

Instrumentality, aesthetics and symbolism of physical artifacts as triggers of emotion

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Building on qualitative data collected from three groups of professionals who assessed the green colour of a public transportation bus, this paper develops a model of the relationship between physical artifacts and emotions. The model suggests that artifacts need to be analysed according to three conceptually distinct aspects: instrumentality, aesthetics and symbolism. These three aspects are suggested to arouse emotion through different mechanisms: a hygiene, a sensory and an associative mechanism. The model opens an arena for extensive future research on the role and influence of physical artifacts in general and on emotions in particular.

1. Introduction

Within the broad focus of the present issue on theories and methods in affective human factors design, we suggest that physical notions elicit emotional reactions. We propose that these reactions are conceptually and empirically distinct from reactions to the activity in which individuals are engaged and from the interpersonal interactions in which they engage. Our overarching argument is that physical artifacts of organizations translate into emotions.

We consider artifacts to be, as defined by the Oxford dictionary, 'artificial products, something made by human beings and thus any element of a working environment' (Hornby 1974: 43). We adopt Gagliardi's (1992: 3) addition to this definition that artifacts are always perceived by the senses and that they have certain intentions, aiming to satisfy a need or a goal. Artifacts can include music (Bachorowski 1999, North *et al.* 1999), odour (Hirsch 1995), colour (Sassoon 1992), cartoons (Scheiberg 1990), dress (Kluger and Rafaeli 2000) and furnishings (Davis 1984, Baron 1994). Our effort here considers the emotional impact of artifacts.

2. A review of the influence of artifacts on behaviours, attitudes and emotion

Among organizational researchers, artifacts are regarded as a form of a message from organizations to various constituents (Gagliardi 1992). Bitner (1992) discusses the impact of such communication on service delivery. Others, including Stern (1988), Yanow (1995), Hatch (1992) and Berg and Kreiner (1992), advance the more general argument that building and office landscapes bear social and psychological consequences for people. However, a long stream of research in environmental psychology has identified a wide range of responses elicited by artifacts (Bateson

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1995). Both visual and acoustic elements produce reactions (Nasar 1994, Takahashi 1995, Bachorowski 1999), although such effects are not always direct: Characteristics of the physical environment have been shown to influence emotion through inferences made about human faces (Maslow and Mintz 1972, Mintz 1972) or about social and personal characteristics of others (Vershure *et al.* 1977).

Multiple studies have documented the influence of physical aspects of organizations on the behaviours, attitudes and emotion of employees (Morrow and McElroy 1981, Marans and Spreckelmeyer 1982, Goodrich 1982, Davis 1984, Oldham 1988, Baron 1994), customers (Donovan and Rossiter 1982, Babin and Darden 1995, Hirsch 1995, North *et al.* 1999) and the interactions between them (Parsons 1976, Altman and Vinsel 1977, Morrow and McElroy 1981, Scheiberg 1990, Baron 1994, Oldham *et al.* 1995). These and other summaries of the effects of the physical environment provide the foundation for our assumption that one distinct effect of artifacts is emotion (see also Wohlwill 1976, Russell and Pratt 1980). We also have some empirical support for this assumption. Russell and Pratt (1980) empirically described the affective quality attributed to environments as maintaining two dimensions—pleasantness and arousal, building on the multi-dimensional view of affect asserted by Russell and Mehrabian (1977, 1978) and succinctly but solidly summarized by Feldman-Barrett and Russell (1999). Nasar (1994) documented that descriptors of the environment, including complexity and order, predict individual emotional responses of arousal and pleasantness.

Regarding employees' emotion, Parsons (1976) noted the physical environment as influencing satisfaction or pleasure in addition to productivity, safety, motivation or social interaction. Baron (1994) reviewed the workplace psychology literature and proposed that environmental cues influence arousal and pleasantness of employees. Scheiberg (1990) investigated the personal decoration of workspace, concluding that employees design their space to express emotions. Goodrich (1982) suggested a relationship between employee mental health and office environment. Similarly, research supports the influence of physical environments on customer emotion (Bitner 1992). Store design and atmosphere are represented psychologically in terms of pleasantness and arousal (Donovan and Rossiter 1982, Sherman *et al.* 1997). Emotion mediates intended shopping behaviours within a store (Donovan and Rossiter 1982, Babin and Darden 1995, Sherman *et al.* 1997) and employee and customer dress elicit emotion (Kluger and Rafaeli 2000). Some patterns of dress produce high pleasantness and low arousal, while others produce low pleasantness and high arousal. Likewise, physical qualities of bars and restaurants elicit behavioural scripts that contain distinct affective tones (Wasserman *et al.* 2000).

