

# 13

## PRODUCT EXPRESSION: BRIDGING THE GAP BETWEEN THE SYMBOLIC AND THE CONCRETE

THOMAS J.L. VAN ROMPAY

*Faculty of Behavioural Sciences, Enschede, The Netherlands*

### I. INTRODUCTION

Browsing through a home improvement magazine, overhearing a conversation about the latest design trend, spotting an ad for the new Peugeot; it is all too clear that those qualities we refer to as symbolic (i.e. qualities that are not ‘literally’ part of product appearance such as *distant*, *inviting* and *firm*) take on increased importance in today’s market. In design and marketing literature, this trend is often traced to the fact that many (or most) products appearing on the market are very similar in function and price, making it hard or simply irrelevant for people to differentiate products on such primary criteria (Postrel, 2003; Veryzer, 1995). As a result, products are ever more evaluated in terms of their experiential benefits: ‘*What does this product say about me?*’, ‘*Is this really me?*’, etc. Indeed, a recent study confirmed such speculations by revealing that consumers’ preferences for product appearance are by and large motivated by symbolic (product) meaning (Creusen and Schoormans, 2005).

Although we all perceive objects as expressive of symbolic meanings, it does not follow that we understand what it is that makes us, for instance, experience a certain product as *adventurous*, *modest* or *trustworthy*. On the contrary, attempts to relate symbolic meanings to formal product features often reach no further than global attributes such as size or color. And even with respect to stereotypical, seemingly obvious relations between form and expression, one may find it is not that easy to explain why, for instance, organic or rounded form features are generally perceived as *secure* or *emotional*. In other words, although perceiving what products express comes most natural,

accounting for a product's expression is less straightforward. Arguably, it is precisely this 'accounting for' that is a prerequisite for successful design.

In this chapter, different perspectives on (product) expression or symbolic meaning (synonyms used alternately) will be presented. Although different in scope and focus, they all share the, sometimes hidden, assumption that an object's perceived expression results from the interaction between object and perceiver. However, in accounting for symbolic meanings, researchers usually stress the role of either the perceiver or the object perceived (Crozier, 1994; Crozier and Chapman, 1984; Dewey, 1934). In order to provide a rough classification of relevant studies in expression (varying widely in focus and scope) they will be presented along these lines. Another reason for doing so is to clarify the rationale underlying a third approach, discussed consecutively. This approach underlines the necessity to simultaneously and explicitly take into account the mutual contributions of both perceiver and object perceived.

In the first part of this chapter we will discuss studies in which the object is at the center of investigation. In this type of study, relations between formal object features and symbolic meanings are explored. In the second part of this chapter we will review research that places primary emphasis on the role of the perceiver in the coming about of an object's expression. According to this approach, symbolic product meanings can be traced to cognitive or biologically centered processes. Following our discussion of object- and individual-centered perspectives, we will present a third perspective, originating in the writings of the philosophers John Dewey (1934) and Merleau-Ponty (1962). Both stress the fact that (symbolic) meaning can only be studied in the light of interactions between individual and environment. By consequence, explicit and equal emphasis should be placed on the interdependent contributions of both object and perceiver. Since object-perceiver interactions are constrained by the peculiarities of the human body, both view meaning as essentially embodied. In the last two decades, this approach has 'resurfaced' in cognitive psychology (e.g. Johnson, 1987; Lakoff and Johnson, 1999), and has proven to be very successful in accounting for symbolic meanings of all kinds. In line with recent studies in cognitive psychology, we will argue that symbolic meanings exemplified by products are rooted in our own embodied experiences arising from interactions with the environment.

Before launching our review it should be stressed that it is not our intention to attest to the merits of one approach or perspective over another. In the course of this chapter, it will become clear that the studies under review vary widely with respect to the type of symbolic meanings addressed, withholding us from any such endeavors. Nonetheless, the relative lack of studies addressing product expression from an interactional perspective justifies, we feel, the more elaborate discussion of this approach presented in this chapter.

## 2. THE EXPRESSIVE OBJECT

At the far end of the spectrum, theories stressing the object perceived in order to account for its expression embrace the assumption that our world and its objects are intrinsically meaningful. As such, expression resides in the object and can be described without taking into account the role of the perceiver, except to say that he or she can be more or less receptive or equipped to perceive an object's expression. The artist Wassily Kandinsky, for instance, considered visual elements such as point, line, and plane (the basic elements of abstract painting) to be fully 'alive', and therefore expressive in and of themselves. In discussing the expressive characteristics of the basic plane, Kandinsky (1926) argues that its four lines, i.e. the two verticals and the two horizontals, are bound up with different

'sounds'. Whereas the 'above' and, although to a lesser extent, the 'left' are expressive of *lightness*, *emancipation*, and *freedom*, the 'below' and the 'right' express *condensation*, *heaviness*, and *constraint* (Kandinsky, 1926). In line with his claim that the basic elements of painting are 'alive' in and of themselves, Kandinsky motivates his assertions in terms of the presumed ability of every great artist to 'feel the breathing of the still untouched plane' (Kandinsky, 1926, p. 116).

Discussing the works of Kandinsky immediately brings to mind the name of Paul Klee; artist, visionary, and, like Kandinsky, teacher at the Bauhaus, the famous school of design in Weimar. Klee considered communication with nature as the most essential condition for the artist. Forms, Klee argued, are important in so far as they symbolize man's relation to the cosmos (Klee, 1953). In symbolizing this relationship, Klee considered line, tone value (the degrees of shading between white and black), and color as the basic formal elements an artist has at his disposal:

Certain proportions of line, the combination of certain tones from the scale of tone values, certain harmonies of color carry with them at the time quite distinctive and outstanding modes of expressions (Klee, 1948, p. 37).

Dependent on the combination of these factors, objects strike us as 'serene or severe, tense or relaxed, comforting or forbidding, suffering or smiling' (Klee, 1948, p. 33). In many of Klee's sketches his attempts to create what he refers to as 'expressive contrasts' can be witnessed. Straight rigid lines, for instance, may be combined with curved smooth lines. The use of medium shades of grey, implying *weakness*, may be alternated with the wide use of all tones from black to white, implying *strength*, and with regard to color; 'what tremendous possibilities for the variation of meaning are offered by the combination of colors' (Klee, 1948, p. 39). Although Klee regarded the origin of artistic expression as intrinsically linked to human life and the relation of man to the cosmos, Klee, in his role as teacher, discussed the symbolic characteristics of his sketches primarily in terms of their formal properties. Likewise, the perspectives to follow, although acknowledging the role of the perceiver, primarily stress the object perceived in order to account for its expression.

## 2.1. Bodily expression

Without doubt, the most basic form of expression is the kind we refer to as 'body language'. Varying from facial expressions to bodily postures, the ways in which people express themselves through their 'body language' are numerous. The posture of an old man may express *defeat* and *resignation*, the movements of a child playfully walking over a thin line *victory* and *temptation*, and the facial expression of an abandoned lover *despair* and *sorrow*. But apart from bodily states or activities in relation to which expression is not an end in itself, but a natural autonomic reflection of one's state of mind, at other times people deliberately engage in bodily activities to express themselves. The type of bodily expression that comes most readily to mind in this context is *dance*.

