# DESIGN CULTURE(S)

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Volume #2

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## Cumulus Conference Proceedings Roma 2021

## Volume #2

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Cumulus the Global Association
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# DESIGN CULTURE(S)

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JUNE 08.09.10.11

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# Domestic AI and Emotional Involvement. Design Perspectives

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**Abstract** | The contribution addresses the current phenomenon of AI spreading in domestic environments but making no meaningful contribution to people's life. The main purpose is to stimulate a conversation about the topic in the design community, trying to trigger critical reflections through the envisioning of – more or less – near future scenarios. Regarding the emotional sphere as a possible asset for the solution of the problem, the investigation starts from the field of psychology, translating some of the basic theories about (positive) emotions into scenarios where AI systems enhance houses, embodying these principles in an intentionally overstressed manner. Science Fiction Prototypes have been applied as research tools to build the scenarios and to infer critical points and interesting possibilities. The outcome of this work is a set of different envisioned futures that can be introduced in workshops and/or didactic activities to further advance the discussion.

**KEYWORDS | ARTIFICIAL INTELLIGENCE, EMOTIONS, DOMESTIC ENVIRONMENTS, INTERACTION DESIGN, SCIENCE FICTION PROTOTYPES**

# 1. Introduction

Referring to the topical issue of AI spreading in domestic environments, with no effective results, this argumentation aims at stimulating a conversation from a design perspective. Since we naturally invest objects and environments with emotional values (Branzi, 2013; Canter, 1972; Diani, 1988; Norman, 2004), as if they were a measure to assess experiences, we wondered if and how design and the latest technologies can improve our emotional well-being at home.

Starting from the analysis of psychological literature about emotions, to better understand the matter to design for, we explored 6 scenarios of a future life with non-human intelligence, each of them embodying a different theory about (positive) emotions. To guide the investigation, we employed Science Fiction Prototypes. This method allowed us to go further to almost dystopic scenarios, clearly stressing the main critical points and interesting possibilities they imply.

Finally, the outcomes of this experimentation are discussed and an integration of the scenarios in workshops and didactic activities is proposed to advance the debate.

# 2. Future AI-enhanced domestic life: a possibility for design

The transition towards a life of sharing our homes with non-human intelligences has already begun. The first wide-spread materialization of AI in the domestic environment is represented by smart speakers integrating virtual assistants: at the end of 2019 over 200 million installed units were expected, and the trend seems growing (Canalys, 2019). Moreover, other AI-enhanced objects are emerging, namely lights, thermostats, doorbells, and even showers, while robots – varying from domestic assistants to pet substitutes – are multiplying (Hitti, 2020).

However, people's relationship with this technology is controversial. Excluding the anxiety generated by filmic hyperboles depicting a world overwhelmed by robots, one of the most frequent sentiments characterizing the use of smart speakers is a disappointment, probably due to a lack of understanding, caused by the underlying invisible operations of these devices (Norman, 2004). Especially, when compared to the promises made by advertising campaigns, smart speakers fall below expectations, having issues in basic elements of interaction like discoverability and proper exploitation of functions (Kinsella, 2018; White, 2018).

Indeed, a positive impact of technology on people's mood and life is key: Norman (2004) states that it should bring richness and enjoyment. Aware of that, brands delivering AI-enhanced products launch commercials leveraging emotional aspects. Accordingly, Amazon Echo is a tool to connect people or just the evolution of a human mate, while Google, emblematically states "You make a house a home. We make a home a nest", overshadowing the product by highlighting people's different emotional states at home.

The reality, though, tells us a very different story. Even if no deep investigations addressed the topic of smart speakers' emotional impact, especially in the long run, we could intuitively

compare them with design theories related to (positive) emotions, to understand that they need further development. As anticipated, following Khaslavsky and Shedroff's principles of the seductive power of design (1999), they excel in the enticement step with attractive promises, but miserably fail in maintaining them, and in making a memorable experience. Likely, whether they respond to an idea of novelty, favourably preserving the quite familiar aesthetic of a speaker, they do not always require the least effort to perform a task, contradicting the first and overarching beneficial feature Hekkert (2006) recognizes. As well, problems arise when it comes to the meaning of the experience, as it is difficult for them to respond to personal significance, virtuous (Desmet & Pohlmeyer, 2013), reflective (Norman, 2004), psychological, or ideological qualities (Jordan, 2000), even marking a rejection of sensuous curiosity and pleasure (Spallazzo et al., 2019).
These limitations, accentuated by the daily relevance they have in the domestic sphere, underline how AI represents a field full of possibilities for design, and the intervention – aiming at humanizing a technology which seems still too far from people – will need to take emotions in consideration because, as Minsky (2007) said: machines cannot be intelligent without any emotions.

