



EDITED BY
ROBERT ALLEN

BULLETPROOF FEATHERS

How Science Uses Nature's Secrets to Design Cutting-Edge Technology



Bulletproof Feathers How Science Uses Natures Secrets To Design Cutting Edge Technology

Matyas Gutai



Bulletproof Feathers How Science Uses Nature's Secrets To Design Cutting Edge Technology:

Bulletproof Feathers Robert Allen, 2010 Fabrics that are not only stain resistant but actually clean themselves Airplane wings that change shape in midair to take advantage of shifts in wind currents Hypodermic needles that use tiny serrations to render injections virtually pain free Though they may sound like the stuff of science fiction in fact such inventions represent only the most recent iterations of natural mechanisms that are billions of years old the focus of the rapidly growing field of biomimetics Based on the realization that natural selection has for countless eons been conducting trial and error experiments with the laws of physics chemistry material science and engineering biomimetics takes nature as its laboratory looking to the most successful developments and strategies of an array of plants and animals as a source of technological innovation and ideas Thus the lotus flower with its waxy water resistant surface gives us stainproofing the feathers of raptors become transformable airplane wings and the nerve deadening serrations on a mosquito's proboscis are adapted to hypodermics With **Bulletproof Feathers** Robert Allen brings together some of the greatest minds in the field of biomimetics to provide a fascinating at times even jaw dropping overview of cutting edge research in the field In chapters packed with illustrations Steven Vogel explains how architects and building engineers are drawing lessons from prairie dogs termites and even sand dollars in order to heat and cool buildings more efficiently Julian Vincent goes to the very building blocks of nature revealing how different structures and arrangements of molecules have inspired the development of some fascinating new materials such as waterproof clothing based on shark skin Tomonari Akamatsu shows how sonar technology has been greatly improved through detailed research into dolphin communication Yoseph Bar Cohen delves into the ways that robotics engineers have learned to solve design problems through reference to human musculature Jeannette Yen explores how marine creatures have inspired a new generation of underwater robots and Robert Allen shows us how cooperative behavior between birds fish and insects has inspired technological innovations in fields ranging from Web hosting to underwater exploration A readable yet authoritative introduction to a field that is at the forefront of design and technology and poised to become even more important in the coming decades as population pressures and climate change make the need for efficient technological solutions more acute **Bulletproof Feathers** offers adventurous readers a tantalizing peek into the future by way of our evolutionary past

Architecture Follows Nature-Biomimetic Principles for Innovative Design Ilaria Mazzoleni, 2013-03-21 This full color volume proposes an innovative methodology that uses the functional aspects of nature to inspire improvements in building design and form encouraging designers to apply biomimetic principles to architectural processes The book focuses on the analysis of various animal skins translating the principles of communication thermoregulation water balance and protection into the built environment Illustrating how biomimetic principles can create a more sustainable way of building this is the first time the author's new methodology as well as the 12 case studies has been published

Regenerative Urban Design and Ecosystem Biomimicry Maibritt Pedersen Zari, 2018-05-20 It is clear that

the climate is changing and ecosystems are becoming severely degraded Humans must mitigate the causes of and adapt to climate change and the loss of biodiversity as the impacts of these changes become more apparent and demand urgent responses These pressures combined with rapid global urbanisation and population growth mean that new ways of designing retrofitting and living in cities are critically needed Incorporating an understanding of how the living world works and what ecosystems do into architectural and urban design is a step towards the creation and evolution of cities that are radically more sustainable and potentially regenerative Can cities produce their own food energy and water Can they be designed to regulate climate provide habitat cycle nutrients and purify water air and soil This book examines and defines the field of biomimicry for sustainable built environment design and goes on to translate ecological knowledge into practical methodologies for architectural and urban design that can proactively respond to climate change and biodiversity loss These methods are tested and exemplified through a series of case studies of existing cities in a variety of climates Regenerative Urban Design and Ecosystem Biomimicry will be of great interest to students professionals and researchers of architecture urban design ecology and environmental studies as well as those interested in the interdisciplinary study of sustainability ecology and urbanism