In general terms, form (i.e. bodily shapes or postures) and motion (i.e. bodily movements) are the main carriers of meaning in dance (Kreitler and Kreitler, 1972). Kandinsky (1926) regarded a dance as an uninterrupted composition of lines and shapes, and, therefore, subject to the same 'rules' applying to formal elements of works of art. But what distinguishes a dance most clearly from, for instance, a painting is its dynamic character; the interaction of form and movement. Most researchers have, for that reason, studied the ways in which dancers express meanings through bodily movement. Oskar

Schlemmer, Kandinsky's colleague and director of the Bauhaus stage in Dessau (1925–1929) is particularly known for his stage plays and workshops in which the relations between stage, body, and space were explored:

We shall observe the appearance of the human figure as an event and recognize that at the very moment it has become a part of the stage, it is a 'space-bewitched' creature, so to speak. With a certainty that is automatic, each gesture and each movement is drawn into the sphere of significance (Schlemmer, 1927. Cited in Wingler, 1974, p. 474).

More recently, Sawada, Suda and Ishii (2003) looked into relations between arm-movement characteristics (i.e. speed, force, and directness) and emotional expression, based on Laban's classification of movement in terms of time, weight, space, and flow (Laban, 1988). They showed that dancers' expressions of *anger* are reflected in arm movements fast in velocity and strong in force, as opposed to slower and weaker arm movements indicative of *sadness* and *joy*. Expressions of *joy* differ from those of *sadness* in that the former are characterized by a longer traveled distance with the arms (i.e. more 'expansiveness') and a more varied trajectory (i.e. more 'indirectness').

In a similar study, De Meijer (1989) demonstrated that expressions of positive emotions, e.g. *joy*, are characterized by upward directed movements (i.e. stretching trunk movement), whereas downward directed movements (i.e. bowing trunk movement) are characteristic of negative emotions. These results are in line with Osgood's finding that people across the world perceive downward-directed curves as *sad* and upward-directed curves as *merry* or *joyful* (Osgood, 1960). Earlier on, we noted that Kandinsky proposed a similar structuring when relating the 'above' to positive connotations like *lightness* and *freedom*, and the 'below' to negative connotations such as *heaviness* and *constraint* (Kandinsky, 1926).

Although the studies discussed in the remainder of this chapter all center on static, non-moving objects such as products and works of art, aforementioned studies are of relevance in so far as both moving and static objects are perceived as infused with symbolic qualities, as will be shown next. A second distinction concerns the difference between two-dimensional and three-dimensional forms, discussed alternately in the remainder of this chapter. Whereas human bodies, products, and sculptures may literally enclose space or convey depth, two-dimensional forms such as paintings are never literally 'open' or 'closed', 'near' or 'distant'. It should be kept in mind, however, that our interest is not in what products literally convey, but in their symbolic or expressive meaning. In that regard, products and two-dimensional objects are alike; they are both perceived as expressive of symbolic meanings through their visual appearance.

## 2.2. Arnheim and the Gestalt school

In the early twentieth century, Gestalt psychology developed as a response to the traditional method of scientific analysis advocating the analysis of complex phenomena in terms of their separate parts. According to the Gestalt psychologists 'the whole is more than the sum of its parts'. A triangle, for instance, is perceived as an independent entity (i.e. a whole), and not just as a collection of three lines plus three angles. In order to account for such primary perceptual phenomena, the Gestalt psychologists proposed a number of innate tendencies, i.e. 'Gestalt principles', guiding our perception of the world and its objects (e.g. Koffka, 1935; Wertheimer, 1938).

The 'similarity principle', for instance, predicts that things that share visual characteristics (e.g. shape, size, color, and orientation) are perceived as belonging together

(i.e. forming one whole). The ‘continuity principle’ reflects the finding that perceptual organization favors continuity over abruptness. Next to proposing gestalt principles, the Gestalt psychologists also assumed a preference for good or ‘prägnant’ gestalts, a term used to designate those gestalts which are the best organizations of stimuli in a given situation. In general terms, good gestalts are characterized by regularity, symmetry, inclusiveness, unity, harmony, maximal simplicity, and conciseness.

Perhaps the most famous proponent of the Gestalt school is Rudolf Arnheim, best known for his enlightening discussions of works of art. He demonstrated that works of art are perceived as gestalts that can be more or less ‘balanced’ dependent on a wide variety of factors (Arnheim, 1974). Paintings, for instance, may express a sense of *stillness* or *striving* dependent on the placement of their constitutive elements within the frame (i.e. dependent on their composition). Whereas compositions properly balanced are generally perceived as *still*, compositions lacking balance are perceived as *restless* or as striving towards equilibrium.

Arnheim’s conception of symbolic or expressive qualities motivates this brief discussion of his writings under an object-centered perspective: ‘Expressive qualities are authentic and objective qualities conveyed by perceptual shape, size, movement, intensity, rhythm, and so on’ (Arnheim, 1992, p. 205). The ability to directly perceive expressive characteristics is explained in terms of the organization of the nervous system, a notion referred to as ‘isomorphism’: ‘If gestalt processes are observed in perceptual experience, analogous processes are likely to account for them in the brain’ (Arnheim, 1992, p. 201). It is this claim, however, that has been subject to criticism for lack of empirical support (e.g. Berlyne, 1971; Crozier and Chapman, 1984). Nonetheless, many of Arnheim’s predictions on the perception of form, and in particular on the role of perceived balance and movement herein, have been supported by controlled studies (e.g. Locher, Gray and Nodine, 1996; Locher and Stappers, 2002).

In his works ‘The dynamics of architectural form’ (1977) and ‘The power of the centre’ (1988) Arnheim also (explicitly) acknowledges the role of the perceiver in the experience of objects and architectural spaces. In the former, he introduces the concept of anisotropy to explain that different directions in space are perceived unequally (Arnheim, 1977). According to Arnheim, this perceived inequality relates to experiences that arise from moving through space; going up, for instance, takes more effort than going down since we have to overcome the force of gravity, or in Arnheim’s words:

The symbolic endowment of architectural shape is compelling only because the humble daily experience of climbing stairs reverberates with the connotations of overcoming the weight of gravity and rising victoriously toward the heights (Arnheim, 1977, p. 210).

As a result of this anisotropy, directions in architecture and works of art are also perceived ‘unequally’; an extension in the vertical dimension is perceived as more pronounced in comparison to an equal extension in the horizontal dimension. It is for this reason that a tree or skyscraper standing up straight ‘looks’ more *impressive* than the same one brought down. Locher and Stappers (2002) demonstrated that anisotropy also influences the perception of visual displays; designs with greater ‘weight’ above the horizontal were rated as significantly more *dynamic* than designs with greater ‘weight’ below the horizontal.

### 2.3. The ecological approach

The ecological approach to perception originates in the writings of J. J. Gibson (1979). According to Gibson, perception of the environment is direct and unmediated. In this

regard, the ecological approach can be seen as congruent with the notions put forward by the Gestalt school. But whereas the Gestalt psychologists explained this capability in terms of the functioning of the nervous system, Gibson assumed meanings are conveyed through information in the light, reflecting textures in the optic array. He considered this hypothesis radical ‘for it implies that the values and meanings of things in the environment can be directly perceived’ (Gibson, 1979, p. 127).