## 3. Translating emotion theories in design scenarios

For a conceptual exploration, different theories about emotions have been adopted as literal guidelines to orientate the design process, in a sort of *exercise in style.* Sharing the spirit that drove Raymond Queneau (1947/2007) to experiment with literary variations of speech, our aim is to activate the creative engine towards unusual outcomes, and meanwhile, to collect different pictures that portray alternative futures and clearly embody the core principles of the currents of thought they stand for.
Future-focused thinking is one of the primary activities of design, especially when related to emerging technology research and the HCI field. For this purpose, the method of science fiction prototyping has been adopted. Considered an "embodiment of the third wave of design and HCI practices, [it has] the aim of capturing the essence of culture, emotion and experiences, and emphasizes the reflective role of the designer in HCI processes" (Kymäläinen, 2016). According to Dourish and Bell (2014), Science Fiction Prototypes (SFPs) as tools for design research could not only anticipate but actively shape the technological futures. In this context, SFPs are employed according to Keinonen's model of design-oriented research (2006), as artefacts that may "open new spaces for design", triggering critical thoughts and further speculations about the topic. In a reinterpretation of his model, here the phenomenon to be analysed (field of research) is AI in the domestic environment, while the framing for interpretation (in this case lying in the field of psychology and not of the art ) are positive emotions, conveying focus and creativity to HCI. Design, instead, maintains its overlapping role to enable the communication between the other fields and brings, as an added value, its expertise to deal with the moment of drunkenness characterizing the introduction of new technology (Antonelli, 2018).

In the following examples, the authors created SFPs with the aim of envisioning domestic scenarios of a more or less near future, where AI exemplifies different psychological theories of emotions. In particular: 3.1, 3.2, and 3.3 address the issue in the most general sense and from a causal perspective; 3.5 and 3.6 express possible ways to pursue positive emotions; while 3.4 lies in-between. The outcomes are intentionally hyperbolic to stress their characteristics, and they show an individual-centred perspective, reflecting the ego-centric character of the psychological theories.
For the argumentation, Johnson's steps to create an SFP (2011) have been followed. Here how they have been intended and indicated in the text: (i) Technology enabling the scenario and set up of the world. (ii) Scientific inflection point –which dramatic change marks the transition to a new progressive scenario? (iii) Implications and ramification of the technology for the world. (iv) Human inflection point – how people's life is modified? (v) Implications, solution or lessons learnt – judgments are intendedly avoided not to influence the reader.
All the scenarios portray future AI-enhanced houses, designed for people's well-being according to the specific theoretical conception explained at the beginning of each SFP, and trying to highlight the key points of the technology: autonomy and adaptivity.

## 3.1 The physiological house

**Literary reference.** Emotions and the physiological responses manifested by human bodies are patently interrelated. In some of the earliest emotion theories of modern psychology, these physiological responses appear to be central in the definition of emotions themselves. In particular, there are visions sustaining that emotional behaviours are a direct consequence of the alterations revealed by the body, as the Peripheral Theory exemplify (James, 1884); while others just state that they occur simultaneously, it is the case of Cannon-Bard Theory (Lindzey et al., 1991). Anyway, modifications of skin conductivity, body temperature, heart rate, blood pressure and other possible reactions, if well balanced with contextual information, can make emotions measurable.
**SFP.** (i) Devices measuring and keeping track of our physiological parameters are already part of our reality, and they will be central in the physiological house. Smart bands and watches integrate sensors to monitor, among others, skin conductivity, heart rate and even heart rhythm for personal ECGs. Even Google's installation *A Space for Being* at Fuorisalone 2019 used wristbands to assess whether people were at ease throughout three multi-sensorial domestic environments (Hitti, 2019a). (ii) To overcome the problem of environments subjectively affecting people's parameters, AI systems, trained to evaluate contextual and personal data and to assess what the physiological responses stand for, are required. (iii) The physiological house will be characterized by a ubiquitous AI system that will have access to the physiological parameters of its inhabitants – wearing their apposite *house bands* – and will be in control of all the environmental facilities (lights, thermostat, music, etc.). Over time it will get to know how its users show their feelings and react to different situations. Then, as a caring mother, the house will interact with them by adapting the environment to people's emotions for their well-being, or by sending messages on their

