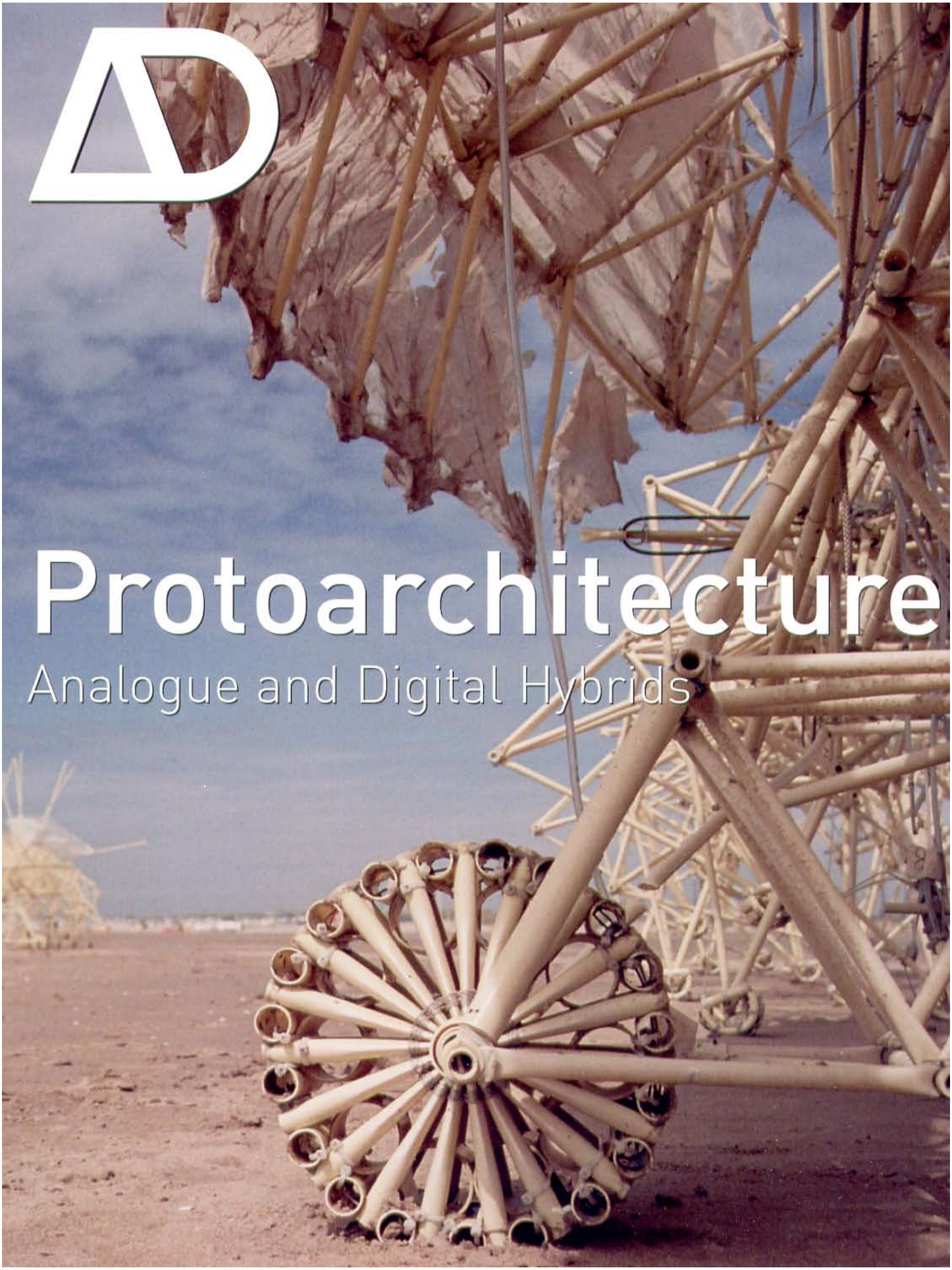


Protoarchitecture

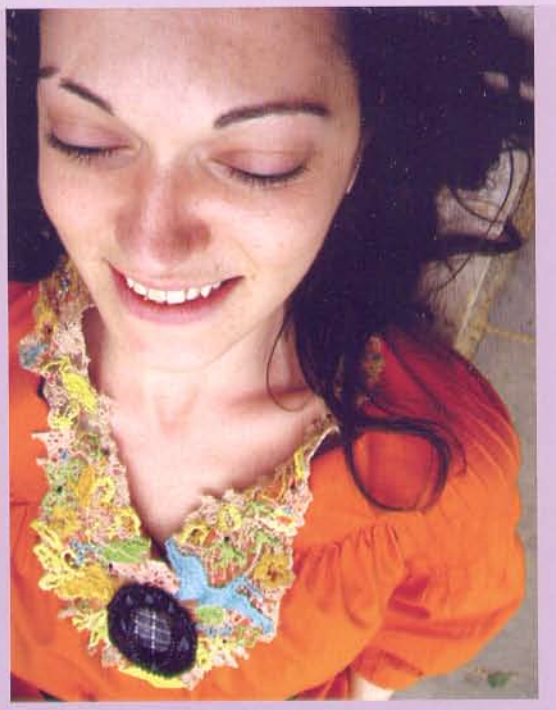
Analogue and Digital Hybrids

Inhabiting the Body and the Spaces of Interaction

Wearable technologies create a tactile interface with the body of the user, providing a new model for architecture in which the surface between the subject and the object is almost seamless and sensory. As Valentina Croci explores, they also call on us to reconsider a more interdisciplinary mode of designing that accommodates a dynamic social dialogue between highly portable small-scale devices, their remote networks and the physical environment.