Biomimicry for Aerospace Vikram Shyam, Marjan Eggermont, Aloysius F. Hepp, 2022-02-19 The solutions to technical challenges posed by flight and space exploration tend to be multidimensional multifunctional and increasingly focused on the interaction of systems and their environment The growing discipline of biomimicry focuses on what humanity can learn from the natural world Biomimicry for Aerospace Technologies and Applications features the latest advances of bioinspired materials properties relationships for aerospace applications Readers will get a deep dive into the utility of biomimetics to solve a number of technical challenges in aeronautics and space exploration Part I Biomimicry in Aerospace Education Design and Inspiration provides an educational background to biomimicry applied for aerospace applications Part II Biomimetic Design Aerospace and Other Practical Applications discusses applications and practical aspects of biomimetic design for aerospace and terrestrial applications and its cross disciplinary nature Part III Biomimicry and Foundational Aerospace Disciplines covers snake inspired robots biomimetic advances in photovoltaics electric aircraft cooling by bioinspired exergy management and surrogate model driven bioinspired optimization algorithms for large scale and complex problems Finally Part IV Bio Inspired Materials Manufacturing and Structures reviews nature inspired materials and processes for space exploration gecko inspired adhesives bioinspired automated integrated circuit manufacturing on the Moon and Mars and smart deployable space structures inspired by nature Introduces educational aspects of bio inspired design for novel and practical technologies Presents a series of bio inspired technologies applicable to the field of aerospace engineering Provides an introduction to nature inspired design and engineering and its relevance to planning and developing the next generation of robotic and human space missions

Design and the Creation of Social Value Doctor Gjoko Muratovski, Craig Vogel, 2019-05-22 Just as the term design has been going through change growth and expansion of meaning

and interpretation in practice and education the same can be said for design research The traditional boundaries of design are dissolving and connections are being established with other fields at an exponential rate Based on the proceedings from the IASDR 2017 Conference *Re Research* is an edited collection that showcases a curated selection of 83 papers just over half of the works presented at the conference With topics ranging from the introduction of design in the primary education sector to designing information for Artificial Intelligence systems this book collection demonstrates the diverse perspectives of design and design research Divided into seven thematic volumes this collection maps out where the field of design research is now

Understanding Everyday Design Soyoung Kim Kwangmin Cho Chajoong Kim The more society gets complicated and developed the more demand for various products As a result we are living in a flood of various products However considering how people consume and use products in their daily life it is not difficult to find people transforming changing the original purpose or adding value to existing products instead of buying new ones This phenomenon has been defined as everyday design In a sense that everyday design provides a better understanding of actual uses in real context it deserves to be studied Therefore this paper attempts to figure out an underlying mechanism of everyday design For this a conceptual framework was developed whose focus was on what triggers everyday design what goals are set and how a product is transformed The conceptual framework was validated with a photographic inventory of users everyday design in our daily life The conceptual framework could provide a better understanding of everyday design in a systematic way If it is considered in the product development process it could contribute to an increase of use satisfaction as well as sustainable design The limitations and a further study are discussed at the end of the paper

Social Value Creation through Multidisciplinary Design Education Steven Kyffin Mersha Aftab Nicholas Spencer The paper proposes that design with a multidisciplinary student cohort as active partners can play the role of bringing the four different stakeholder groupings namely government industry society and academia together within the creative consortia and create innovation for the greater good of the society By studying a selection of social innovation projects undertaken by multidisciplinary student teams as connector integrators which engaged with companies government bodies and community groups we have examined a combination of four different activities across different economic and cultural human experience contexts to assess their different degrees of appropriateness in creating future value We apply these methods to establish creative consortia which has enabled us to reframe the context of the problem space We believe that the creative consortia has the potential to create more relevance in the solution space greater engagement in realizing the proposition into the future and a higher opportunity for integration of such future principles into emerging government policy and national innovation agendas