*house bands*. (iv) Living in the physiological house will mean that, once at home, one has nothing to worry about: even *before experiencing* negative emotions, the house will have it all settled. Of course, at the beginning, there will be some misunderstandings, for instance, if one gets scared watching a horror movie, the house may turn on the lights and suggest him/her to call someone not to stay alone. (v) Inevitably, an ideal scenario takes time to settle because human emotions represent a very complex matter, and so many different data need to be triangulated for a complete overview. This would also implicate that a huge amount of power and digital/physical space will be necessary for the infrastructure of the AI system.

## 3.2 The neurological house

**Literary reference.** Emotional responses can also be attributed to the internal activity of the brain. Neurological theories suggest that emotions arise in the limbic system (Picard, 1997). Activating the amygdala, the anterior cingulate, or the prefrontal and somatosensory cortices (Damasio, 1994), emotions become an observable phenomenon: they leave a neural signature, identifiable through fMRI (Functional Magnetic Resonance Imaging) as a distributed pattern of activity (Kassam et al., 2013).

**SFP.** (i) Being able to access data from the brain and the nervous system is essential for the neurological house, and the premises to facilitate this task are emerging. In fact, Elon Musk's start-up, Neuralink, is developing implants that can connect minuscule electrode threads to the brain, to record the detected electrical signals and transmit the information outside the body (Hitti, 2019b). (ii) Musk envisions the implant to create a symbiosis with AI, and this may represent the first sparkle for the neurological house. Everybody would have implants that AI systems integrated in the house will read, analyse and respond to, directly stimulating the appropriate part of the brain with electric impulses – similarly to the neurologist Duchenne de Boulogne eliciting emotion-related facial expressions by applying faradic shock on facial muscles (Duchenne, 1876). AI systems will be trained to recognize and reproduce emotional patterns in the brain, and their focus will be to understand its inhabitants' preferred states and to satisfy their requests. (iii) Not much will be needed in the house to reach a balanced state of well-being, as positive emotions will be directly inferred through the brain implant. Furnishings and decorations will be superfluous, as only the survival-related equipment will be necessary. Secondary needs, like midnight snacks, will not be a problem as the right stimulus will quiet the hunger. (iv) Satisfying non-vital yet beneficial needs with no material aids will have several silver linings: it will increase people finances, as superficial goods or services will have no use, and it could even prevent health problems like obesity or drug addiction. (v) Nonetheless, the artificially induced constant positive state of mind will impede people to do anything non-related to subsistence.

## 3.3 The cognitive house

**Literary reference.** Cognitive theories of emotions indicate the element of reasoning as determinants for emotional behaviour. Two main currents are accredited. According to the Appraisal Theory (Lazarus, 1991), a personal automatic evaluation immediately follows an event, determining whether it is beneficial, non-relevant or harmful, then a suitable emotion is elicited. While, Schachter-Singer Theory (1962) hypothesizes that when we experience an event that causes physiological arousal, the resulting emotion depends on the motivation that our cognitive process recognizes. If no explanation can be found, we search the environment for clues as to how to label the physiological response, As emerged in an experiment (Schachter & Singer, 1962) people who could not understand that physiological responses of their bodies depended on epinephrine injections could be emotionally manipulated with induced cognition towards euphoria or anger.

**SFP.** (i) As cognition cannot be measured, a basic assessment of human-AI interaction has to come from external manifestations of emotions: body language, voice tone, etc. All functions currently under development. (ii) For the cognitive house, AI ubiquitous systems – in control of all the environmental facilities, including pervasive monitoring – have to be implemented with notions about what is beneficial for people's well-being, and with their inhabitants' preferences and goals. (iii) More or less subtly manipulating people's internal appraisal of events, it will encourage well-being by changing the contextual conditions to trigger positive affects if it detects good behaviours or habits, or negative sensations if it spots bad ones. The house will act like a stubborn educator, ever conceiving new ways to get the better of them, and inhabitants will choose it precisely to achieve their goals. For instance, if one wants to get in shape, the house could low the temperature and make the lights colder to infer discomfort as (s)he eats sweets, or turn on energetic music to celebrate an exercise session. (iv) Either if the user perceives the intentions of the house (appraisal theory) or not (Schacter-Singer theory), (s)he will be encouraged to follow the right path. Though, the motivational process will not have immediate positive results, and people could quit early or endure and reach their goals. (v) In any case, AI finding a balance between physical (health) and psychological well-being (happiness) will be a challenge.