However, the precise relationship between emotions and the physical environment appears to be complex and is insufficiently documented. It is on this relationship that we seek to focus in the current study of artifacts. Since the nature of the relationship may be due to qualities of the stimulus, we first discuss the issue of analysing artifacts.

3. Analysing artifacts

How can artifacts be analysed? We propose here a model for analysing artifacts, which integrates diverse perspectives of the academic literature. Such integration, we have found, is essential for relating artifacts to emotions. Our model argues that *artifacts can and should be analysed on three independent dimensions—instrumentality, aesthetics and symbolism*. These three dimensions do not represent one dis-

ciplinary focus on artifacts, but rather an integration of a diverse set of disciplines, including human factors, psychology, sociology, philosophy and organizational behaviour. This integration is briefly summarized next, to provide a foundation for understanding what it is about an artifact that sets off emotions.

Wener (1985) offers the seeds of such integration, identifying three levels for analysing artifacts. A first basic level according to Wener is the *ergonomic* level, which entails the influence of aspects of the work environment on individual *performance*. Howell (1994) and Oldham (1988) operated at this level in that they related characteristics of the workplace to employee performance of job tasks. A second level according to Wener (1985) is the *social ecology* level, where the design of a work environment (i.e. the arrangement of desks, distance between workstations, size) influences the development of interpersonal interactions. Empirical work at this level was reported, for example, by Oldham *et al.* (1995) as well as by Altman and Vinsel (1977). A third and most abstract level of analysing artifacts, according to Wener (1985) is the *symbolic* level, which refers to the symbolic meaning concealed in a set of physical properties. In this vein, Ornstein (1986) and Stern (1988) explore the values represented by desks, chairs and logos.

A related set of theoretical efforts identified categories of artifacts. Bitner (1992), for instance, suggested three categories: ambient conditions (music, smell), space and function (equipment, arrangement) and symbols and style. Davis (1984) suggested a similar but more complicated categorization system, proposing three types of artifacts—physical structure (space, location, arrangement), physical stimuli (noise, reading material, incoming mail) and symbolic artifacts (signs, colours, carpets, furniture). Baker *et al.* (1994) suggest yet another categorization theory, which includes ambient factors (temperature, music), social factors and design factors. However, in this typology the latter category (i.e. design factors) was further divided into functional factors and aesthetic factors. Nasar (1994) proposed yet another categorization system—formal stimuli, which can be measured (size, form, proportion, colour) vs symbolic stimuli, which have more abstract and subjective meaning (style).

Implicit to all these categorization schemes is the assertion that categories are mutually exclusive, meaning that an artifact belongs to one discrete category or another. Authors do not state this assumption explicitly, yet very few analyses of artifacts avail multi-dimensionality. Also missing from available analyses is a coherent theory of how artifacts operate. That is, once an artifact is categorized, what happens then? Although artifacts have been linked to emotion, as our review of the literature suggests, the mechanisms through which this link occurs remain unexplored. Toward remedy of these two shortcomings, we propose a different way of analysing artifacts. We do not suggest another categorization scheme. Rather, we argue that artifacts can and should be analysed on three independent dimensions—instrumentality, aesthetics and symbolism. We also propose and illustrate that these dimensions influence emotions through conceptually distinct mechanisms.

3.1. *A model for analysing artifacts*

There are some hints in current theory that artifacts can embody conceptually distinct and independent qualities. Canter (1977) and Lang (1988), for example, discuss both how people act and feel in different places. Markus (1987) suggests three concepts for the characterization of buildings—form, space and function. Hershberger and Cass (1988) identify multiple factors on which buildings can be

evaluated, including utility evaluative and aesthetic evaluative. Yet, these and similar efforts analyse distinct aspects of a building as having distinct implications. In Markus' (1987) analysis, for example, the form of a building is considered a design factor rather than a function factor. In Goodrich's (1982) analysis, an office environment is considered an instrumental cue, not a symbolic cue. Thus, current models maintain the implicit assumption that an artifact is to be categorized into one analytic category.