Adam Whiton and Yolita Nugent, No-Contact Jacket, 2006
above: The No-Contact Jacket is equipped with an anti-aggression device that can be manually activated in the event of an attack. By pressing a button located near the wrists, the electrified surface of the fabric on the back of the jacket releases an 80,000-volt charge, capable of momentarily paralysing an assailant. The padding and lining of the jacket are insulated to protect the wearer. The jacket underlines the vulnerability of women in an urban context and functions by using the instinctive gestures of the human body.

Valérie Lamontagne, Peaux d'Âne, 2007
below: The Peaux d'Âne suit reflects changes in the sky and in barometric pressure, and climatic variations. The system is composed of a portable device (Weather Davis) that records such environmental variations; a central computer using MAX/msp software that codifies the information; and wireless micro-controllers inserted in the fabric of the suit. Electronic circuits inserted in the fabric interconnect the micro-controllers. The project confers symbolic and narrative value on the experience of the physical environment and underlines the unexplored applications of computational technologies in smart textiles.



Elena Corchero, Solar Vintage, 2007
Solar Vintage is made up of a series of accessories for the body (a fan, a necklace, a collar and hair clips) in an evidently obsolete and affected style. The accessories contain solar cells, LEDs and resistors, rendering them capable of storing solar energy that can be released at night by integrated light sources, providing wireless and entirely ecological illumination.

Wearable technologies are digital or electronic artefacts that work in close contact with the body of the user. Often they are related to technological instruments that reproduce images or music, or Bluetooth technologies for cellular and wireless connection. They represent a transposition of the functions of mobile telephones into objects that we wear, rather than carry in a bag or pocket as part of a single device. All the same, the primary difference between wearable technologies and portable devices such as cellular phones is the type of interaction between the subject and the object being worn.

Wearable technologies tend to distribute operable functions to various parts of the body, connecting activation with performance. In this way a reciprocal relationship is created between the object and the body to the point that, on the one hand, the body becomes a component in the functioning of the device (that is, activating processes through movement or the variation in body temperature or heartbeat), and on the other the object influences the sensorial and perceptive channels of the user, creating a level of heightened (augmented) awareness. They are integrated in a discreet manner within the gestures of the user, transforming his or her methods of interacting with space and other individuals. As a result of this potential, we are now witnessing an increased level of experimentation aimed at investigating new possibilities of perception of the body-prosthetic and the new dynamics of the user within built space.

Wearable technologies are artificial prostheses for the body. However, they are not substitutive, nor do they compensate for the malfunctioning of a sick or otherwise disabled body; on the contrary, they intensify the senses and perception of the natural body or the subject's ability to interact with the exterior environment. Similar to common computer and digital technologies, wearable technologies allow the subject to recontextualise his or her position, even in antipodal conditions, in an instantaneous and non-corporeal way, broadening the spatial confines of his or her actions. The subject thus acquires a 'diffuse body', a varied presence in the infrastructures of inhabited space and flows of information – from the space of the body to that of the urban environment, from direct social relations to long-distance communication.

Unlike traditional portable technologies, interaction with the device does not take place through graphic interfaces (the logic of the menu or icon on a screen), but through tactile and direct contact with the instruments located on the body. This implies the simultaneous design of new, tactile interfaces (hand-held and manipulable), and the dynamics of interaction between the subject and the technological

device. Leah Buechley, for example, introduces digital hardware into body accessories, tying their activation to predetermined physical movements of the user. Seen in this light, the design of the artefacts also implies the definition of the sequence of gestures necessary for the functioning of the device. Tactile interfaces, furthermore, operate using a more emotional and symbolic language. The user's movements must be devoid of any ambiguity – it is necessary to distinguish what is, and is not, related to the functioning of the device – and they must be natural, part of our everyday repertoire of gestures. An example can be found in the No-Contact Jacket, an anti-aggression device developed by Adam Whiton and Yolita Nugent, which is electrified down the back, based on the idea that a hunched-over position is the most common reaction in the event of danger.

The research into wearable technologies reflects both the development of technologies and the social environment in which this takes place (work, free time, holidays, the family, urban dwelling and so on). The wearable nature of the objects affects the perception of distances between individuals, distances that Edward Hall describes as spatial intervals that exist between two bodies, according to the type of relationship (friendship, working relationship, love and so on).[1] These distances are a kind of psychological limit that sanctions the rules of reciprocal contact, based also on the specific conditions of physical space. This is a theme that has been investigated by Teresa Almeida in Space Dress, a dress that can be inflated by the user according to her situation. The dress was originally conceived of for use in the New York subway during rush hour, and thus becomes the material representation of the dynamics of interaction between individuals in a shared space, allowing the wearer to act on her qualitative perception.

