they communicate? But life is not in Alter, and it's not in human beings, but it's in between. That is what some people say. Sometimes I think this is right, but at other times, there still seems to be something that's missing.*

Here, as Ikegami reports, they think *across* Alter to speculate whether life might be a relational phenomenon in the sense that it emerges *in between* machines and human beings. However, what matters here, we think, is not that Alter persuades them into determining what life is and how it works, but how it alludes to possible ways of experiencing and perceiving life and its processes. It was not that Alter was a form of material proof or evidence that would persuade them into thinking that life could take hold outside organic substrates, but instead that it could act as a technological object that would allude them into thinking about life and its boundaries *against* the biological frameworks, in which it is

usually arrested. Instead, by interacting with Alter, they would set themselves up for an unexpected encounter in the face of the unknown:

I don't want to describe what life is by saying "ok, this is the concept to understand life", these are the equations for living systems, or this is the material you put into the system to make it alive. I think life is more about processes.

To think of life as processes, organic or even inorganic, is not uncommon in the field of artificial life, biology or computer science [19, 21]. However, what Ikegami bespeaks here is also a conception that life cannot simply reside within forms, structures or embodied bits of vitality, for instance such as the soft tissues of animal species or molecular structures. Neither, he and his team of researchers believe, can life be sufficiently conveyed through chemical formulas, mathematical equations, or computer simulations, which have often been heralded as more or less accurate models of life and lifelike processes, exhibiting novel forms of vitality [20]. Rather, by setting themselves up to be voluntarily taken by surprise by Alter, they enable themselves to reimagine and rethink what life could perhaps be about. But process to Ikegami also refers to how we encounter technologies, as he asks what happens in such encounters:

[in the encounter] *you want to pick up as many meaningful side effects as possible. For example, the side effect of building and firing a rocket is the amazing view of it. At the start, it's "let's build a rocket!" but after it's done, the question: "what did you see?" becomes much more meaningful. I always prioritize the latter, but on the other hand, it's almost impossible to predict what is going to happen.*

In grappling with Alter during experiments, Ikegami and his team seem not only to juxtapose what they already know about life, as a natural kind, against the alluring suggestions of Alter, referencing itself as a possible case of life, but they also seek to trace these so-called side effects. However, Alter, as mentioned before, is not material proof or evidence of artificial life as such, something designed to denounce biology, but rather a material entity that alludes Ikegami and his team to categorically include technology, data, information, bits, bytes, and robotics into the domain of the life. While Alter allows them to reconsider what life is through the nomenclature of cybernetics, information, and robotics, against the backdrop of biology, DNA, cells and genes, they hope to discover the emergence of new patterns, new modes of aliveness that are not premised on established biological schemes. Thinking of life, through bodies, as processes, patterns, and flows of information, surfacing from human-machine interactions and bodily movements, we think, is the side-effect that allows them to think of life as something in *excess* of the biological, breaching its boundaries previously established by biology. Importantly, however, they believe so without any positive assurance that their ideas and interpretations are exhaustive.

By virtue of being strange and unknown to them, Alter alludes them into rewiring relations between life, the biological and the artificial, calling to their attention new possibilities for thinking about life as ever-evolving patterns. Alter, as an allusive machine, offers to them, not a counterpoint but a technolgical extension to biological life and evolution, referencing itself as a probable embodiment of *possible* life, without denouncing that life is *also* a natural kind. Alter alludes them to think in the interstices between the known and the unknown, the familiar and the unfamiliar, the natural and the artificial, human and machine, shaping their perception of life as something *more* than the biological.

Alter performing to the Public

Outside the lab, this strand of thinking is protracted, when Alter is presented to the public. In the public arena, Alter operates to allude people into reflecting on the universality of life and what it means to be alive. Specifically, during public demonstrations, Alter works to motivate belief in the fidelity of artificial life to "real" life through the spectacle of the demonstration itself. During our fieldwork, we had the chance to attend a public demonstration to experience an encounter between Alter and a group of tech-enthusiasts, journalists, reporters, bloggers, artists, and photographers. We specifically attended a public demonstration held at the Intercommunication Centre (ICC) in Shinjuku, Tokyo, where Alter featured as one of the main attractions. Here, the crowd had assembled to experience up front the android that was allegedly endowed with life.

In the large conference room, Alter was, however, visibly hidden from the anticipating crowd, who had been seated in front of the stage to listen to Ikegami, who would do a presentation from a couple of slides projected onto a large screen behind him. During the panel talk, Ikegami presented his general thoughts about the Alter-project, to which he appended that the primary intention with Alter was to minimize the appearance aspect instead to explore and convey life merely through motion and sound. From the stage, Ikegami shuffled through his slides, depicting details about the technical specifications of Alter, while he spoke over them: Alter is composed of 42 pneumatic actuators and has a face of indeterminate age and gender, a face that could be anyone's, its neural network, he went on, modelled on the neural circuitry of the human brain, and so on. The crowd patiently listened to Ikegami, who circulated the question:

Why do machines that differ from living organisms in both their mechanisms and purpose of existence seem more lifelike at times than some organisms?