One exception to this discrete approach is presented by Strati (1992), who advances an 'aesthetic approach' to artifacts and argues that classifying artifacts into aesthetic objects and functional objects is inaccurate and misleading because any artifact is likely to load on both factors. Strati (1992: 571) illustrates that while a picture is typically classified as 'aesthetic' and a chair is typically classified as 'functional', chairs and desks have aesthetic properties and pictures have functional properties. A picture of a wheelchair, for example, has the important functional property of informing drivers that a specific parking space is reserved for cars of handicapped individuals. Strati (1992) explains:

I have described the physical aspect of the room—furniture embellishment, status symbols, work technologies and the organizational communication of them, avoiding the customary procedure of separating them according to their functions or hierarchies. I have done this because it is fundamentally important in the aesthetic reading of organizational life to avoid any distinction between what is a piece of artwork and what is an object of routine practice.

Strati (1992) further notes that an ideal industrial product is both useful and beautiful. Thus, he suggests that the aesthetic dimension and the functional dimension, both of which he advances for analysing artifacts, are conceptually independent, since a certain degree of functionality and a certain degree of aesthetics can characterize any artifact. There is no obvious positive or negative correlation between the functionality and aesthetics of an artifact.

This argument is the foundation of our model in which artifacts are to be analysed on multiple dimensions, rather than be classified into a particular dimension. This argument provides a critical foundation for understanding emotions because an artifact's loading on each of the three dimensions in our model is likely to have its own set of effects on emotions. We briefly describe each of the dimensions for analysing artifacts next, as a prelude to describing an empirical study that explores and documents their impact on emotions.

3.1.1. Instrumentality: The instrumentality of an artifact refers to the extent to which the artifact contributes to performance or to promoting goals. People have goals to accomplish, and artifacts can be evaluated according to whether they help or hinder the accomplishment of these goals. Canter (1977, 1997) aptly illustrates this feature of artifacts with respect to physical places or environments. Gibson's (1979) ecological approach suggests that what people perceive in the environment are 'affordances', namely the extent the environment supports or hampers desired activities. Nielsen (1994) referred to the 'usability' of artifacts as a critical feature.

Shumaker and Pequegnat (1989) suggest two models of the impact of the physical environment on efficiency and productivity. A first model, entitled 'direct influence', is where the environment supports or disturbs the performance due to bad location, damaged equipment, etc. A second model, entitled 'indirect influence', is where the

environment causes stress, which in turn hampers performance. Garling and Golledge's (1989) review of environmental psychology consistently emphasizes the key role that individual perception of the impact of an environment on facilitating performance plays in assessments of this environment. Thus, the importance of instrumentality of an artifact as a dimension of assessing this artifact is indisputable. However, this is not the only dimension relevant to such assessments. As elaborated next, our review of the literature posits at least two other dimensions—aesthetics and symbolism.

3.1.2. *Aesthetics*: A second essential dimension regards the aesthetics of an artifact, which is the sensory experience it elicits, and the extent to which this experience fits individual goals and spirit. Lang (1988) notes that understanding an aesthetic experience requires distinguishing between three types of environmental experiences—sensory aesthetics (colours, odours), formal aesthetics (forms, complexities) and symbolic aesthetics (associative meanings which cause pleasure). Nasar's (1994, 1997) typology of environmental cues also focuses on aesthetics. According to Nasar, formal as well as symbolic stimuli have aesthetic implications. Strati (1992, 1999), who played a central role in rejuvenating the importance of aesthetics to organizations, connects between architectonic aesthetics and organizational experiences. Related efforts by Gagliardi (1992), Dean *et al.* (1997) and Ramirez (1991) further position aesthetics as an essential, but independent, dimension in assessments of artifacts.

3.1.3. *Symbolism*: A third dimension is the symbolism an artifact represents—the meanings or associations it elicits. Csikszentmihalyi and Rochberg-Halton (1981) illustrate that things, even simple or mundane such as chairs and tables, have meanings. Schein (1990), Trice and Beyer (1993) and Stern (1988) position artifacts as symbols representing the values of organizational cultures. Ornstein (1986) illustrates that the physical layout of an organization associates the organization with certain qualities. Importantly, the attributions made to an artifact are not necessarily those intended by the organization, because of the process of interpretation made by the observer and the complexity of attribution and associative process. Davis (1984) argues that artifacts are frequently subject to multiple interpretations, and can have both intended and unintended symbolic consequences. Raz (1997: 206), for example, describes a 'communication failure story' in Tokyo Disneyland, where a sign for a toilet confuses park guests because the toilet has an English sign saying 'rest rooms' and in Japanese 'rest' stands for 'resuto' (restaurant). According to Raz, park guests seeing the sign continue to bother park employees because they do not realize it symbolizes toilets. Gagliardi (1992) focuses attention on views of corporations afforded by symbols and artifacts. Berg and Kreiner (1992) discuss how physical settings of organizations are actually 'symbolic resources'. Hatch (1992) reports how attitudinal and behavioural responses to offices are products of the meanings that individuals attribute to the work environment.

