




Human-Automation Interaction pp 193–211

Homeodynamic Environments, Homeodynamic Products and Intelligent Biointerfaces: Affective and Pleasurable Design to Maintain and Restore Human Homeostasis

[Rachel Zuanon](#) , [Claudio Lima Ferreira](#) & [Evandro Zigiatti Monteiro](#)

Chapter | [First Online: 15 December 2022](#)

89 Accesses

Part of the [Automation, Collaboration, & E-Services](#) book series (ACES, volume 12)

Abstract

From the perspective of homeodynamics (ROSE 1998), life regulation processes, and the resulting balance achieved, unfold in a dynamic flow and in continuous transformation. That differs from the possible idea of a fixed and immutable balance. Prominent within this perspective is the concept of “Homeodynamic Environments and Products,” coined by the co-founders of the DASMind [Design, Art, Space and Mind]—UNICAMP Transdisciplinary and Cooperative Research, Innovation and

Outreach Network, also authors of this chapter. This concept, in dialogue with intelligent biointerfaces, proposes the affective and pleasurable design of environments and products aimed at maintaining and restoring human homeostasis. Therefore, they draw on a transdisciplinary and complex approach to understand the conception, design, planning, development and implementation of architectural and urban environments, as well as physical and/or digital products, in deep synergy with individuals' body-mind-spirituality sphere. Environments and objects become crucial elements in the body's continuous and dynamic internal adjustment process. As preventive and restorative for health and well-being, affective and pleasurable homeodynamic environments and products are not merely designed as passive elements, but rather to act consistently and dynamically on the human organism.

Keywords

Homeodynamic architectural environments

Homeodynamic urban environments

Homeodynamic physical and/or digital products

This is a preview of subscription content, [access via your institution.](#)

▼ Chapter

USD 29.95

Price excludes VAT (Brazil)

- DOI: 10.1007/978-3-031-10788-7_11
- Chapter length: 19 pages

- Instant PDF download
- Readable on all devices
- Own it forever
- Exclusive offer for individuals only
- Tax calculation will be finalised during checkout

Buy Chapter

▼ eBook

USD 149.00

Price excludes VAT (Brazil)

- ISBN: 978-3-031-10788-7
- Instant PDF download
- Readable on all devices
- Own it forever
- Exclusive offer for individuals only
- Tax calculation will be finalised during checkout

Buy eBook

▼ Hardcover Book

USD 199.99

Price excludes VAT (Brazil)

- ISBN: 978-3-031-10787-0
- Dispatched in 3 to 5 business days
- Exclusive offer for individuals only
- Free shipping worldwide
[Shipping restrictions may apply, check to see if you are impacted.](#)
- Tax calculation will be finalised during checkout

Buy Hardcover Book

[Learn about institutional subscriptions](#)

Notes

1. The DASMind [Design, Art, Space and Mind] | UNICAMP Transdisciplinary and Cooperative Research, Innovation and Outreach Network is dedicated to theoretical and applied research in the transdisciplinary fields of architecture, urbanism, design and art, related to the areas of

cognitive sciences, neurosciences, artificial intelligence, bioengineering, health sciences and education. Further information at:

<https://www.iar.unicamp.br/dasmind> [107].

2. The ideal homeodynamic range “is not absolute – it varies according to the context in which an organism is situated” [14]. Near the ends of the homeodynamic range, “the viability of living tissue declines, and the risk of disease and death increases; in a certain segment of the range, however, living tissue thrives and functions more efficiently and economically. Functioning close to the range ends, even for only brief periods, is actually an important advantage in unfavorable living conditions, but it is still preferable for states of life to function close to the efficient interval” [14].
3. The circadian rhythm acts like a biological clock that, even in the absence of light, keeps our neurophysiological functions minimally regulated for an approximate period of 24 h [105].

