Damasio’s Concept of Homeostasis as a Useful Discourse for Human Wellbeing

Abstract
The paper discusses Damasio’s homeostasis theory and its potential connection to design. It starts with the evolution of physiological regulation from the Hippocratic theory of body humours through Claude Bernard’s milieu intérieur, Walter Cannon’s formulation of the concept of homeostasis, culminating with Damasio’s homeostasis theory emphasising conscious homeostatic feelings, besides the unconscious mechanisms of physiological control. Next, it shows the importance of Damasio’s homeostasis theory in perception, consciousness, as well as affect and wellbeing, and how it can inform the design discourse, specifically regarding emotions, embodiment, and environment. It poses questions such as whether design could be viewed as an extension of ourselves, acting as a psychic stabiliser or destabiliser. It argues that how we feel may eventually serve as a homeostatic design guide and that knowledge of homeostasis may improve wellbeing and the built environment.

Keywords
Antonio Damasio
Homeostasis
Neuroscience
Design
Wellbeing
Introduction

Contemporary neuroscience research, especially from the last 20 years and rigorous methodology have supported the scientific validity of the psychological and philosophical hypotheses addressed in design and architecture. The paper discusses the role of homeostasis and its connections to design from the perspective of neuroscientist Antonio Damasio, whose work has helped to clarify the significance of affect in cognition and decision-making. Damasio’s homeostasis theory may be the most helpful for the design discourse out of all the research he has been developing.

Homeostasis, from the Greek words for “same” and “steady,” refers to any process that living things use to actively maintain fairly stable conditions necessary for survival (Scientific American, 2000). However, the richness of the idea of homeostasis is not adequately reflected by the concept as it is traditionally conceived.

The paper, therefore, aims to examine homeostasis more broadly in light of Damasio’s theory. It argues that design can illustrate such a regulating mechanism and that knowledge of homeostasis may be pertinent to this field. It poses questions, such as how Damasio’s homeostasis theory could help us comprehend perception and emotion in design. Could design be viewed as an extension of ourselves, acting as a psychic stabiliser or destabiliser? It discusses how Damasio’s homeostasis theory broadens our understanding of preferences and logical decision-making and how designers can use feedback to produce more intelligent and effective projects. Additionally, it reaffirms the significance of feelings and emotions as basic types of cognition and their importance in promoting wellbeing.

This topic offers a distinct possibility since the relevance of the body’s homeostasis and wellbeing is becoming clearer in neuroscience (Damasio et al., 2000) and could be translated to the design areas. A discussion of Damasio’s homeostasis theory, which is a self-regulating mechanism that enables an organism to retain internal stability while adjusting to shifting internal and external circumstances, leading to wellbeing, sheds light on how it might improve design and the built environment (Damasio, 2018; Damasio, 2000).

Concluding, this discursive theoretical paper employs an epistemological approach rather than a scientific one with the hope of imagining new design possibilities by extending existing neuroscience scientific proven information to the disciplines of the design field while raising exciting questions. Its objective is to employ interdisciplinary research to open new opportunities rather than present precise solutions.
The Traditional Concept of Homeostasis

The understanding of physiological control has progressed over time. It started with the Hippocratic treatise, The Nature of Man, and the theory of the four humours (blood, phlegm, yellow bile, and black bile). According to this theory, good health is described as the balance and combination of the humours, while their imbalance and separation are the causes of disease (Hippocrates et al., 1931). The concept of homeostasis or *milieu intérieur* was first introduced by the French biologist Claude Bernard, who saw that plants’ roots grew toward the area with the most water and nutrients (Damasio, 2021; Bernard, 2013).

The term “homeostasis” and the use of control theory (feedback and feed-forward regulation) were both created by the physiologist Walter Cannon to describe how a consistent internal environment is maintained (Cannon, 1929). For the homeostasis concept, this evolution was crucial. However, these traditional concepts of homeostasis typically fail to mention two different types of internal milieu parameter management, just mentioning the unconscious physiological regulation that happens automatically without the organism’s awareness. For example, when it is hot, we sweat (Wagner & Silber, 2004).