## 3.4 The activity house

**Literary reference.** In line with a phenomenological approach, Activity Theory, mainly explored by Leontiev, suggests that human perception of the world lies in the experience, and it is triggered by subject-object activities, intended as purposeful, transformative (Kaptelinin, 2014). Even though it does not directly address to the nature, function and underlying mechanisms of emotions (Kaptelinin & Nardi, 2009), it can be inferred that they may be a consequence of experience. In particular, Csikszentmihalyi (1990) identified the highest level of well-being in the condition of Flow. That means being immersed in an activity which lies in a balance between one's skills and perceived challenge.

**SFP.** (i) The activity house, as the name implies, will pursue an active home life. For a dynamic interaction, AI should focus on always improving Natural Language Processing and

Generation (NLP/G) and Computer Vision (CV) to detect and respond to emotions accordingly. (ii) As soon as the AI system connected to the activity house will be installed in people's smartphones, it will unobtrusively monitor what happens to the user by accessing the device microphone, calendar, email and messages. Thus, it can keep track of the daily routines and modulate organization and propositions accordingly. Once at home, in fact, the AI system will manage the time of the inhabitants to make them reach a preferred state of well-being, by proactively proposing positive activities as a conversational agent, and by following them through a system of environmental cameras. (iii) At least at home, people will not need to think about what to do, as AI knows it better. As an entertaining system for happiness, it could suggest relaxing with a yoga session after a tough day or to try a new recipe for a personal sense of fulfilment, and it can guide the inhabitants throughout their activities by warning them in case of wrongdoing and with visual supports. For the system to work, AI capability to learn and adapt over time to its users' characters, lifestyles, aims, increasing skills and external events, is essential. (iv) People will find in the activity house a matching support: who likes being surprised will look forward to discovering in which kind of activity they will be engaged in, while planners will see everything perfectly settled with no efforts. No wasting of time will bring to frustration: AI will allow making the most of it. (v) As a bespoke system that enables and encourages people to live an active and meaningful domestic life, it will prevent them routine organizational matters, becoming indispensable over time.

## 3.5 The hedonic house

**Literary reference.** In the hedonistic tradition, life is a quest for pleasure for pleasure's sake, while negative affect is avoided (Deci & Ryan, 2008). This kind of well-being is ephemeral in nature. As demonstrated by the treadmill metaphor (Brickman & Campbell, 1971), the constant pursuit of increased well-being always returns to hedonic neutrality: positive and negative feelings provoked by a change of condition do not last forever, and people get used to them. Like rats on a treadmill: they keep running, but their condition will never change.
**SFP.** (i) In addition to bring pleasure, the hedonic house should be attentive to what happens inside and self-sufficient, not to bother the owners in any way. Thus, CV, NLP/G, and AI applied to robotics seem a perfect fit. (ii) Home appliances would be designed to autonomously perform their duties, and to create pleasurable sensations. (iii) The house will be filled with appealing and intriguing objects, and their functioning will be an enjoyable event. For instance, a laundry machine, directly linked to the wardrobe, could autonomously manage dirty and clean laundry, deciding when to do the washing or refreshing clothes. While in operation, it will give off a fresh scent, both to please people with positive sensations and to communicate its operational status. To facilitate the autonomy of the appliances, the space will be appropriately configured, and a control room will host the necessary equipment for the autonomous updating of self-sufficient machines. In fact, as soon as people get used to their functions and positive elicitations, these will evolve, adding new functions and positive feedbacks, involving also physical modifications. (iv) Then, the house will be a personal paradise, completely at the service of its inhabitants. It will shelter

people from mundane negativity while functioning just to convey pleasure. The only thing people will have to do when they need something will be to push the right button. (v) As the next frontier of consumerism, it may create addiction.