Taking Aim at wicked problems A Practical Philosophy for Educating Designers in the Making of Wise Decisions Paul Emmerson Robert Young Today s design pedagogies lack the characteristics for redressing the nature of the wicked problems they attempt to solve such as sustainability We argue it is not fair for future generations to suffer the systemic

effects of our unsustainable consumer culture partly resulting from today's design professionals' decisions which ensue because design is an amoral discipline lacking a systemic perspective. To rectify design's characteristic failings as part of a PhD study we report a new pedagogical architecture founded as the synthesis of the practices of design and civics forming the relationship design as civics DaC a practical philosophy. We position DaC as a reflexive systemic radical political praxis for every citizen possessing the explicit teleological goal to achieve the good life for all. DaC takes a transdisciplinary approach. It integrates the discoveries of cognitive science and linguistics to expose how we construct our understanding of the world interpreting metaphors and frames which we utilize to aim DaC. Alongside shared social practice theory SSP and insights from developmental psychology that reveal the distinctly human capacity of shared intentionality engendering humankind's willingness for cooperation and empathy for fairness. That living in a fairer society is desired by people from rival political perspectives with egalitarian societies reporting lower environmental impact lifestyles and more willingness for transitioning toward sustainment. Thus it is humankind's cooperative behavior and aligning values that provides the foundational rationale of DaC's SSP goal to achieve the good life through the ongoing critical examination of its aim of resolving fairness between citizens. Developing a Matrix for Designerly Way of Creating Shared Value DCSV. Four Examples of CSV via Perspectives of Design. Kyulee Kim. Today while profit maximization is still the bedrock of the capitalist model people have embraced the idea of social contribution as a useful strategy in businesses. In this recent movement Creating Shared Value CSV strives for a win-win solution that creates both social and business value. While in its early stage CSV is showing promise and potential society is witnessing a paradigm shift from practices of corporate social responsibilities CSR to CSV which is more sustainable and effective approach. Since Porter and Kramer originally introduced the concept in 2011 CSV's application has expanded to many areas of business management but it has not been discussed comprehensively in design research as of yet. The title of this paper Designerly Way of Creating Shared Value DCSV is inspired by Nigel Cross's famous book Designerly way of knowing 2006. Designerly is an adjective describing how designers think and behave that is different from professionals in scientific disciplines. The aim of this paper is to propose a new matrix illustrating the link between creating shared value and design and to systemically describe the existing examples of DCSV. The paper will begin with an introduction to the concept of CSV followed by a brief literature review on CSV in design research. The second part will focus on demonstrating the new DCSV matrix by illustrating the four examples that exemplify it. Design for Social Innovation Digital Technologies and Local Communities. Teresa Franqueira Gon al o Gomes. Abstract. The use and democratization of new digital technologies have given visibility to groups of people and grassroots organizations that can be considered agents of change in the transition to a more sustainable world. Design plays an important role in the definition of strategies and in the development of innovative solutions to tackle some of the contemporary problems society faces. This paper aims to show several projects developed over the last 5 years in the subject Design for Social Innovation at the Master

in Design and the Master in Engineering and Product Design at the University of Aveiro and its relation to the new social media and technologies By using Service Design tools to improve Social Innovations and the integration of new digital technologies we design new and improved solutions to foster sustainable development The creation of a DESIS Lab has also allowed to develop innovative design solutions within local communities The methodology used is based on Learning by Doing with an important and relevant initial phase using ethnographic methods The results are showed as academic projects that can be applied and replicated in different contexts The Extent of Transformation Measuring the Impact of Design in VCS Organizations Laura E Warwick Robert A Young A Design for Service DfS approach has been linked with impacts that significantly alter touchpoints services and organizational culture However there is no model with which to assess the extent to which these impacts can be considered transformational In the absence of such a model the authors have reviewed literature on subjects including the transformational potential of design characteristics of transformational design transformational change and organizational change From this review six indicators of transformational change in design projects have been identified evidence of nontraditional transformative design objects evidence of a new perspective evidence of a community of advocates evidence of design capability evidence of new power dynamics and evidence of new organizational standards These indicators along with an assessment scale have been used to successfully review the findings from a doctoral study exploring the impact of the DfS approach in Voluntary Community Sector VCS organizations This paper presents this model as a first step to establishing a method to helpfully gauge the extent of transformational impact in design projects Applying Design Thinking for Business Model Innovation for a Nonprofit Organization Case Study Art la Carte Alison Miyauchi Scott Cressman The challenges facing many small nonprofit organizations are increasing at a greater rate than the internal capacities of many within this sector are able to address effectively This situation has small nonprofits questioning their sustainability and ability to deliver their services in the long term Often these small nonprofit organizations are working within a business model and communications paradigm that has remained unchanged for decades and one which is proving no longer effective in attracting awareness engagement and support Many of these organizations are facing a critical failure requiring significant business model innovation to achieve both their short mid and long term goals Design thinking is an avenue for nonprofits to achieve business model innovation by developing new unique concepts supporting an organization s viability and the processes for bringing those concepts to fruition This case study outlines the design thinking process applied to business model innovation for a small 22 year old nonprofit approaching critical business failure Generative Design Research for Sustainability Exemplary Cases for the Adaptation of the EC Guide Tool and the ERM Method Mert Kulaks z It r G ng r Boncuk u Dilruba O ur smail Yavuz Paksoy Senem Turhan a la Do an This paper presents the main process of a graduate course entitled Generative Design Research for Sustainability offered in the Department of Industrial Design at Middle East Technical University in the spring semester of 2015 2016 through exemplary design research cases