The Concept of Homeostasis According to Damasio

The fundamental contribution of Damasio to previous homeostasis theories was the emphasisation of a second regulatory mechanism in humans and most animals that involves feelings (Damasio & Carvalho, 2013; Damasio, 2021), especially those known as homeostatic feelings, which are the simplest ones, dealing with significant situations of life regulation. Examples include hunger, thirst, pain, desire, wellbeing, pleasure, and malaise. They are associated with affects: they have a valence or quality (positive or negative) and intensity or arousal (weak or strong) that determine whether they have a pleasant (joyful, energetic, relaxed) or unpleasant aspect (disagreeable, painful, sick) and the sum of these emotional dimensions is instructive because it provides a concise assessment as to whether the organism’s current state is conducive to sustained health or flourishing, in the case of wellbeing, or whether it needs to be corrected, in the case of hunger and malaise (Damasio & Damasio, 2016; Damasio, 2022, 1:18).

Damasio’s Concept of Homeostasis on Perception

According to Damasio, our perception is divided into three main parts. The first is the perception of the organism’s interior, called interoception (the degree of contraction of visceral muscles, heart rate, and levels of metabolites in the internal milieu, among others). The interoceptive process begins with peripheral sensing of homeostatic changes, whether visceral or humoral, producing subjective and
conscious feelings called homeostatic (Carvalho & Damasio, 2021). The second is the perception of the organism's exterior, exteroception, and is perceived via the exteroceptive senses (smell, taste, touch, hearing, and sight), which produce emotions. They are perceived but not felt directly as feelings. Nevertheless, they may lead to what is called emotional feelings, becoming conscious. So, emotions don’t contain intrinsic valence, although they are commonly labelled with valences generated from body states. They “borrow” the labels first developed as a component of homeostatic regulation (Damasio & Carvalho, 2013).

In between those two is proprioception, which concerns our ability to sense how striated muscles are as they contract and how they move skeletal parts. The body actively adapts itself to facilitate the best interaction possible with the environment. For example, the eyeball, head, and neck move into optimal positions to track objects effectively (Damasio, 2022, 1:18).

Therefore, for Damasio, perception consists of receiving and acting on messages from the environment. He emphasises the body and the physical and sociocultural environments in which it exists, as they are both necessary for regulation (Damasio, 2005).

Damasio’s Concept of Homeostasis on Consciousness

Damasio believes that consciousness starts with homeostatic feelings. For example, when we feel hunger and pain, we are automatically conscious of those states; that is where their value resides. In addition, any form of experience or thought accompanied by one of those feelings will also be automatically conscious (Damasio, 2022, 1:18). So, according to Damasio’s Somatic Marker Hypothesis, higher cognition processes such as rational choices and preferences, use the valence and intensity of feelings first developed as a component of homeostatic regulation; therefore, feelings are basic forms of cognition, influencing reason and decision-making (Damasio, 2005).

When a situation is present, memory performance is enhanced by mental states infused with positive or negative valences, incentives, or disincentives, and appealing or aversive conditions (Damasio & Damasio, 2016). Then, the conscious feeling of homeostatic regulation interacts with cultural group tunings, such as complex affects, drives, motivations, and emotions tailored through evolution and individual sociocultural experiences (Damasio et al., 2000).
Damasio’s Concept of Homeostasis on Affect and Wellbeing

According to Damasio, as perception depends not only on exteroception but also on interoception and proprioception, even sad external stimuli, such as music, for example, may lead to a pleasurable response and wellbeing. He explains that this might depend on whether there was an initial homeostatic imbalance and if the sad music could successfully correct it. He claims there is an interaction between personality, social context, learned associations, and mood in pleasurable responses to sad music, which can be understood in terms of homeostasis regulation (Sachs et al., 2015).

For example, if listening to sad music does not make one feel good, maybe there may not have a homeostatic imbalance, or the musical stimulus did not correct the imbalance. If listening to sad music leads to wellbeing, there might have been a homeostatic imbalance which was corrected because the music was aesthetically pleasing, engaged the imagination or specific memories, made the person feel understood or emotionally secure, diverted attention from current issues or stimulated intense emotions, among others (Sachs et al., 2015).

How Damasio's Concept of Homeostasis Can Inform the Design Discourse

Following Damasio’s thought, one of the main messages of the paper is the importance of understanding emotions in design. Don Norman proposed one of the most significant theories of emotional design. He divides the emotional system into three primary levels, heavily connected, which combine to form the entire product experience. The first is the visceral level, referring to the first impression of a design and is related to non-conscious, quick affective reactions. The second is the behavioural level, the practical and functional aspects of the experience, largely subconscious, of the product in use. The third is the reflective level which considers a product's rationalisation and intellectualisation, the only conscious level (Norman, 2004).