Central to the theory of direct perception is the concept of an ‘affordance’, defined as a specific combination of invariant properties of an environment relative to a particular organism (Gibson, 1979). Gibson argued that people perceive things in terms of what actions they afford, i.e. in terms of what we can do with them. A chair, for instance, affords ‘sitting’, a cup affords ‘holding’, and a tree affords ‘climbing’. Clearly, for a bird or elephant none of these affordances holds; it is in this sense that affordances are relative to a particular organism. The notion that objects are perceived in terms of what they afford is reminiscent of the Gestalt school (Bruce, Green and Georgeson, 1996), and in particular of Koffka’s concept of ‘demand characteristics’:

To primitive man each thing says what it is and what he ought to do with it: a fruit says ‘Eat me’; water says ‘Drink me’; thunder says ‘Fear me’, and woman says ‘Love me’ (Koffka, 1935, p. 7).

Although Gibson was not primarily interested in objects’ symbolic or expressive characteristics, his writings are of interest for the present context in so far as affordances may guide the attribution of symbolic meanings. Upon perceiving a chair, for instance, an individual may not just realize that it affords sitting; based on specifics of the chair he may understand that it affords a particular type of sitting. A chair with extended armrests, for instance, affords a more relaxed type of sitting than a chair with no armrests. Accordingly, the former may be perceived as more *dignified* or *stately* than the latter. In a similar fashion, distinguishing between motorbikes in terms of symbolic qualities such as *toughness* or *ferociousness* may be based on appreciation of the bodily position afforded by shape and positioning of the motorbike seat (Kreuzbauer and Malter, 2005).

## 2.4. Discussion

The studies on expression reviewed in this section place primary emphasis on the object perceived. Although at times certainly successful in relating symbolic or expressive characteristics to the visual appearance of objects, a difficulty of studies originating in this approach is that they often fall short in explaining the relations uncovered. Arnheim’s assertion, for instance, that the proposed relations can be accounted for in terms of the workings of the nervous system is hard to sustain in the absence of empirical data. It is only when he explicitly acknowledges the role of the perceiver in the experience of space and objects, that one ‘understands’ why, for instance, the vertical connotes qualitatively different meanings than the horizontal.

From a philosophical point of view, object-centered theories on expression are problematic in so far as they embrace the assumption that the world ‘possesses’ fixed properties that can be ‘picked up’. When looking at our own experience it may indeed seem natural to consider objects, for instance, *impressive*, *natural* or *playful* in and of themselves. But as it turns out, attempts to account for such expressive or symbolic qualities are frustrated as long as one concentrates primarily on the object of perception. To address the difficulties encountered by an object-centered approach, both practical and philosophical, researchers increasingly shifted the emphasis of their projects from stimulus properties of objects to the processes underlying their perception and understanding.

### 3. THE CONSTRUCTIVE INDIVIDUAL

Paralleling the rise of cognitive science, researchers became increasingly interested in the ways in which processes related to the workings of body and mind partake in the establishment of meaning. Whereas in object-centered studies symbolic qualities were primarily studied in terms of objects' formal properties, in the perspective discussed next emphasis is on the individual and all that influences his or her experience of the world.

#### 3.1. Arousal and the aesthetic experience

By far the most influential biologically centered theory on the aesthetic experience of visual stimuli is Berlyne's psychobiological approach (Berlyne, 1971). Assuming people prefer an optimal level of arousal engaging the nervous system to the right extent, Berlyne considered the potential to introduce a rise in this arousal level the most characteristic feature of works of art. This potential, Berlyne argued, is contingent on stimulus properties such as 'perceived novelty', 'surprisingness', and 'complexity', properties he refers to as 'collative'.

Asymmetrical and irregular forms, for instance, are more 'complex' in comparison to symmetrical and regular forms and, therefore, have greater arousal potential. Berlyne was primarily interested in stimulus qualities capturing attention, increasing arousal, and affording exploration, and not so much in symbolic or expressive meanings of stimuli. Berlyne's findings, however, are of relevance to our project in so far as they suggest a relation between the arousal potential of stimuli and their expressiveness. Underscoring this relation, Berlyne argues:

Art biased towards heightening arousal is called dramatic, dynamic or stirring. If the arousal-moderating devices have the upper hand, art is said to be static, harmonious or serene (Berlyne, 1971, p. 254).

Obviously, people may prefer different levels of arousal, and dependent on the context in which the stimulus is perceived its arousal potential will vary. In paintings, for instance, a visual element is always embedded within a complex structure comprising both stylistic and semantic layers that codetermine its arousal potential, and hence to some degree its symbolic meaning or expressiveness (Cupchik, 1994).

With respect to product design, Berlyne's writings inspired Coates (2003) to explore the relation between perceived novelty and product expression. Departing from Osgood's framework for the measurement of meaning (Osgood, 1957), Coates showed that higher degrees of novelty trigger perceptions of products as more 'potent' and 'active', as opposed to products presenting less novelty. Hence, they are perceived as expressing higher degrees of related characteristics such as *excitement* and *emotionality* ('activity'), and *dominance* and *toughness* ('potency').

#### 3.2. Dynamization and empathy

Another biologically anchored phenomenon relevant to our discussion is the 'dynamic' or 'dynamizing' mode of response (Werner and Kaplan, 1963). Dynamization originates in enhanced kinesthetic or motoric reactivity, and relates to the fact that people, when asked to explain why they relate a certain form to a particular feeling or concept, often refer to a hypothetical quality of motion along its lines. One may, for instance, relate a circle to the concept of *infinity* because movement along its contour is endless and repetitive. Likewise, a sharp angle may be referred to as *shocking* or *thrilling* for its acute

and sudden change in direction of motion. And long curves may be said to express *calm* because their ‘motion’ is slow (Kreitler and Kreitler, 1972). In contrast to studies on bodily expression discussed earlier, in this line of reasoning the origin of symbolic expression is not sought in properties of the object or (simulated) shape as such, but primarily in the motoric activity associated with the stimulus.

German psychologist Theodor Lipps (1897), for instance, discusses dynamization in relation to ‘empathy’ or ‘*einfühlung*’. According to Lipps, people show a tendency to imitate perceived movements or dynamic postures of people and objects. Since specific motoric movements automatically give rise to their emotional counterparts, Lipps argued, we come to feel or experience the emotion of another person (i.e. empathize with another person) or experience an object as expressing a particular symbolic concept. *Sadness*, for instance, is commonly reflected in curved, earth-bound bodily postures. Upon observing a like-formed object, Lipps claimed, we ‘unknowingly’ imitate its posture. And since a curved, earth bound posture gives rise to the emotion it corresponds with, i.e. *sadness*, we come to feel the emotion and locate its origin in the object perceived, whereby it becomes expressive (Lipps, 1897).

Although research indeed shows that people tend to imitate behaviors, e.g. movements and emotional expressive behaviors of others (Bandura, 1969), Lipps’ claim that the emotional experience ‘automatically’ follows from such simulations has not withstood the test of time. The works of Schachter and Singer (1962), for instance, clearly show that physiological changes alone do not suffice to evoke a full blown emotional experience; of equal importance are the ways in which these sensations are interpreted.