After his inaugurating talk, photographers were quietly guided to a set of cardboard walls, behind which Alter stood silently waiting to be revealed. The lights in the conference room were turned off leaving the crowd's murmur in all-encompassing darkness. As Alter's "singing" began to resound, the cardboard walls were pushed aside to reveal Alter standing on a small elevation with its air-compressors concealed in the back room. Frequently lit up by the momentary flashes of cameras, Alter's body moved smoothly through the dark, attuning to the audio levels

within the room, to produce fluent movement patterns, seemingly dancing to the vibrations of the crowd's murmur and the snapping sounds of the cameras. To the audiences' wonder, camera flashes and bodily gestures, Alter itself generated not only autonomous movements but "sang" with a voice of its own. While the illuminated red LED's, mounted on its open panel in its scalp and joints seemed to move freely in the air, drawing illuminated lines upon the dark canvas, the room thickened with tranquil ambient music when Alter intensified its singing to its audience. To the audience, Alter was presented as an entity capable of moving and speaking on its own behalf, itself showing how life might look otherwise, as something conveyed through a non-carbon-based set of mechanisms, i.e. code. The encounter between Alter and the audience brings about an awareness of life, as something that might possibly be attained in artificial bodies, however, based on code rather than molecules. In turn, the encounter propelled the imaginations of the audience to become apprehensive to the (animistic) idea that (artificial) life is attainable as a technological property, and not merely as a biological property. In other words, Alter alluringly attested to the idea that life was something technologically attainable, not by falsifying previous notions of biological life, but by reminding audiences of the partiality of this proposition itself. Alter was itself expressive of this capacious conception of life, gesturing towards new habitual modes of acting upon and knowing the world through the aperture of new possibilities, once again alluding to the notion that life is something *more* than biology.

However, with reference to the underlying philosophy underpinning Alter, and the ways by which Ikegami kept articulating Alter during the show, it was clear that Alter's *affect* was also an *effect* of this. In other words, although Alter seemed to be itself bespeaking the possibility of life as consistent with robotic technology, this could not be disassociated from Ikegami's articulations and trained readings of Alter, its background and history, its actions and purposes, resulting from their experiments with artificial life in general. In short, the words of Ikegami worked to accompany the very materiality and performance of Alter, embedding the audience solidly within the conceptual and interpretive framework of artificial life, consolidated and transmitted through the panel talk and Alter's stage performance. As such, Alter's physical presence and performance, coupled with Ikegami's words spoke directly across the boundaries of possibility, embodying Ikegami's own notion that *artificial life is larger than biological life*. Yet this, we hold, would not work without the presence of Alter. Recalling Ikegami's notion:

Alter and artificial life systems can amplify society in order to notice that there is a frame, and then go beyond that frame.

The encounter at ICC, we suggest, became a concrete materialization of going beyond frames in terms of thinking. Yet, it was not the case that Alter was staged intentionally to persuade audiences deliberately through the tactics of persuasion [22], but rather that this encounter between Alter and audiences spoke latently and allusively to the possibility that robots, and non-organic systems, might be rendered fully alive in the near future. Indeed, what made the demonstration of Alter fascinating to the crowd, we suggest, was a sense that Ikegami was not fully in control: Alter was, as Ikegami also noted, designed to generate spontaneous and self-generated movements and sounds from sensory inputs provided through its immediate surroundings. This made its behaviour seem realistic and purposeful, as it drew its *life force* from its environment, perhaps even intentionally. The allusive force conjured by Ikegami's presentation and Alter's performance not only extend the idea of allusive machines to include more than materiality, but was visually and audibly overwhelming to the crowd, who were stimulated to think about what life is and what it means to be alive. Alter profoundly activated the imagination of the participants to reflect on new possibilities and new modes of co-existence with artificial life systems and robots. And with reference to Ikegami's overall vision, the demonstration reminded the audience that technologies, like Alter, could make us think in new ways, to become aware of our own human biases and prejudices towards each other and living technologies, as well as reminding us how artificial life might change society. To use Ikegami's own words, the audience was *amplified* to go beyond what they thought they knew already by inviting them to re-evaluate their conception of technology.