For Norman, as for Damasio, emotions are usually underrated, but they affect how we feel, behave, and think. So, emotion and cognition can't be separated, always affecting each other. In his book Emotional Design, Don Norman mentions Damasio’s work with people with brain injuries, impaired emotional systems, and decision-making, as well as Damasio’s Somatic Marker Hypothesis (Norman, 2004, p.12).

Nevertheless, maybe it would be possible to re-think the diagram initially presented by Don Norman, proposing a feedback loop directly connecting the visceral with the reflective level, now knowing through Damasio’s work the extent of the connection between emotions and rational thoughts and how the latter borrows the valence of the former Fig. 2.
Another critical message of the paper is the importance Damasio gives to the body and the environment in which the body is placed, regarding perception, consciousness, affect, and wellbeing. One of the main theories of perception used in the design field is Gibson's ecological approach, developed during the 60s and 70s. He defined visual perception as the involvement of the entire organism as it moves through its surroundings (Gibson, 2014). Later, Francisco Varela, Evan Thompson, and Eleanor Rosch introduced the term ‘enactivism’ (Foglia & Wilson, 2013), related to ‘enaction’, which is how a subject of perception creatively matches its actions to the requirements of its situation (Protevi, 2006).

Evan Thompson also worked with the philosopher Alva Noë who claims that perceiving is both a kind of action and a way of thinking about the world. For him, perceptual awareness depends on the perceiver having "sensorimotor knowledge", an implicit comprehension of how sensory stimulus varies with movement (Noë, 2006). He says that “perception is presence and absence through time" because it depends on our sensory-motor and conceptual skills (previous knowledge), understanding that is also responsiveness to how things feel and matter to us (Noë, 2012).

All these theories resonate with Damasio’s work, emphasizing embodiment and environment. However, adding to that, for Damasio, subjectivity might depend considerably on the changes in the body state during and just before the processes leading to an object’s perception. So a representational object, a responding organism, and a state of self-evolving due to the organism’s response to the object are encompassed concurrently in working memory and attended, affecting how we feel and think (Damasio, 2005). The neuroscientist Anil Seth adds to that by stating that perception depends as much, if not more, on controlling regulations as on the signals coming into the brain from the outside world (Seth, 2017).

So, Damasio’s work suggests that the perception of an object is never static, as it depends heavily on homeostatic processes and interoception, besides proprioception and exteroception. It also suggests that how we feel and think about a design may not be as objective as we thought, and they might even differ from each other, guiding behaviour unconsciously (Bechara et al., 1997). We always think about how design affects our wellbeing. However, in fact, wellbeing might start in the body of the individual and what it is capable of perceiving in terms of interoception. According to the neuroscientist Lisa Barrett, “We intuitively feel that what we see and hear influences how we feel, but it’s mostly the other way around: how you feel alters what you see and hear” (Campbell, 2017).
In 1996, the philosopher Richard Shusterman introduced a theoretical framework he named “somaesthetics” through the compounding of “soma”, an expression derived from the Greek word for body, and “aesthetics”, from aesthesis, meaning ‘sensory perception’ (Shusterman, 1999). It led to the appearance of soma-based design, which includes first-person movement-based designs and methodologies focusing primarily on the aesthetics of those experiences, to examine connections between positive or negative subjective understandings in a determined environment. It considers the user’s cultural background, habits, and values, unlike most user-centred design projects, which are created from a third-person perspective (Höök et al., 2017).

Paul Dourish, a computer scientist and anthropologist, also contributed to the exploration of phenomenology in design, especially regarding human-computer interaction, by bringing sociological, anthropological, and cultural studies understandings of human activity to the design of technological systems in an effort that he calls “embodied interaction”. He states that our body, considering its culture, social norms, and practices, influences technological embodiment and actively shapes our experiences rather than being passive receivers. For example, our physical actions, typing on a keyboard or swiping on a touch screen, determine how we interact with technology (Dourish, 2001).