References

1. Kowaltowski DCC (1998) Aesthetics and self-built houses: an analysis of a brazilian setting. *Habitat Internacional* 22(3):299–312
2. Cavalcanti PB, Azevedo GAN, Duarte CR (2007) *Humanização, imagem e caráter dos espaços de*

saúde. Cadernos PROARQ 11:7–10

3. Lukiantchuki MA, Souza GB (2010) Humanização da arquitetura hospitalar: entre ensaios de definições e materializações híbridas.

Arquitextos 118(1). Available at:

<https://vitruvius.com.br/index.php/revistas/read/arquitextos/10.118/337>. Last Accessed on 26 Jan 2021

4. Leitner AD, Pina SM (2020) Arquitetura sob a ótica da humanização em ambientes de quimioterapia pediátrica. Ambiente Construído 20(3):179–198
-

5. Barros R, Kowaltowski Doris CCK (2013) Do projeto urbano ao detalhe construtivo: “a pattern language” finalmente traduzida.

Vitruvius 137(1). Available at:

<https://vitruvius.com.br/index.php/revistas/read/resenhasonline/12.137/4734>. Last Accessed on 26 Jan 2021

6. Malard ML (1993) Os objetos do cotidiano e a ambiência. In: 2º Encontro Nacional de Conforto no Ambiente Construído, vol 2, pp 359–361
-

7. Pallasmaa J (201.) A imagem corporificada— imaginação e imaginário na arquitetura. Bookman, Porto Alegre
-

8. Pol E (1992) Seis reflexiones sobre los procesos psicologicos en el uso, organizacion y evaluacion del espacio. In: Amérigo M, Aragonés JI, Corraliza J (eds) El comportamiento en el medio natural y construido. Junta de Extremadura, Badajoz

9. Thibaud JP, Duarte CR (2013) Por une écologie sociale de la ville sensible: ambiances urbaines en partage. MetisPresses, Genève

10. Thibaud JP (2004) O ambiente sensorial das cidades: para uma abordagem de ambiências urbanas. In: Tassara ET, Rabinovich EP, Guedes MC (eds) Psicologia e ambiente, pp 347–361. EDUC, Sao Paulo

11. Tuan YF (1980) Topofilia: um estudo da percepção, atitudes e valores do meio ambiente. DIFEL, Sao Paulo

12. Tuan YF (2005) Paisagens do Medo. Unesp, Sao Paulo

13. Kohlsdorf G, Kohlsdorf ME (2017) Ensaio sobre o desempenho morfológico dos lugares. FRBH, Brasília

14. Damásio AR (2011) *E o cérebro criou o Homem*. Companhia da Letras, Sao Paulo

15. Damásio AR (2004) *Em busca de Espinosa: prazer e dor na ciência dos sentimentos*. Companhia da Letras, Sao Paulo

16. Bear MF, Connors BW, Paradiso MA (2017) *Neurociências—Desvendando o sistema nervoso*. 4th ed. Artmed, Sao Paulo

17. Cannon WB (1929) Organization for physiological homeostasis. *Physiol Rev* 9:339–443

18. Silverthorn DU (2003) *Fisiologia Humana: uma abordagem integrada*, 2nd ed. Manole, Sao Paulo

19. Zuanon R, Ramos MO, Lima CF, Monteiro EZ, Gallo H (2019) Memories and brain maps: representations of fear, risk and insecurity in downtown areas. *Lect Notes Comput Sci* 11581:509–523

20. Rose S (1998) *Lifelines: biology beyond determinism*. Oxford University Press, Nova York

21. Aboulafia A, Bannon LJ (2004) Understanding affect in design: an outline conceptual framework. *Theor Issues Ergonomics Sci* 5(1):4–15

22. Blythe MA, Overbeeke K, Monk AF, Wright PC (eds) (2003) *Funology: from usability to enjoyment*. Kluwer Academic Publishers, Dordrecht

23. Brave S, Nass C (2003) Emotion in human-computer interaction. In: Jacko J, Sears A (eds) *The human computer interaction handbook: fundamentals, evolving technologies and emerging applications*. Lawrence Erlbaum Associates, Mahwah, pp 81–96

24. Carroll JM (2004) Beyond fun. *Interactions* 11(4):38–40

25. Chapman J (2005) *Emotionally durable design: objects, experiences and empathy*. Earthscan, London

26. Crossley L (2003) Building emotions in design. *Des J* 6(3):35–45

27. Desmet PMA, Hekkert P (2002) The basis of product emotions. In: Green W, Jordan P (eds)

Pleasure with products, beyond usability.