conducted by the graduate students at the doctoral level These cases focus on the adaptation of the generative tool and the method namely Experience Chart EC Guide tool and Experience Reflection Modelling ERM method in line with the graduate students particular research topics First the paper provides the course objectives outcomes and process then it explains the EC Guide tool and the ERM method to be adapted and implemented within the context of the course Then these generative tool and method and their adaptations are demonstrated through the exemplary cases i e efficient use of working environment in design studios lighting practices in kitchen environment and interactive prototyping practice selected from the submitted assignments considering their quality originality and comprehensiveness The main emphasis of this paper is on the adaptation and implementation of the EC Guide tool and the ERM method through providing the experiences insights and suggestions of the graduate students who are also the co authors of the paper Based on that review major conclusions and findings are presented through comparing and contrasting these cases for the future development of the course

Beyond Greener Things Sustainability within Communication Design Practice Niki Wallace Robert Crocker This paper reviews contemporary communication design practice in Australia through a series of interviews with practitioners conducted to better understand the place of sustainability in contemporary practice It is especially concerned with the expectations and experience of designers and their attitudes toward sustainability in practice and the contrast between designing greener things and establishing more sustainable outcomes for their clients through deeper collaboration The paper is part of a larger PhD project attempting to establish ways of expanding the understanding of sustainability for communication designers

Craft and Design for Sustainability Leverage for Change Xiaofang Zhan Stuart Walker Traditional craft has been relegated to the margins in modern culture being perceived as out step with technological economic and societal progress However emergent research is rediscovering the nature of craft and its potential for contributing to design practice in conjunction with developments in science and technology Through the analyses of craft and sustainability strong connections are revealed as well as some incompatibilities The contribution of this paper is to a map a systemic view of craft and b establish a theoretical understanding of the relationship between craft and a holistic understanding of sustainability Drawing on recent research that proposes three areas of leverage for sustainability we argue that craft as a system of making knowing and being has significant potential to contribute actively and tangibly to the transitional conditions thereby serving as an agency for sustainable transformation

Nature Inspired Organizational Design Framework for Open Collaboration Platform Development Sojung Kim Joon Sang Baek Over the last two decades for profit and not for profit organizations have increasingly adopted open collaboration such as open innovation and crowdsourcing as a strategy for innovation Information and communication technology ICT has played a major role in forming open collaboration communities but organizational design also needs to be considered to encourage the active participation and collaboration of actors Nonetheless organizational design aspect has seldom been addressed in developing open collaboration platforms In this research an organizational design framework for

open collaboration was developed through a nature inspired design approach This framework suggests that the self organization mechanism of social insects provides inspirations for the design of the platform especially in terms of setting simple rules to induce behaviors of the actors and facilitating interactions among them Since the open collaboration strategy depends on external actors who are not in employment relationship an organization cannot force their contribution Accordingly the organization s capability to induce the spontaneous participation of actors is essential and it implies the potential role of designers in platform design based on a thorough understanding of actors We thus claim that designers can bring a new perspective to organizational design Open collaboration platforms serve as an exemplar in which designers contribute to the design of an organizational environment that fosters collaboration