### 3.3. Metaphor and analogy

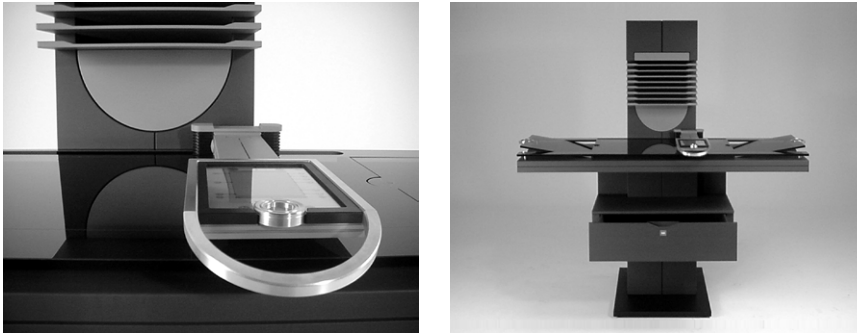
In interacting with products, people frequently draw implicit comparisons between products belonging to different categories, or between products and other phenomena (e.g. objects of nature, people or animals). The reason for doing so is that one may learn about a particular object by relating it to another. This ability is referred to as metaphorizing, defined as experiencing or understanding one thing, i.e. the target domain, in terms of another, i.e. the source domain (Lakoff and Johnson, 1980).

The most popular computer interface is the ‘desktop’ on which the user drags items into folders, moves these to a desired location, or drops them in the trashcan (just to name a few of the actions the ‘desktop’ affords). The ‘desktop’ is successful because virtually everyone knows how to operate it by relying on existing knowledge from daily office work involving real desktops. For instance, one easily understands the purpose of placing related Microsoft Word-files in one folder, since placing paper documents in (physical) folders is a familiar ‘office activity’. It is in this sense that designers can allow their users to understand a relatively new or complex domain more easily by presenting it in terms of a domain they are familiar with.

Next to using metaphor foremost as a means to render a new or complex product intelligible, i.e. to reduce the cognitive workload, designers may also employ a metaphor in order to promote other kinds of user experiences. At Delft University, for instance, a project was initiated addressing the design of a copier (Figure 13.1), departing from the metaphor ‘Interacting with a machine is a dance’ (Hekkert, Mostert and Stompff, 2003).

One aspect of a ‘dance for two’ is that the participants feel and respond to each other’s moves, an aspect labeled ‘resonance’. The designers mapped this aspect onto the copier by reconsidering the (traditional) ways in which copiers react to user behavior. Agitated movements, for instance, cause this copier to offer more resistance in handling its different parts, whereas smooth movements evoke less resistance. In resonating with





**FIGURE 13.1** Copier (from Hekkert et al., 2003).



**FIGURE 13.2** CD player (IDEO).

its user, the product breaks free from inflexible interaction patterns that so often make traditional copiers a burden to deal with. Hence, the copier is no longer a frustrating machine but rather a dance partner and, therefore, experienced in terms of those qualities people commonly ascribe to dancers (e.g. *supportiveness*, *flexibility*, and *sensitivity*).

Whereas metaphor involves the transfer of meaning from one domain to another, a product analogy typically involves a functional similarity between an object and another object or phenomenon. In contrast to metaphor, the transfer of meaning is usually not considered a defining characteristic of a product analogy. IDEO's CD player may serve as an example (Figure 13.2).

The analogy with a traditional light switch is clear; pulling the chord will either turn on or off the CD player similar to how a light may be switched on or off. But this is

where the similarity stops; it is, supposedly, not the designer's intention to map meanings from the domain of lights or light switches onto his product, but merely to point out a surprising or witty functional similarity. One could argue, however, that the difference between metaphor and analogy is not as straightforward, or generally agreed upon, as perhaps suggested in this brief discussion. The designer of IDEO's CD player, for instance, might object that his design was in fact centered on the transfer of meaning, grounded in the metaphor 'Music is light' (i.e. 'music' is a source of 'light' in the lives of people).

Based on such considerations, several authors have pointed out that our understanding of a symbolic expression rests on the intention we ascribe to its creator, i.e. on our figuring out what it is the designer tries to communicate (Cupchik, 2003; Forceville, 1996; Gibbs, 1999; Sperber and Wilson, 1995). In case we assume, for the moment, the designer of IDEO's CD player did in fact have the metaphor 'Music is light' in mind (and not just a functional analogy), his product may very well acquire a different, perhaps 'deeper', meaning, changing the experience of the product as a whole. Of particular interest in this regard are Cupchik's writings on metaphor:

Metaphors are generated through intentional acts and presume a point of view on the part of their creators, prompting readers to adopt a perspective in their 'effort after meaning' (Cupchik, 2003, p. 19).

Readers adopting an appropriate perspective, Cupchik argues, spontaneously experience the unity of the metaphor, brought about by a merging of the two domains involved (Cupchik, 2003). Arguably, this 'merging' takes on special significance in relation to product design where source and target literally merge, i.e. they literally occupy the same space (cf. Forceville, Hekkert and Tan, 2006). As a result of this merging, we usually do not distinguish between source and target in the experience of products; what is experienced is an integrated, seemingly novel phenomenon.

Elaborating on the aforementioned 'desktop metaphor,' Fauconnier and Turner (2002) point out:

The user manipulates this computer interface not by means of an elaborate conscious analogy but, rather, as an integrated form with its own coherent structure and properties. From an 'objective' point of view, this activity is totally novel – it shares very few physical characteristics with moving real folders ... Yet the whole point of the desktop interface is that the integrated activity is immediately accessible and congenial (Fauconnier and Turner, 2002, p. 24).

Fauconnier and Turner (2002) refer to integrated forms of the kind discussed, i.e. novel structures that arise from the merging of two or more domains, as 'blends'.

Although this brief discussion might suggest metaphors are special, stylistic devices a designer has at his or her disposal, in the next section we will discuss a more fundamental way in which metaphor partakes in our experience of the world.

### 3.4. Learned meanings

Product experience is also influenced by conventions specific to a particular group of people, culture or geographical region; conventions that we learn and familiarize with through interacting with our environment and others within our culture. The role of conventions is particularly stressed in 'semiotics', the theory of signs, defined as: 'Everything that, on the grounds of a previously established social convention, can be taken as something standing for something else' (Eco, 1976, p. 16). I have learned, for instance, that red flashing lights and high beeping sounds stand for, i.e. signal, danger. Likewise, specific gestures stand for anger or contempt (*I gave him the finger*), and specific kinds of

clothes or haircuts for membership of, or adherence to, a specific social class or ideology. As indicated by these examples, semiotics is basically concerned with communication between people living within a society by means of some system of shared conventions (Smythe, 1984).

As for industrial design, the theory of signs gave rise to a discipline called product semantics, defined by Krippendorff and Butter (1984; chapter 14, this volume) as:

An effort to understand and to take full responsibility for the symbolic environment into which industrial products are placed and where they should function by virtue of their own communicative qualities (Krippendorff and Butter, 1984, p. 4).

For the study of these communicative qualities, it is constructive to distinguish between ‘denotation’ and ‘connotation’. Whereas the former refers to the communication of a product’s primary function, the latter reflects the communication of socio-cultural values and behavioral standards (Muller, 2001). A chair’s primary function, for instance, is ‘sitting’; the communication of this function by means of the conventionalized form elements laid down in the prototype of the category is what we refer to as ‘denotation’.