Taylor & Francis, London, pp 60–68

28. Desmet PMA, Porcelijn R, Van Dijk MB (2005) HOW to design WOW: introducing a layered-emotional approach. In: Proceedings of international conference on designing pleasurable products and interfaces, pp 71–90. Technical University of Eindhoven, Eindhoven

29. Forlizzi J, Disalvo C, Hannington B (2003) On the relationship between emotion, experience, and the design of new products. *Des J* 6(2):29–38

30. Green WS, Jordan PW (eds) (2002) *Pleasure with products: beyond usability*. Taylor and Francis, London

31. Hancock PA, Pepe AA, Murphy LL (2005) Hedonomics: the power of positive and pleasurable ergonomics. *Ergonomics Design* 13(1):8–14

32. Hassenzahl M (2004) Emotions can be quite ephemeral. We cannot design them. *Interactions* 11(5):46–48

33. Helander MG, Khalid HM, Tham MP (2004) Proceedings of the international conference on

affective human factors design. ASEAN

Academic Press, London

34. Helander MG, Tham MP (2003) Hedonomics; affective human factors design. *Ergonomics* 46:1269–1271

35. Jordan PW (1998) Human factors for pleasure in product use. *Appl Ergon* 29(1):25–33

36. Jordan PW (1999) Pleasure with products: human factors for body, mind and soul. In: Green WS, Jordan PW (eds) *Human factors in product design: current practice and future trends*. Taylor and Francis, London, pp 206–217

37. Jordan PW (ed) (2000) The four pleasures: a framework for pleasures in design. In: *Proceedings of the conference on pleasure based human factors design*. Philips Design, Groningen

38. Khalid HM (2004) Conceptualizing affective human factors design. *Theor Issues Ergon Sci* 5(1):1–3

39. Khalid HM (2006) Embracing diversity in user needs for affective design. *Appl Ergon* 37:409–418

40. Khalid HM, Helander MG (2004) A framework for affective customer needs in product design. *Theor Issues Ergonomics Sci* 5(1):27–42

41. Mcdonagh D, Lebbon C (2000) The emotional domain in product design. *Des J* 3(1):31–43

42. McDonagh D, Hekkert P, Van Erp J, Gyi D (eds) (2004) *Design and emotion: the experience of everyday things*, pp 317–32. Taylor and Francis, London

43. Mugge R, Schoormans JPL, Schifferstein HNJ (2008) Product attachment: design strategies to stimulate the emotional bonding to products. In: Schifferstein HNJ, Hekkert P (eds) *Product experience*. Elsevier Science Publishers, London, pp 425–439

44. Nagamachi M (2001) *Research on kansei engineering: selected papers on kansei engineering*. Nakamoto Printing, Hiroshima

45. Norman DA (2004) *Emotional design: Why do we love (or hate) everyday things*. Basic Books, New York

46. Picard RW (1997) *Affective computing*. MIT Press, Cambridge

47. Panksepp J (1991) Affective neuroscience: a conceptual framework for the neurobiological study of emotions. In: Strongman KT (ed) International review of studies of emotion, pp 58–99. Wiley, Chichester

48. Panksepp J (1998) Affective neuroscience. Oxford University Press, New York

49. Damásio A (1999) The feeling of what happens: body and emotion in the making of consciousness. Harcourt Brace & Company, San Diego