### 3.6 The eudemonic house

**Literary reference.** In contrast with the previous one, Eudemonic Theories focus on living life in a full and deeply satisfying way, pursuing personal development and meaning (Deci & Ryan, 2008). This conceptualization does not imply that happiness coincides with only positive emotions, instead it considers well-being not as an outcome or end state but as a process of fulfilling or realizing one's true nature. To better define the characteristics of an eudemonic life and identify its key elements, different theories have been elaborated, such as self-determination theory (Ryan & Deci, 2000), well-being theory – PERMA (Seligman, 2011), or the six dimensions of psychological well-being (Ryff, 1989) including, for instance, self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth.

**SFP.** (i) The eudemonic house will be the refuge to find well-being in the most meaningful dimensions of life. Acting like a conscience, its relationship with people should be quiet and discreet. In this respect, an AI system linked with sensors to perceive human beings and enhanced surfaces to communicate with them will constitute the basic technological equipment. (ii) To make the system flourishing is a proactive and shared perceptual (Marti, 2010) behavior, i.e. when the house detects the presence of a user, it should manifest its interactive intention and start it without being prompted. (iii) The eudemonic house will be a safe place to improve one's psychical and emotional health. The AI system will – more or less directly – assesses its inhabitants' levels of psychological well-being. Any surface in the environment can be a spot for communication: portraying questions, making suggestions, and instilling reflections to increase the personal values that mostly require an intervention. The interaction is smooth and subtle, and it depends on the user whether to embrace the cue or not. Impositions will not be allowed as without voluntariness, involvement is impeded. (iv) People living in the eudemonic house will learn to advocate their free time to meaningfully improve themselves and their lives, gradually reaching a complete sense of personal fulfillment. (v) Despites its pervasiveness, too much freedom may cause users to ignore the system's inputs, as it happens with apps notifications.

## 4. Discussion

As anticipated, SFPs have been employed as theoretical experimentation to infer useful insights that could guide future design inquiries. Indeed, the scenarios are deliberately exaggerated to easily bring out the main features of the underlying psychological theories as well as the main critical points and interesting possibilities. Of course, they have the limit of being highly subjective, as they are the result of the authors' brainstorming activity. Though, our intention is to initiate a discussion, oriented to focus the attention on the topic and to open a debate in the design community towards concrete and viable solutions. A possible

outcome of this work could be submitting the SFPs – with no design clues – in didactic contexts or workshop involving scholars and professionals to further advance the discussion.

In particular, the illustrated scenarios led us to three levels of considerations.

**Design-driven considerations.** From a design perspective, what emerges is that a cross-disciplinary approach is powerful to both address topics with more meaningful insights and to trigger creativity. Unconventional starting points for the discipline can lead beyond the borders of the absurd, but also suggest interesting directions. Maybe similar exercises can be developed changing the baseline references (a classification of AI possibilities could be one) to uncover different outcomes.

While, the main issue resulting from the development of SFPs in relation to domestic AI is the relevance of spatial dimensions. In all the scenarios it affects the entire environment somehow, as it seemed to be the most natural and consistent way to respond to the brief. Otherwise, confined in a single device, AI would not exploit its full potential.

**Human-driven considerations.** The overemphasized scenarios also reveal several issues related to the human sphere. They immediately raise ethical and ontological questions like privacy, sustainability and the role of sociality – both from an interpersonal and a collective point of view – that should be addressed even before designing, as regulators are trying to do. A further reflection involves the meaning of AI as part of domestic life. Self-determination theory (Deci & Ryan, 2008) sustains that the three universal psychological needs to satisfy for our well-being are: autonomy, competence and relatedness. Yet, is not AI aiming at the opposite? If we will rely on it, we will lose control over many things and even unlearn some basic tasks, while it is unclear how relationships could be improved. Evidently, fulfilling one request has multiple downsides and a balance has to be found.

**AI-driven considerations.** AI-enhanced products or systems are not like any other predetermined object, and this is a matter we must learn how to deal with if we want meaningful experiences. Then, understanding how this technology can affect interactions, especially long-term ones, is essential.

Additionally, as intuitively suggested, both emotions and AI are multifaceted and complex domains to work with, then solutions cannot be simplistic, and a comprehensive approach is needed. In fact, in the scenarios, a univocal approach was often limiting the possibilities of the AI, while summing up different psychological and design perspectives could enrich the experience.

Eventually, if AI is going to be implemented exploiting its full potential, it will radically change the paradigm of people's life. Then, how can design drive the transition towards a beneficial outcome? Right now, it is a very open and debated question, concerning experts from different fields – i.e. Beneficial-AI movement (Tegmark, 2017) – and the design community really needs to contribute.

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