Next to communicating its primary function, a chair also communicates, i.e. connotes, supplementary or secondary meanings. Dependent on features of its design, a chair may be typified as an everyday office chair or a majestic throne. Conventions play a role herein in that particular materials or forms are readily associated with specific socio-cultural values. Materials like silver and gold, for instance, are easily associated with *luxury* and *refinement*, recycled materials and plastic, on the other hand, are generally perceived as *cheap* or *trashy*.

Designers, for this reason, may be considered communicators who have at their disposal a repertoire of forms and materials connoting agreed upon, shared meanings. Following this conceptualization of design as a process of communication, designers and researchers at times advocate the development of a suitable form language in which to talk about the symbolic qualities of products (e.g. Krippendorff and Butter, 1984). In car and theater design, for instance, designers often rely on the idea that consumers recognize a certain number of established, standard characters. Organic form features, for instance, are readily recognized as expressing *cuteness* and *friendliness* within Western culture, granting a car an overall friendly ‘character’ (Janlert and Stolterman, 1997).

### 3.5. Discussion

The studies reviewed in this section place primary emphasis on biological or cognitive processes involved in the experience of objects, hence the emphasis on biologically motivated levels of arousal in the nervous system, learned meanings, metaphorizing, etc. In its strong form, the individual-centered perspective considers an object’s expression to be foremost a construct of the mind; objects merely present ‘information’, what really matters are the ways in which we process that information. It is this assumption underlying a so-called ‘idealist’ approach, one could argue, that is at times problematic. For by focusing primarily on the perceiver, they often fall short in providing us with the means to trace the symbolic or expressive meanings people give to objects.

Regardless of the emphasis on either object or perceiver, it is of course true that the studies discussed so far in one way or the other acknowledge the contributions of both. In the perspective discussed next, however, it is stressed that explicit and equal emphasis should be placed on the interdependent contributions of both object and perceiver by focusing on the way they interact. This third perspective, coined ‘embodied realism’

(Lakoff and Johnson, 2002), originates in the writings of the American philosopher John Dewey and the French philosopher Merleau-Ponty. Both stress the fact that meaning can only be studied in the light of the interactions between individual and world. Since these interactions are constrained by the peculiarities of the human body, both view meaning (in opposition to theories in which meaning has nothing or little to do with the human body) as essentially embodied. Although notions that conceive of meaning as embodied are thus not ‘new’, it is only in the last two decades that a comprehensive scientific theory centered on embodiment and its relation to symbolic meaning has gradually emerged within the field of cognitive semantics.

#### 4. THE INTERACTIONAL STANCE

After reviewing both object- and individual-centered perspectives bearing on the subject of expression, Dewey concludes: ‘Both of the theories considered separate the live creature from the world in which it lives; lives by interaction through a series of related doings and undergoings’ (Dewey, 1934, p. 103). According to Dewey, meaning is not a more or less fixed property of world or mind, but arises in interactions between individual and environment. Accordingly, Dewey argues, in order to account for an object’s expression, one has to focus on the fusion of qualities directly present in the object and meanings extracted from prior experience:

Different lines and different relations of lines have become subconsciously charged with all the values that result from what they have done in our experience in our every contact with the world about us. The expressiveness of lines and space relations in painting cannot be understood upon any other basis (Dewey, 1934, p. 101).

In stressing interactions between people and their environment (i.e. ‘our every contact with the world about us’) as the focal point of expression, Dewey acknowledges the role of the body in shaping our experience of the world. In a similar fashion, Merleau-Ponty coins the term ‘motor intentionality’ to characterize activities that involve a ‘bodily’ understanding of objects (Merleau-Ponty, 1962).

An implication of the writings of both Merleau-Ponty and Dewey concerns their emphasis on knowledge as an ongoing process, rather than a fixed or static ‘thing’. In concordance with Merleau-Ponty, Dewey argues that we do not learn about our world by intellectually figuring out how things are (i.e. by forming mental representations), but through interacting with it. According to both, it is only through these interactions that we have a world to begin with, or in the words of Mark Johnson: ‘We are what we are at this instant, and our world is what it is at this instant, only because of our embodied interactions’ (Johnson, 1991, p. 11). And since these interactions are ever changing, so are the kinds of understanding they give rise to.

The notions put forward by Dewey and Merleau-Ponty form the basis for the research reviewed in the remainder of this section. As indicated by these studies, the kinds of bodily understanding discussed by Merleau-Ponty and Dewey are not trivial or limited to specific, concrete situations, but influence our experience of the world in general.

##### 4.1. Lakoff and Johnson on metaphor

In the early 1980s, Lakoff and Johnson brought metaphor back in fashion by the release of their book *Metaphors we live by* (Lakoff and Johnson, 1980). Next to reestablishing

metaphor as an interesting phenomenon, they convincingly showed many of the traditional views on meaning and understanding to be mistaken. Until recently, for instance, metaphor was primarily considered a linguistic stylistic device. What Lakoff and Johnson showed was that metaphor is not just a linguistic device, but lies at the basis of thought in general.

A specific class of metaphors, referred to as ‘spatial-relational’ (Johnson, 1987; Lakoff and Johnson, 1980), is of direct relevance to the subject under discussion. As Lakoff and Johnson demonstrated, spatial-relational metaphors are grounded in bodily interactions between individual and environment, and structure the way we understand symbolic expressions of all kinds. In *My spirits were high again*, for instance, a sense of happiness is conveyed in terms of being ‘high’ above the ground. In *I am down*, on the contrary, sadness is associated with being in a ‘low’ position. Apart from happiness and sadness many other concepts may also be defined in terms of the same spatial-relational concept. One may, for instance, also ‘use’ the notion of ‘being high’ to convey a sense of achievement or success as in *I am on top of the world*. Next to being defined in terms of a ‘low/high’ orientation, symbolic linguistic concepts may also receive their structuring from spatial-relational aspects such as ‘inside/outside’, ‘front/back’, ‘balanced/unbalanced’, ‘near/distant’, ‘center/periphery’, etc. A not so friendly or talkative person, for instance, may be described as *distant*, or a psychotic patient as *unbalanced* or *unstable*.

Although Lakoff and Johnson were the first to study this type of metaphor in a systematic way, Arnheim had pointed out their existence as early as 1977:

All genuine metaphors derive from expressive shapes and actions in the physical world. We speak of ‘high’ hopes and ‘deep’ thoughts, and it is only by analogy to such elementary qualities of the perceivable world that we can understand and describe non-physical properties (Arnheim, 1977, pp. 208–209).

As suggested by Arnheim, defining concepts in terms of specific spatial-relational aspects is not arbitrary but relates to ‘actions in the physical world’. Lakoff and Johnson refined Arnheim’s claim by arguing that the structuring in question is grounded in experiences arising from repeated embodied interactions with the environment. Of special importance to their theory is the notion that embodied interactions may share a similar structure, referred to as an *image schema*.