50. Damásio A (2000) O mistério da consciência. Companhia das Letras, Sao Paulo

51. Damásio A (2021) O erro de Descartes: emoção, razão e cérebro humano. 3rd edn. Companhia das Letras, Sao Paulo

52. Damásio A (2012) Self comes to mind: constructing the conscious brain. Vintage Books, New York

53. Damásio A (2018) A estranha ordem das coisas: as origens biológicas dos sentimentos e da cultura. Companhia das Letras, Sao Paulo

54. Peper M, Markowitsch HJ (2001) Pioneers of affective neuroscience and early concepts of the emotional brain. *J History Neurosci Basic Clin Perspect* 10(1):58–66

55. Lundy-Ekman L (2004) *Neurociência: fundamentos para a reabilitação*, 2nd edn. Elsevier, Rio de Janeiro

56. Watt D (2007) Toward a neuroscience of empathy: integrating affective and cognitive perspectives. *Neuropsychanalysis: Interdis J Psychoanal Neurosci* 9(2):119–140

57. Berridge KC, Kringelbach ML (2008) Affective neuroscience of pleasure: reward in humans and animals. *Psychopharmacology* 199:457–480

58. Lent R (2008) *Neurociência da Mente e do Comportamento*. Guanabara Koogan, Rio de Janeiro

59. Dalgleish T, Dunn BD, Mobbs D (2009) Affective neuroscience: past, present, and future. *Emot Rev* 1(4):355–368

60. Panksepp J, Asma S, Curran G, Gabriel R, Greif T (2012) The philosophical implications of

affective neuroscience. *J Conscious Stud* 19(3–4):6–48

61. Armony J, Vuilleumier P (eds) (2013) *The Cambridge handbook of human affective neuroscience*. Cambridge University Press, Cambridge

62. Adolphs R (2017) How should neuroscience study emotions? By distinguishing emotion states, concepts, and experiences. *Soc Cognitive Affective Neurosci* 12(1):24–31

63. Adolphs R, Anderson DJ (2018) *The neuroscience of emotion: a new synthesis*. Princeton University Press, Princeton

64. Eberhard J, Patoine B (2004) Architecture with the brain in mind. *Cerebrum* 6(2):71–84

65. Zeisel J (2006) *Inquiry by design: environment/behavior/neuroscience in architecture, interiors, landscape, and planning*. W. W. Norton, New York

66. Anthes E (2009) Building around the mind. *Sci Am Mind* 20(2):52–55

67. Mallgrave H (2010) *The architect's brain*. Wiley-Blackwell, United Kingdom
-
68. Arbib M (2012) *Brains, machines and buildings: towards a neuromorphic architecture*. *Intell Buildings Int* 4(3):147–168
-
69. Pallasmaa J, Mallgrave H, Arbib M (2013) *Architecture and neuroscience*. TapioWirkkala Rut Bryk Foundation, Finland
-
70. Eberhard J (2014) *Neuroscience and architecture of health care facilities*. In: 2nd workshop neuroscience and architecture. Woods Hole, Massachusetts
-
71. Zuanon R (2014) *Design-neuroscience: interactions between the creative and cognitive processes of the brain and design*. *Lect Notes Comput Sci* 8510:167–174
-
72. Robinson S, Pallasmaa J (2015) *Mind in architecture neuroscience, embodiment, and the future of design*. MIT Press, Massachusetts
-
73. Ellard C (2015) *Places of the heart: the psychogeography of everyday life*. Bellevue Literary Press, New York
-

74. Choi Y, Kim M, Chun C (2015) Measurement of occupants' stress based on electroencephalograms (EEG) in twelve combined environments. *Build Environ* 88:65–72

75. Dance A (2017) The brain within buildings. *Proc Natl Acad Sci* 114:785–787

76. Lacuesta R, Garcia L, García-Magariño I, Lloret J (2017) System to recommend the best place to live based on wellness state of the user employing the heart rate variability. *IEEE Access* 5:10594–10604