In 2015, the interactive designer Jelle Stienstra published an article inviting us to re-think technology, which frequently reduces people to shared characteristics, diving into generalisations. He claims that user-model-inspired design strategies and products frequently tend to find the best solutions for most people rather than concentrating on their unique subjective experiences, embodied skills, physical characteristics, worldviews, and potential behaviours, adapted to the context’s open and dynamic nature. So, he states the need for assessment strategies that promote phenomenology-inspired design thinking, reevaluating the discrete (objective) measures and metric systems and making them compatible with the nuanced (subjective) and always-evolving aspects of life (the continuous) to develop products that embrace diversity and a rich and complicated social environment (Stienstra, 2015).

Going back to Damasio’s concept of homeostasis and its impact on affect and wellbeing, it is possible to suggest that design, like art, enables a range of emotions to be felt and communicated subtly without language and may have the power to express, regulate, and amplify emotions. Design, therefore, could be seen as an extension of ourselves, acting as a psychic stabiliser or destabiliser. In this case, the relationship between the user’s personality, background, context, and mood may also, be more important than we thought in contributing to the enjoyment of a design Fig. 3. Soma-based design and Dourish and Stienstra’s views were a great movement in that direction, but maybe mood and personality could still be considered in the design process.

In addition, understanding that ongoing physical and psychological homeostatic imbalances may also influence the perception and affective state of a design means that they can change at any time Fig. 4. So, the question might be whether it would be conceivable to create open-ended, homeostasis-based designs constantly informed by these changes to achieve wellbeing. If feelings influence emotions and, nowadays, emotions can be captured and measured to a certain extent with biodata measurements, Quantified Self practices, and AI, would that be possible? (Macruz et al., 2021).
Designers are increasingly adopting biofeedback systems during the design phases, using biometric data (heart rate, breathing patterns, and muscle tension), micro-facial expressions and AI, eye trackers, skin conductance response (SCR), and brain waves. However, they usually use those during the design proposal but rarely after the design is ready, embracing homeostatic changes and body states transformations. In addition, the implementation of enhanced cross-modal perception and information processing, involving information obtained from more than one modality, typically sensory and multisensory integration, especially between touch and vision, is little explored. So, how could designers use other body-state feedback besides biodata to produce more intelligent and performative spaces, products, and services?

Fig. 3 How sad stimuli can become pleasurable, leading to positive feelings. Diagram adapted from Sachs, M. E., Damasio, A., & Habibi, A. (2015). The pleasures of sad music: a systematic review. Frontiers in human neuroscience, 9, 404, 5.

Fig. 4 Two examples of homeostatic imbalance resulting in pleasurable responses. Diagram adapted from Sachs, M. E., Damasio, A., & Habibi, A. (2015). The pleasures of sad music: a systematic review. Frontiers in human neuroscience, 9, 404, 8.
Furthermore, it is important to consider that there are different thresholds to homeostatic feelings depending on the person and even for the same individual in different moments. Meditative practices and mindfulness, for instance, focus on the body, interoceptive senses, and homeostatic feelings. Through that, a person can influence these states, changing thresholds. The change in the interoceptive side drags on some changes in the exteroceptive one, modifying psychological states (Damasio, 2022, 1:18). For this reason, designers could pay more attention to internal stimuli, how they affect what we perceive and feel and consider whether there is a way for design to influence these states, changing thresholds to be more open to exteroceptive inputs, for example. Understanding homeostasis and how it works is crucial because it may influence the design process more deeply than we think.

Conclusions

Contemporary neuroscience and its rigorous methodologies support theories related to architecture and design. The paper discusses the role of homeostasis according to Antonio Damasio and its potential relation to design. It begins with the development of homeostasis across time, culminating with Damasio's homeostasis theory which calls attention to conscious homeostatic feelings, apart from the traditional unconscious mechanisms of physiological control. Next, it shows the importance of Damasio's homeostasis theory in perception, consciousness, affect, and wellbeing. Lastly, it discusses how it can inform the design discourse, specifically regarding emotions, embodiment, and environment.

The paper has potential as a line of inquiry since it discusses Damasio’s theories, which are supported by an extensive body of scientifically proven research that can inform the design discourse. Although neuroscience is starting to demonstrate the significance of the body’s homeostasis and emotions, the paper raises awareness of the need for designers to consider the implications of homeostasis theory in their daily work practices. How we feel may eventually serve as a homeostatic design guide.