## 4.2. Image schemas

Image schemas are spatial-relational structures manifest in our everyday interactions. The ‘verticality schema’, for instance, arises from our ambition to achieve an erect, upright position. In our attempts we continually experience the effects of gravity pushing us down. As we grow older, we find we can resist gravity and achieve and maintain an upright position, an effort that requires power and control. We find we have control over people and things in our environment when we are literally higher (e.g. surveying a crowd of people from up ‘high’, or manipulating objects from ‘above’). Conversely, we may feel threatened or vulnerable when people or things rise above us (e.g. lying on the floor while others surround us standing up straight, or looking up at a skyscraper reaching ‘high’). What these examples have in common is that they all reflect embodied interactions between an individual and his environment that share a similar spatial-relational structure (i.e. all interactions involve an individual’s bodily orientation in the vertical plane).

Similarly, in all of our interactions we are either in or out of containers of various kinds. At this moment, I am inside my office. As I walk outside, I head for my car that is another type of container. And at night I step in and out of bed, yet another type of

container. In other words, this containment structure (i.e. image schema) figures as a constant throughout our everyday interactions, or as a ‘pattern in the ongoing flow of our experience of a world’ (Johnson, 1991, p. 12). Phenomenologically, we find that various degrees of containment give rise to different types of feelings. Higher degrees of containment generally bring about higher degrees of experienced *security* and *protection*, but at the same time constrict our freedom to move, making us feel *trapped* or *isolated*. Such interactions (and the experiences they give rise to) are embodied in that they are constrained by the peculiarities of the human body. A container of any kind, for instance, is (too) small or (too) large, narrow or wide only in relation to our physical bodies.

Lakoff and Johnson mostly provide linguistic evidence to demonstrate the reality and structuring role of image schemas (Johnson, 1987; Lakoff, 1987; Lakoff and Johnson, 1980). Linguistic expressions such as *She is always looking down on others* and *We made it to the top* refer to a verticality structure or schema. And because of aforementioned coupling between image schemas and experiences manifest in our own interactions, one intuitively understands such expressions as conveying a sense of *success* or *power*. In that sense, Lakoff and Johnson not only acknowledge a bodily mode of understanding underlying our experience of the physical world and its objects (as put forward by Dewey and Merleau-Ponty), but also show how such bodily ‘knowledge’ is at the basis of our understanding of symbolic or figurative language (i.e. language that is not about concrete objects or interactions with them).

Image schemas not only partake in language understanding. Lakoff and Núñez (2000) demonstrated that image schemas also constrain mathematical reasoning. With respect to the ‘containment schema’, for instance, the basic fact that we can either be ‘in’ or ‘out’ of a container, but never ‘in’ and ‘out’ at the same time structures our reasoning about conceptual containers in mathematics such as closed sets of points. A point, for instance, is either ‘in’ or ‘out’ of the closed set, but never ‘in’ and ‘out’ at the same time. In a similar vein, Lakoff and Núñez demonstrate that the mathematical concept of ‘infinity’ is grounded in embodied actions that are conceptualized as cyclical or ‘not having completions’, e.g. moving or breathing (Lakoff and Núñez, 2000).

### 4.3. Image schemas and product expression

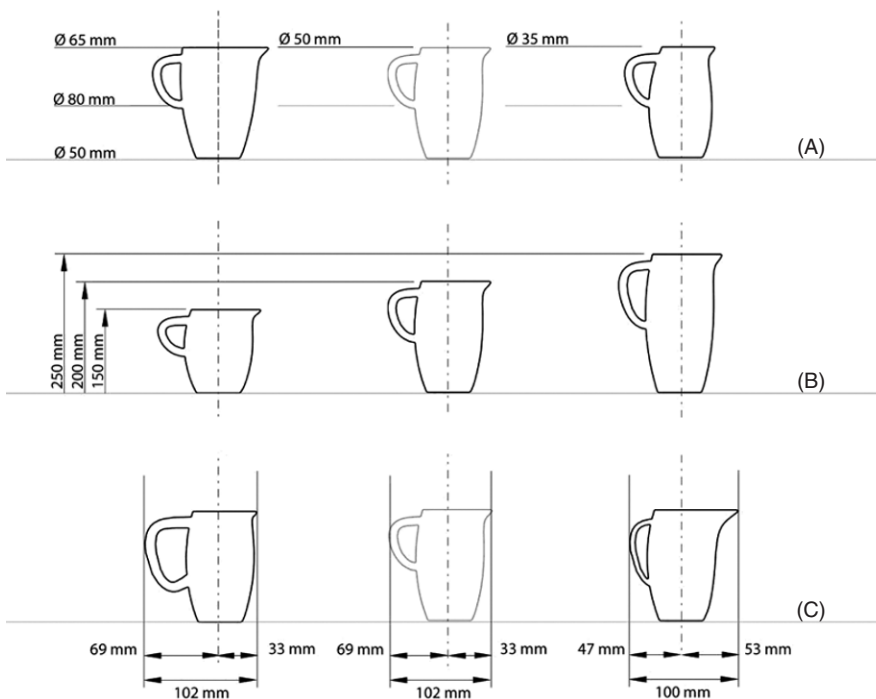
Several authors have studied relations between image schemas and product expression (Johnson, 2002; Muller, 2001; Van Rompay, Hekkert and Muller, 2005a; Van Rompay, Hekkert, Saakes and Russo, 2005b). Van Rompay et al. (2005a,b) proposed that perceiving product expression involves recognition of spatial-relational structures in a product’s spatial gestalt. For instance, similar to how containers protect and cut people off from their environment, designed objects may do the same in relation to the contents they enclose. And since increasing degrees of closure bring about feelings of *security* and *constriction*, objects providing high degrees of closure to their contents are perceived as lending expression to these experiences to a greater extent than objects providing less closure to their contents. Similarly, following the logic of the verticality schema, the higher an object articulates a rising upward, the more likely it is perceived as *dominant*, *impressive* or *proud*. And in analogy to experiences we have ourselves when not properly balanced, objects perceived as unbalanced are understood as *restless*, *unstable*, and *uncontrolled*.

To provide experimental support for these predictions, in one of our studies we designed water jugs representing the image schemas discussed (i.e. the containment schema, the verticality schema, and the balance schema) to varying degrees (Figure 13.3). Ratings of these variants on selected symbolic qualities confirmed our predictions (Van Rompay et al., 2005b). Thus, jugs providing higher degrees of closure to their contents

(Figure 13.3A) were perceived as increasingly expressive of symbolic qualities such as *secure* and *constricting*. Similarly, an increase in height (Figure 13.3B) resulted in higher ratings on characteristics such as *dominant* and *impressive*. And jugs improperly balanced, due to an uneven distribution of spout and handle around the vertical axis (Figure 13.3C), received high ratings on *restless*, *unstable* and *uncontrolled*.

In short, these findings show that our understanding of product expression is grounded in embodied interactions with the environment; perceiving objects as infused with symbolic meanings rests on recognition of spatial-relational structures in product form. To use Dewey's words, such structures 'have become subconsciously charged with all the values that result from what they have done in our experience in our every contact with the world about us' (Dewey, 1934, p. 101). Perceiving product expression, however, should not be considered a passive, analytical process, but rather an imaginative process in which we feel or 'undergo' the relations presented by the object. In this process, the perceiver 'takes' the perspective of the object perceived and comes to 'feel' the experiential consequences of the relations the object embodies. Perceiving a jug as *secure* or *confining*, for instance, involves a projection 'into' the jug. It is this process that enables us to 'feel' its (over)protective qualities. Accordingly, genuine, i.e. embodied, expression results not only from acting on, but also from simultaneously undergoing the relations presented by the object (cf. Dewey, 1934).