Introduction to Biomimetics and Bioinspiration Bharat Bhushan,2024-10-31 This textbook provides a comprehensive overview of biomimetics and biologically inspired materials capturing the essence of innovation that draws inspiration from nature Featuring diverse examples of biomimetics the book explores surfaces exhibiting characteristics such as roughness induced super phobicity philicity self cleaning mechanisms antifouling properties low drag reversible adhesion high hardness and mechanical toughness It also covers phenomena like water harvesting purification insect locomotion and piercing The book emphasizes durable materials and surfaces with a strong focus on the Lotus Effect superoleophobic philic surfaces anti biofouling water purification oil water separation shark skin inspired low drag surfaces gecko inspired reversible adhesion nanofabrication water harvesting and mosquito inspired painless piercing This is the first textbook on biomimetics and bioinspired surfaces It is tailored for undergraduate or graduate students of materials science chemistry physics and biology and serves as an excellent resource for a one semester course in biomimetics bioinspiration while also functioning as a valuable textbook for applied nanotechnology courses Accessible to both novices and experts alike as well as practitioners solution seekers and the intellectually curious this book is poised to contribute to the advancement of biomimetics fostering a deeper understanding of nature s design brilliance and its transformative potential in materials science

Mimicking Nature Ashokan Kannarath,2014-01-22 This book is specially designed to get a basic idea about biomimicry as a solution for sustainable development how animal and plant models become an ideal natural teacher to construct and design modern mans requirements without causing pollution This book has nine chapters The first section is devoted for introduction the second for sustainable development the third one for inspiration derived from plants twenty four examples fourth one for inspiration derived from animals thirty five examples The fifth chapter is devoted for research in biomimicry and the sixth chapter is for development in biomimicry at the molecular level The seventh one is for modern city planning by mimicking nature with special reference to Lavasa the first biomimicry town planning in India The eighth chapter is for explanation of some case studies in biomimicry and the last chapter is to inform the reader about some access point in biomimicry resources followed by further study and the last section is an index of the contents

Smart Composite Coatings and Membranes Maria Fatima

Montemor,2015-11-09 Smart Composite Coatings and Membranes Transport Structural Environmental and Energy Applications provides the latest information on the increase in demand for new smart materials for a wide array of different technological applications The book comprehensively reviews the latest developments in smart composite materials used as membranes barriers and coatings with a special focus on corrosion protection transportation structure and the wide range of applications Part one examines the properties processing and manufacture of smart composite materials along with techniques for modeling the behavior of these materials while other sections review the use of smart composite coatings in aerospace marine and metal structural applications examine the protective properties and applications of smart composite coatings and introduce specific low environmental impact and energy efficient applications such as energy generation and storage water management and stone conservation Explores the use of smart composite materials for coatings barriers and membranes Comprehensively reviews the latest developments in smart composite materials with a special focus on corrosion protection transportation structure and the wide range of applications Examines the properties processing manufacture and behavior modeling of smart composite materials Focuses on applications that have an impact on more effective energy savings and efficiency green house emissions and environmental protection Biotechnologies and Biomimetics for Civil Engineering Fernando Pacheco Torgal,J. A. Labrincha,M. V. Diamanti,C.-P. Yu,H. K. Lee,2014-08-16 Putting forward an innovative approach to solving current technological problems faced by human society this book encompasses a holistic way of perceiving the potential of natural systems Nature has developed several materials and processes which both maintain an optimal performance and are also totally biodegradable properties which can be used in civil engineering Delivering the latest research findings to building industry professionals and other practitioners as well as containing information useful to the public Biotechnologies and Biomimetics for Civil Engineering serves as an important tool to tackle the challenges of a more sustainable construction industry and the future of buildings Trans Structures: Fluid Architecture and Liquid Engineering Matyas Gutai,2015-01-15 Architecture is based upon the misconception that strong is stable both in sense of energy and structure as an unchanged state of microclimate would require more material or insulation Trans structures are the opposite building elements with the response ability to change according to external conditions in order to maintain stability in terms of structure and or energy In this type of building any effect structural or thermal load would generate an immediate affect a response of the structure Energy and weight would be counteracted and on a total scale change would not occur Such buildings are always in transition from one state to another unlike conventional structures

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