Andrea Branzi has pointed out how the widespread introduction of mobile digital and electronic technologies into everyday life has further emphasised the distance between the city as a scenario for fixed architecture and the metropolis as a flow of information, services and goods.[2] What is more, the quality of the urban environment deals primarily with the latter definition. Objects therefore assume a fundamental role in the experience of the city due to their ability to create a network of human relations (immediate or long distance through the 'diffuse body'), the memories connected to a site and the mediation of services. Thus, according to Branzi, it is necessary to refunctionalise the urban context in relation to the new range of objects, hypothesising 'discontinuous' architectural models that are almost situationalist, flexible towards changes in services and relationships between users.

Teresa Almeida, Space Dress, 2006
The dress can be inflated at the push of a button by electrically operated micro-fans, allowing the wearer to physically 'shift' other individuals in overly crowded spaces. The project highlights the need of the user to actively manage her experience of the physical environment, affecting her perception of the quality of space.

Meejin Yoon, Defensive Dress, 2007
This project lies somewhere between art and design. The suit lifts the prickly feathers the moment the integrated sensor detects the presence of a nearby external body. The feathers are composed of a hollowed copper cable filled with Flexinol, a shape memory alloy. If the external body violates the user-determined safety distance, the sensors activate a small electrical charge that heats the Flexinol, which shrinks the copper and then modifies the form of the feathers.

The design of these wearable technologies must not, in fact, be separated from the physical context in which they are to be used: in other words, together with the object, it is necessary to consider the architectural design of the space and the network of technological infrastructures present in the surrounding and remote environment. Design thus becomes interdisciplinary and context specific: it is necessary to design architecture that is capable of dialoguing with wearable technologies, similar to objects that modulate environmental variables – the emission of sounds, images and smells, or climatic conditions, for example. In analogous terms, mobility, characterised by wearable technologies, imposes that we provide 'smart environments', integrated with digital and sensing technologies, in order to create spaces that are enhanced by interactive functions. We can imagine a space filled with remote-sensing instruments that use electromagnetic waves or fields, computers immersed in space (for example, ubicomp and pervasive computing), and devices that are integrated in physical objects.

Many projects, such as Solar Vintage by Elena Corchero, analyse the way users move in a space, and address problems such as the self-sufficiency of worn technological systems. Corchero's devices are capable of storing energy through solar cells, which can be transferred to other electronic devices, such as laptop computers or mobile phones. These devices can also power light sources or LEDs inserted within the same wearable objects. Wearable technologies therefore transform the way the user perceives a space, underlining his or her active role in experiencing environments and services.

The interaction between wearable objects and built space thus places emphasis on the fruition of the man-made (built) environment, and on the social dynamics that take place within it. The body and the emotional and sensorial dimensions must be at the centre of design in order to generate new, even more experimental topics for more interdisciplinary and user-focused architectural design. AD+

Translated from the Italian version into English by Paul David Blackmore.

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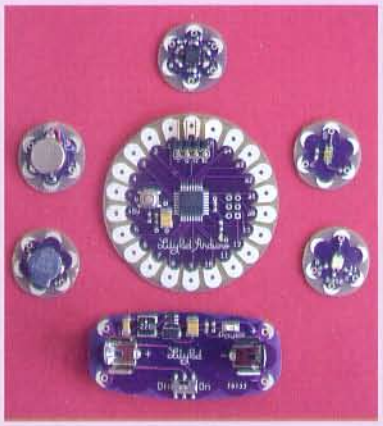
Notes

1. Edward Hall, *The Hidden Dimension*, Doubleday (New York), 1966.
2. Andrea Branzi, *Modernità debole e diffusa. IL mondo del progetto all'inizio del XXI secolo*, Skira (Milan), 2006.



Leah Buechley, Lilypad Arduino, 2007
Leah Buechley uses form to investigate alternatives to electronic interfaces. Lilypad Arduino incorporates Arduino hardware within fabric pads 6.3 centimetres (2.5 inches) in diameter, which are interconnected by micro-controllers and electrical circuits. During a performance in collaboration with Michael Theodore, the user wore a sweater equipped with sensing appendages capable of monitoring muscular movement, acceleration and direct contact with the wearable device. The data were detected by an external computer allowing changes in sound or other output in the room according to the movement of the user.

Jenny Chowdhury, 802.11 Apparel, 2007
This series of clothing interacts with the movement of the wearer. Each garment features five strips of fabric with integrated electrical circuits, sensors/detectors and WI-FI signals, Arduino micro-controllers and LEDs. The garments emit light dependent on the movements of the wearer and variations in the electromagnetic fields in the environment, providing a means of visualising both interaction with, and the exchange of energy within, a space.