Interestingly, 'perspective taking' has been extensively studied in social psychology and has been shown to underlie our capacity to make sense of other people's thoughts and feelings (e.g. Ames, 2004). And with respect to design, Donald Schön (1988, 1992) alludes to a similar process when demonstrating how designers and architects 'project' themselves inside their drawings to get a 'feel' for the experiential consequences of their design moves: 'Thanks to her ability to see and travel in the drawing as though seeing



**FIGURE 13.3** Front views of the image schema-based manipulations: row (A) containment schema manipulation; row (B) verticality schema manipulation; row (C) balance schema manipulation.

and traveling around the building, her move experiment is also a voyage of discovery' (Schön, 1992, p. 150). Hence, Schön claims, designers' and architects' design moves are 'embodied in acts of seeing' (Schön, 1992, p. 137). Our results suggest that not only is 'perspective taking' or projection essential to the creation of design, as suggested by Schön, but also to the experience of design.

#### 4.4. Variability in the perception of product expression

In presenting the embodied perspective, we suggested that it would allow us to understand those aspects of product expression that are relatively stable across situations and individuals. Human bodies, after all, show little variation across the world, irrespective of cultural origin, and the same holds, although to a lesser degree, for the environments we interact with. Therefore, the symbolic meanings discerned in products should show consistency across regions and cultures, a claim persuasively formulated by Rudolf Arnheim:

The symbolism of the arts could not move us so profoundly and prevail over changes in cultural convention, were it not rooted in the strongest, most universal human experiences (Arnheim, 1977, p. 210).

In order to test the cross-cultural relevance of our findings, a replication of the study reported, using identical stimulus materials, was conducted in Brazil (Van Rompay et al., 2005b). Although the results were by and large consistent with the Dutch findings, lending partial support to our prediction, several inconsistencies emerged.

Most notably, the containment schema manipulation (reflected in the degree to which the jugs enclose their contents, see Figure 13.3A) did not influence ratings on symbolic qualities as expected. For instance, the prediction that increasing degrees of containment would result in higher ratings on *secure* (a prediction supported by the Dutch results) was not supported by the Brazilian findings. Arguably, such discrepancies relate to differences in social interactions, climate, and/or occurrences of violence. For instance, being alone in closed isolated spaces may not be regarded as safe in Brazil, explaining why higher degrees of containment are not perceived in terms of increasing degrees of *security*. Closed forms, that is, may be thought of as representing isolation or retreat from the environment whereas open forms represent connectedness with, or a reaching out to, the environment. Alternatively, retreat or isolation from the environment may be more positively valued in Western European (i.e. individualist) countries whereas collectivism or connectedness to the environment is emphasized in Brazil. And on a more mundane level, differences in weather conditions might influence the connotations people ascribe to indoor and outdoor spaces across cultures. Although these are, admittedly, wild guesses, explanations of this kind may motivate why forms connote different symbolic meanings across cultures.

Another source of variability pertains to the physical environment in which products reside. A product that strikes us as *stately* or *dignified* in a design store may lose its charm back home in our living room. In accounting for such contextual or environmental influences, it has to be kept in mind that products 'acquire' their expression in relation to their environment. Thus, a large vase may strike us as *impressive* because of its size relative to other objects in the environment. Accordingly, changing the measurements of the latter will bring about a change in our perception of the product's symbolic meaning. It is in this sense that symbolic qualities are not static or fixed properties but relational; objects are not expressive of (embodied) symbolic qualities in and of themselves but only in relation to the environment or context in which they reside.



## 5. CONCLUSION

In this chapter we set out to provide an overview of studies in expression with the intent to account for relationships between the concrete (i.e. the product's formal features) and the symbolic (i.e. the product's perceived expression). After all, that is what (some or most) designers do; they have to find a way to 'translate' their ideas regarding the product's envisioned expression into (concrete) form and materials. In order to do so, we argued, it is imperative to understand how a perceived expression comes about. The answer we arrived at was not just that both perceiver and object have to be taken into account, but that we have to understand how interactions between people and their environment give rise to specific experiences. Only then can one account for symbolic meanings exemplified by product form. Of course, the type of symbolic meanings accounted for by this approach, i.e. experience-based expressions, should be distinguished from other types of symbolic meaning discussed throughout this chapter. For instance, symbolic qualities related to learned meanings clearly are not, or at least to a lesser extent, grounded in embodied interactions. Obviously then, not all symbolic meanings are embodied.

But with respect to embodied expressions, are the insights presented also of practical relevance for designers? Several exploratory design exercises and workshops based on the findings presented suggest they are (Van Rompay, 2005; Van Rompay and Hekkert, 2004). In these practices, designers were instructed to design a product with a specific expression. Most striking, and frequently mentioned, was the comment that the insights had allowed them, i.e. the designers, to relate something abstract and difficult to their own experiences, thereby facilitating the translation from idea to form. It would certainly be of interest to further explore how the insights presented should be tailored to best suit designers' needs. Such explorations in collaboration with designers might also reveal how the insights presented can be related to other formal product features, e.g. material selection, and how the findings presented apply to more detailed levels of the form giving process.

In summary, the studies reviewed in this chapter demonstrate that there are many factors that underlie a product's symbolic meaning, most of them well documented in scholarly literature. Surprisingly few studies, on the other hand, have addressed the role of embodiment in the experience of design. In this chapter, we set out to demonstrate the merits of an interactional, embodied approach to product expression. Again, this should not obscure the fact that significant parts of what products express relate to factors other than embodiment, as shown throughout this chapter. But regardless of the extent to which symbolic product meanings are embodied, it is our contention that theories on product experience should take this important factor into account. For it is only then that we come to understand how everyday interactions shape our experience of design.

## REFERENCES

- Ames, D. R. (2004). Inside the mind reader's toolkit: Projection and stereotyping in mental state influence. *Journal of Personality and Social Psychology*, 87(3), 340–353.
- Arnheim, R. (1974). *Art and visual perception*. Berkeley and Los Angeles: University of California Press.
- Arnheim, R. (1977). *The dynamics of architectural form*. Berkeley and Los Angeles: University of California Press.
- Arnheim, R. (1988). *The power of the centre*. Berkeley and Los Angeles: University of California Press.
- Arnheim, R. (1992). *To the rescue of art: Twenty-six essays*. Berkeley and Los Angeles: University of California Press.