77. Tilley S, Neale C, Patuano A, Cinderby S (2017) Older people's experiences of mobility and mood in an urban environment: a mixed methods approach using electroencephalography (EEG) and interviews. *Int J Environ Res Public Health* 14(2):151

78. Zuanon R, Faria BAC (2018) Landscape design and neuroscience cooperation: contributions to the non-pharmacological treatment of Alzheimer's disease. *Lect Notes Comput Sci* 10917:353–374

79. Zuanon R, Oliveira MRS, Gallo H, Ferreira CL (2018) Drawing memories: intersections

between the sites of memory and the memories of places. Lect Notes Comput Sci 10917:375–391

80. Faria BAC, Zuanon R (2019) Architecture-neuroscience cooperation: project recommendations to therapeutic gardens design for the non-pharmacological treatment of individuals with Alzheimer's disease. Lect Notes Comput Sci 11582:181–199

81. Monteiro EZ, Ferreira CL, Zuanon R, Oliveira MRS, Bernardini SP (2019) Architecture in mind: elderly's affective memories and spatial perceptions of a downtown area. Lect Notes Comput Sci 11582:306–321

82. Zuanon R, Oliveira MRS, Ferreira CL, Monteiro EZ (2020) Memória, emoções e sentimentos: impactos na percepção espacial e afetiva da área urbana central de Campinas. DAT J 5:4–21

83. Ulrich R (1983) Aesthetic and affective response to natural environment. Behav Nat Environ 6:85–125

84. Ulrich R (1984) View through a window may influence recovery from surgery. Science 224(4647):420–421

85. Ulrich R (1992) How design impacts wellness. *Healthcare Forum J* 30:20–25
-
86. Ulrich R (2002) Health benefits of gardens in hospitals. in: international exhibition. In: Paper for conference plants for people, pp 1–10. Flórida
-
87. Wilson EO (1984) *Biophilia*. Harvard University Press, Massachusetts
-
88. Kaplan R, Kaplan S (1989) *The experience of nature: a psychological perspective*. Cambridge University Press, New York
-
89. Ulrich R, Simons R, Losito B, Fiorito E, Miles M, Zelson M (1991) Stress recovery during exposure to natural and urban environments. *J Environ Psychol* 3:201–230
-
90. Marcus CC (2003) Healing havens. *Landscape Archit Magaz* 93(8):84–109
-
91. Rogers K (2012) The biophilia factor. In: Rogers K (eds) *Out of nature: Why drugs from plants matter to the future of humanity*, pp 49–72. University of Arizona Press, Tucson
-
92. Kalvaitis D, Monhardt R (2015) Children voice biophilia: the phenomenology of being in love

with nature. *J Sustain Educ* 9:1–21

93. Hand KL, Freeman C, Seddon PJ, Recio MR, Stein A, Heezik Y (2017) The importance of urban gardens in supporting children's biophilia. In: *Proceedings of the national academy of sciences of the United States of America* 114(2):274–279
-
94. Silveira BB, Felipe ML (2019) *Ambientes restauradores: conceitos e pesquisas em contextos de saúde*. UFSC, Florianópolis
-
95. Zuanon R (2011) *Bio-Interfaces: designing wearable devices to organic interactions*. In: Ursyn A (ed). *Biologically-inspired computing for the arts: scientific data through graphics*, pp 1–17. IGI Global, Pennsylvania
-
96. Zuanon R (2013) *Designing wearable bio-interfaces: transdisciplinary articulations between design and neuroscience*. *Lect Notes Comput Sci* 8009:689–699
-
97. Zuanon R (2020) *Biointerfaces inteligentes: transdisciplinaridade e transversalidade em arte-arquitetura-design-ciência-tecnologia*. In: Oliveira HC, Chitolina MR, Santos NC (eds) *Transdisciplinaridade nas Ciências e nas Artes*, pp 235–248. PPGART-UFMS, Santa Maria
-