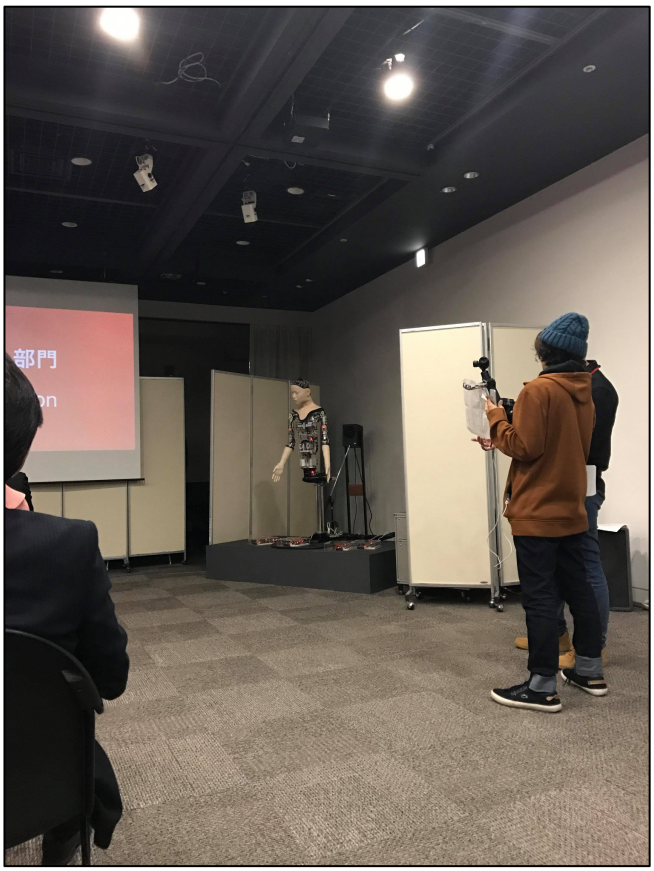

Figure 3: Alter on stage, ICC, Shinjuku

DISCUSSION

Not quite aligning to the tenets of persuasive technology and the notion of theory machines [11], Alter, as an allusive machine, seems to allude both users and designers. In the examples provided in this paper, Alter alluringly bespeaks the possibility of artificial life in various ways, suggesting that artificial life researchers are not necessarily *strategic, with defined behavioural outcomes in mind* [22], but rather explorative and speculative, with unpredictable behavioural outcomes in mind. Their aim is not to arrive at an absolute definition of life, or to persuade themselves and others to conform to certain desires or agendas, as prescribed by technology, but to be suspended in relays of allusion. Likewise, the audience encountering Alter at public demonstrations are perhaps hardly persuaded, but instead alluded to think of life beyond its biological moorings, to think of life in terms of technology, code, and androids.

We do not contest the proposition that persuasion is a technological disposition, but we diverge from the strong discourse articulating persuasion as a calculated and deliberate act carried out by designers in direct relation to users. The concept of allusive machines, we hope, offers a fresh capacious reading of technology, which might open new research pathways for the future. But more importantly, as we have tried to show, technologies may not always be thought of as persuasive but may be thought of as simply stirring our imaginations, in turn, potentially affording us to become more innovative and creative. Perhaps far-fetched, this paper itself may potentially be viewed as an allusive machine in the form of text, alluding us into reopening questions whether persuasion *always* entails deliberation and intention? How persuasion and allusion are conceptually distinguishable from various mechanisms of power, authority, or coercion? (for instance, by what means we can tell the difference between, say, persuasion, allusion, cajolery, seduction or coercion?), or whether we can find instances in which people are unknowingly or unwillingly being persuaded against their will? And if so, how do we discern and recognize the ethics of persuasive technology rather than celebrate its power? Finally, is persuasion measurable? We do not think that the concept of allusive machines necessarily sidesteps these problems, but perhaps it is useful to open new research trajectories that trace and reconsider the multiple ways to think about technologies.

CONCLUSION

In this paper, we have introduced the concept of allusive machines to describe technical forms, which allude people in various ways into shaping their ideas and beliefs without any positive assurance that their convictions are exhaustive. Inspired by persuasive technology and the notion of theory machines, we have proposed to think of technologies as allusive, arguing that allusive machines diffractively enable both users and designers to critically engage with new propositions on the backdrop of what they already know. When encountered, allusive machines make fluctuations between new propositions and existing forms of knowledge, in turn gesturing towards new horizons of possibility, calling attention to new habitual modes of acting upon and knowing the world.

ACKNOWLEDGMENTS

We extend our thanks to Takashi Ikegami and his friends.