- Bandura, A. (1969). *Principles of behavior modification*. New York: Holt, Rinehart and Winston.
- Berlyne, D. E. (1971). *Aesthetics and psychobiology*. New York: Appleton-Century-Crofts.
- Bruce, V., Green, P. R. and Georgeson, M. A. (1996). *Visual perception: Physiology, psychology, and ecology* (3rd Ed.) East Sussex: Psychology Press.
- Coates, D. (2003). *Watches tell more than time: Product design, information, and the quest for elegance*. London: McGraw-Hill.
- Creusen, M. E. H. and Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. *Journal of Product Innovation Management*, 22, 63–81.
- Crozier, W. R. (1994). *Manufactured pleasures: Psychological responses to design*. Manchester: University Press.
- Crozier, W. R. and Chapman, A. J. (1984). The perception of art: The cognitive approach and its context. In: W. R. Crozier and A. J. Chapman (Eds.) *Cognitive processes in the perception of art*, pp. 3–23. Amsterdam: North-Holland.
- Cupchik, G. C. (1994). Emotion in aesthetics: Reactive and reflective models. *Poetics*, 23, 177–188.
- Cupchik, G. C. (2003). The ‘interanimation’ of worlds: Creative metaphors in art and design. *The Design Journal*, 6(2), 14–28.
- De Meijer, M. (1989). The contribution of general features of body movement to the attribution of emotions. *Journal of Nonverbal Behavior*, 13, 247–268.
- Dewey, J. (1934). *Art as experience*. New York: Berkley Publishing Group.
- Eco, U. (1976). *A theory of semiotics*. Bloomington, IN: Indiana University Press.
- Fauconnier, G. and Turner, M. (2002). *The way we think: Conceptual blending and the mind's hidden complexities*. New York: Basic Books.
- Forceville, C. (1996). *Pictorial metaphor in advertising*. Routledge: London.
- Forceville, C., Hekkert, P. and Tan, E. (2006). The adaptive value of metaphors. In: U. Klein, K. Mellman, and S. Metzger (Eds.) *Heuristiken der Literaturwissenschaft. Einladung zu disziplinexternen Perspektiven auf Literatur*, pp. 85–109. Paderborn: Mentis.
- Gibbs, R. W. (1999). *Intentions in the experience of meaning*. Cambridge, MA: Cambridge University Press.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.
- Hekkert, P., Mostert, M. and Stomppf, G. (2003). Dancing with a machine: A case of experience-driven design. *Proceedings of the 2003 International Conference on Designing Pleasurable Products and Interfaces*, Pittsburgh, pp. 114–119.
- Janlert, L. E. and Stolterman, E. (1997). The character of things. *Design Studies*, 18, 297–314.
- Johnson, M. (1987). *The body in the mind: The bodily basis of meaning, imagination, and reason*. Chicago: Chicago University Press.
- Johnson, M. (1991). Knowing through the body. *Philosophical Psychology*, 4(1), 3–18.
- Johnson, M. (2002). Architecture and the embodied mind. *Oase*, 58, 75–93.
- Kandinsky, V. (1926). *Point and line to plane*. New York: Dover Publications.
- Klee, P. (1948). *On modern art*. London: Faber and Faber.
- Klee, P. (1953). *Pedagogical sketchbook*. London: Faber and Faber.
- Koffka, K. (1935). *Principles of Gestalt psychology*. London: Routledge and Kegan Paul.
- Kreitler, H. and Kreitler, S. (1972). *Psychology of the arts*. Durham, NC: Duke University Press.
- Kreuzbauer, R. and Malter, A. J. (2005). Embodied cognition and new product design: Changing product form to influence brand categorization. *Journal of Product Innovation Management*, 22, 165–176.
- Krippendorff, K. and Butter, R. (1984). Product semantics: Exploring the symbolic qualities of form. *Innovation: The Journal of the Industrial Designers Society of America*, 3(2), 4–9.
- Laban, M. (1988). *The mastery of movement*. Plymouth, MA: Northcote House.
- Lakoff, G. (1987). *Women, fire and dangerous things: What categories tell us about the nature of thought*. Chicago: Chicago University Press.
- Lakoff, G. and Johnson, M. (1980). *Metaphors we live by*. Chicago: Chicago University Press.
- Lakoff, G. and Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought*. New York: Basic Books.
- Lakoff, G. and Johnson, M. (2002). Why cognitive science needs embodied realism. *Cognitive Linguistics*, 13, 245–263.
- Lakoff, G. and Núñez, R. E. (2000). *Where mathematics comes from: How the embodied mind brings mathematics into being*. New York: Basic Books.
- Lipps, T. (1897). *Raumästhetik*. Leipzig, Germany: Barthes.
- Locher, P., Gray, S. and Nodine, C. (1996). The structural framework of pictorial balance. *Perception*, 25, 1419–1436.
- Locher, P. and Stappers, P. J. (2002). Factors contributing to the implicit dynamic quality of static abstract designs. *Perception*, 31, 1093–1107.

- Merleau-Ponty, M. (1962). *Phenomenology of perception*. London: Routledge and Kegan Paul.
- Muller, W. (2001). *Order and meaning in design*. Utrecht, The Netherlands: Lemma Publishers.
- Osgood, C. E. (1957). *The measurement of meaning*. Urbana, IL: University of Illinois Press.
- Osgood, C. E. (1960). The cross-cultural generality of visual-verbal synesthetic tendencies. *Behavioral Science*, 5, 146–169.
- Postrel, V. (2003). *The substance of style*. New York: Harper Collins.
- Sawada, M., Suda, K. and Ishii, M. (2003). Expression of emotions in dance: Relation between arm movement characteristics and emotion. *Perceptual and Motor Skills*, 97, 697–708.
- Schachter, S. and Singer, J. E. (1962). Cognitive, social and physiological determinants of emotional state. *Psychological Review*, 69, 379–399.
- Schlemmer, O. (1927). 'Bühne'. In: H. M. Wingler (Ed.) *The Bauhaus: Weimar, Dessau, Berlin, Chicago*, pp. 474. Massachusetts, MA: MIT Press.
- Schön, D. A. (1988). Designing: Rules, types and words. *Design Studies*, 9, 181–190.
- Schön, D. A. (1992). Kinds of seeing and their function in designing. *Design Studies*, 13, 135–156.
- Smythe, W. E. (1984). Psychology and the traditions of symbolization. In: W. R. Crozier and A. J. Chapman (Eds.) *Cognitive processes in the perception of art*, pp. 45–63. Amsterdam: North-Holland.
- Sperber, D. and Wilson, D. (1995). *Relevance: Communication and cognition* (2nd Ed.) Oxford: Blackwell.
- Van Rompay, T. (2005). *Expressions: Embodiment in the experience of design*. Delft University of Technology, The Netherlands.
- Van Rompay, T. and Hekkert, P. (2004). Designing embodied expressions. In: J. Redmond, D. Durling and A. de Bono (Eds.) *Futureground: Proceedings of the Design Research Society*, Vol. 2, pp. 230–237. Melbourne: Monash University Press.
- Van Rompay, T., Hekkert, P. and Muller, W. (2005a). The bodily basis of product experience. *Design Studies*, 26(4), 359–377.
- Van Rompay, T., Hekkert, P., Saakes, D. and Russo, B. (2005b). Grounding abstract object characteristics in embodied interactions. *Acta Psychologica*, 119(3), 315–351.
- Veryzer, R. W. (1995). The place of product design and aesthetics in consumer research. *Advances in Consumer Research*, 22, 641–645.
- Werner, H. and Kaplan, B. (1963). *Symbol formation: An organismic–developmental approach to language and the expression of thought*. New York: Wiley.
- Wertheimer, M. (1938). Laws of organization in perceptual form. In: W. Ellis (Ed.) *A source book of Gestalt psychology*, pp. 71–88. London: Routledge and Kegan Paul.