98. Morin E (1999) *La tête bien faite. Repenser la réforme—Réformer la pensée*. In: *Collection L Histoire Immediate*, p 18, Éditions du Seuil, Paris
-
99. Morin E (2005) *Introdução ao pensamento complexo*. Sulina, Porto Alegre
-
100. Ferreira CL (2011) *A obra de design brasileiro dos Irmãos Campana sob o olhar das relações complexas*. Doctoral thesis, Instituto de Artes, Universidade Estadual de Campinas-UNICAMP, Campinas, Brazil
-
101. Ferreira CL (2014) *O design contemporâneo brasileiro e sua complexidade*. Livronovo, Aguas de Sao Pedro
-
102. Ferreira CL, Lona MT, Chimirra V (2014) *Irmãos Campana: A concepção projetual no design brasileiro*. In: Paraguai L, Zuanon R (eds) *Design, arte e tecnologia—DAT 9, vol 1*, pp 31–49. Rosari, Sao Paulo
-
103. Santos FC, Pimentel LC (2020) *Manual do Estilo de Vida*. nVersos, Sao Paulo
-

104. Freire RA, Monteiro EZ, Ferreira CL (2018) Challenges of open design—from theory to practice. *DATJ* 3:353–391
-
105. Legates T, Fernandez D, Hattar S (2014) Light as a central modulator of circadian rhythms, sleep and affect. *Nat Rev Neurosci* 15:443–454
-
106. Monteiro EZ, Turczyn DT (2018) The five categories of solá-morales as a legacy for reading the urban landscape. *Archit City Environ* 12:73–90
-
107. The DASMind [Design, Art, Space and Mind] | UNICAMP Transdisciplinary and Cooperative Research, Innovation and Outreach Network Homepage,
<https://www.iar.unicamp.br/dasmind>

Author information

Authors and Affiliations

**State University of Campinas [UNICAMP],
Campinas, 13083-889, Brazil**

Rachel Zuanon, Claudio Lima Ferreira & Evandro
Ziggiatti Monteiro

Corresponding author

Correspondence to [Rachel Zuanon](#).

Editor information

Editors and Affiliations

**School of Industrial Engineering, Purdue
University, West Lafayette, IN, USA**

Vincent G. Duffy

**Human-Computer Interaction Center, Aachen
University, Aachen, Nordrhein-Westfalen,
Germany**

Martina Ziefle

**Department of Industrial Engineering, Tsinghua
University, Beijing, China**

Pei-Luen Patrick Rau

**International School of Technology and
Management, Feng Chia University, Taiwan,
China**

Mitchell M. Tseng

Rights and permissions

[Reprints and Permissions](#)

Copyright information

© 2023 Springer Nature Switzerland AG

About this chapter

Cite this chapter

Zuanon, R., Ferreira, C.L., Monteiro, E.Z. (2023).
Homeodynamic Environments, Homeodynamic Products
and Intelligent Biointerfaces: Affective and Pleasurable
Design to Maintain and Restore Human Homeostasis. In:
Duffy, V.G., Ziefle, M., Rau, P.L.P., Tseng, M.M. (eds)
Human-Automation Interaction. Automation,

Collaboration, & E-Services, vol 12. Springer, Cham.

https://doi.org/10.1007/978-3-031-10788-7_11

[.RIS](#) [.ENW](#) [.BIB](#)

DOI

https://doi.org/10.1007/978-3-031-10788-7_11

Published	Publisher Name	Print ISBN
15 December 2022	Springer, Cham	978-3-031- 10787-0

Online ISBN	eBook Packages
978-3-031- 10788-7	Intelligent Technologies and Robotics Intelligent Technologies and Robotics (R0)

Not logged in - 45.160.250.190

Not affiliated

SPRINGER NATURE

© 2023 Springer Nature Switzerland AG. Part of [Springer Nature](#).