REFERENCES

1. B. Arnrich, O. Mayora, J. Bardram, G. Tröster N. Saranummi, H. Wactlar J. E. Bardram A. Triantafyllidis, V. Koutkias, I. Chouvarda, and N. Maglaveras, *Pervasive Healthcare.* Methods of Information in Medicine, 2010. 49(1): p. 67-73.
2. Magnus Bang, *Persuasive technology, design for health and safety, 7th International Conference, PERSUASIVE 2012, Linköping, Sweden, June 6-8, 2012. Proceedings*, ed. M. Bang, E.L. Ragnemalm, and W.-B. International Conference on Persuasive Technology for Human. 2012, Berlin New York: Springer.
3. Shlomo Berkovsky, *Persuasive Technology, 8th International Conference, PERSUASIVE 2013, Sydney, NSW, Australia, April 3-5, 2013. Proceedings*, ed. S. Berkovsky, J. Freyne, and W.-B. International Conference on Persuasive Technology for Human. 2013, Berlin New York: Springer.
4. Lars Rune Christensen, *Practices of Stigmergy in the Building Process.* Computer Supported Cooperative Work (CSCW), 2014. 23(1): p. 1-19.
5. Sunny Consolvo, *Designing and evaluating a persuasive technology to encourage lifestyle behavior change*, D.W. McDonald, Editor. 2008, ProQuest Dissertations Publishing.
6. William D. Crano and Radmila Prislin, *Attitudes and Persuasion.* 2006. 57: p. 345-374.
7. Janet Davis, *SIGCAS, CAS, HCI & sustainability.* ACM SIGCAS Computers and Society, 2008. 38(2): p. 19-21.
8. J. P. Faber, P. Markopoulos, P. Dadlani, and A. Van Halteren, *AULURA: Engaging users with ambient persuasive technology*. 2011. p. 215-221.
9. B. Fogg, *Persuasive technology: using computers to change what we think and do.* Ubiquity, 2002. 2002(December): p. 2.
10. Bj Fogg, *Captology: the study of computers as persuasive technologies*. 1997. p. 129-129.
11. Peter Galison, *Einstein's Clocks and Poincaré's Maps: Empires of Time*, ed. P. Galison. 2003, London: Sceptre.
12. J. Ham, R. Bokhorst, R. Cuijpers, D. Van Der Pol, and J. J. Cabibihan, *Making Robots Persuasive: The influence of combining persuasive strategies (gazing and gestures) by a storytelling robot on its persuasive power*. 2011. p. 71-83.
13. Jaap Ham, Raymond Cuijpers, and John-John Cabibihan, *Combining Robotic Persuasive Strategies: The Persuasive Power of a Storytelling Robot that Uses Gazing and Gestures.*

International Journal of Social Robotics, 2015. 7(4): p. 479-487.
14. J. Hamari, J. Koivisto, and T. Pakkanen, *Do persuasive technologies persuade? - A review of empirical studies*. 2014. p. 118-136
15. W. A. Wijnand A. Ijsselsteijn, *Persuasive technology, first international conference on persuasive technology for human well-being, PERSUASIVE 2006, Eindhoven, The Netherlands, May 2006, Proceedings*, ed. W.A.W.A. Ijsselsteijn and W.-B. International Conference on Persuasive Technology for Human. 2006, Berlin: Springer.
16. John Johnston, *The Allure of Machinic Life: Cybernetics, Artificial Life, and the New AI*. 2008: The MIT Press.
17. M. Kaptein, P. Markopoulos, B. de Ruyter, and E. Aarts, *Personalizing persuasive technologies: Explicit and implicit personalization using persuasion profiles.* International Journal Of Human-Computer Studies, 2015. 77(3): p. 38-51.
18. Maurits Kaptein, Boris De Ruyter, Panos Markopoulos, and Emile Aarts, *Adaptive Persuasive Systems: A Study of Tailored Persuasive Text Messages to Reduce Snacking.* ACM Transactions on Interactive Intelligent Systems (TiiS), 2012. 2(2): p. 1-25.
19. Marc Lange, *Life, "artificial life," and scientific explanation.* Philosophy of Science, 1996. 63(2): p. 225.
20. Christopher Langton, *Artificial life: The Proceedings of an Interdisciplinary Workshop on the Synthesis and Simulation of Living Systems*. Santa Fe Studies in the Sciences of Complexity, ed. C. Langton. Vol. 6. 1989, Reading, MA: Addison-Wesley. 655.
21. Christopher Langton, *Toward Artificial Life.* Whole Earth Review, 1988. 58.
22. Dan Lockton, David Harrison, Tim Holley, and Neville Stanton, *Influencing interaction: development of the design with intent method*. 2009. p. 1-8.
23. Daniel Pargman and Barath Raghavan, *Rethinking sustainability in computing: from buzzword to non-negotiable limits*. 2014. p. 638-647.
24. Calo Ryan, *Robotics and the Lessons of Cyberlaw.* California Law Review, 2015. 103: p. 513-1679.
25. Piiastiina Tikka and Harri Oinas-Kukkonen, *Contributing or receiving-the role of social interaction styles in persuasion over a social networking platform.* Personal and Ubiquitous Computing, 2017. 21(4): p. 705-721.
26. Joseph Weizenbaum, *Computer power and human reason, from judgment to calculation*. 1993, London: Penguin Books.