In short, three dimensions are suggested here as essential to capturing the influence of artifacts—an instrumental dimension, an aesthetic dimension and a symbolic dimension. What is still unclear is whether or how each of these dimensions elicits emotions, the topic on which we focus next.

4. How do artifacts elicit emotion?

Students of emotion maintain an intellectual debate about the question of what comes first, emotional responses or cognitive assessment. Schachter and Singer (1962) documented that cognitive appraisals are often sufficient to determine the quality of an emotional experience. They showed that, although there are physiological bases to emotional experiences, attributions of a reason for the experience influence perceptions of the quality of the experience. Lazarus (1984) supported this notion with the argument on the primacy of cognition, claiming that cognitive assessment is what produces emotional reactions. Cognitive appraisal of a situation, according to Lazarus, determines the intensity of emotional experiences. Zajonc (1980: 151, 1984) disagreed with Lazarus, arguing: 'preferences need no inferences'. Zajonc (1984) views emotion as independent of cognition and as immediate physiological and psychological responses to stimuli.

Our analysis circumscribes this debate by assuming that both of these mechanisms are central to the impact of artifacts on emotions. We view these alternative processes as related to the emotional impact of distinct dimensions of artifacts. To substantiate this view and enhance the understanding of how artifacts relate to emotions, we conducted a qualitative study of reactions to an artifact. The artifact was the colour of buses of a public transportation organization in Israel. Although colour may be viewed as a minor, technical artifact, our study, as described below, reveals how it maintained the three dimensions of instrumentality, aesthetics and symbolism. Moreover, these three dimensions all led to emotions.

5. Method

Our data are multiple reactions to the effort of a public transportation organization in Israel to improve its image through bus design. Buses, which were previously coloured red and white or violet and white, were painted a dark and homogeneous green. The green colour was selected by various consulting firms and was declared and bolstered in public relations efforts. However, the colour produced massive and unexpected responses from multiple constituents: passengers, bus drivers and other employees, other people on the road (drivers and pedestrians), competitors and advertisers and special interest groups (e.g. environmental organizations, disabled and senior citizens). Company management was genuinely surprised by the criticism that the colour campaign received.

We saw the focus on colour as a powerful theoretical case study of the impact of artifacts because of the relative simplicity with which it could be defined and sensed. Colours are a central and dominant notion perceived by the senses. Yet, they also communicate meanings and influence emotions and behaviours (cf. Sassoon 1992). This made us expect that colour would be simple enough for people to notice and discuss, yet rich enough to exemplify and help us elaborate our theory.

5.1. Data collection

Our focus here is on the analysis of the colour by a set of experts who were selected because we assumed their expertise is in one of the three dimensions of our model for analysing artifacts (see figure 1). We did *not* introduce the model to these experts, but rather asked them for their open-ended assessments of and reactions to the colour (see Appendix). We interviewed experts during a period of 3 months, starting the week that the green colour was announced in the news.

5.1.1. *Instrumentality experts*: These comprised individuals working with the artifact, namely bus drivers and technical staff, who are involved in the day-to-day operation of the buses and individuals trained in the engineering of such artifacts, namely civil and industrial engineers involved in analyses of the utility and usability of buses (cf. Nielsen 1994). First, we conducted semi-structured interviews with company employees including bus drivers ($n=29$) and technical support staff (i.e. engineers and mechanics, $n=10$). Secondly, we interviewed advanced students and professors of transportation and industrial engineering ($n=35$) (cf. Hakkert and Katz 1991, Hakkert 1994).

5.1.2. *Aesthetics experts*: These were individuals whose area of expertise is in the realm of artistic design or creation. Such individuals undergo training in both creation and assessment of aesthetic properties of products and art pieces. We conducted semi-structured interviews with such aesthetic experts ($n=12$), including product and industrial designers and visual communication experts. Half of this group comprised advanced students in these areas and the other half comprised professionals with more than 5 years experience in the area.

5.1.3. *Symbolism experts*: These were professionals who consider artifacts as a means of communication. These are individuals whose expertise focuses on the messages a product or its package can send to various target groups. The mandate of such professionals is, for example, to design ads, packages, products and verbal messages in a fashion that arouses the 'right' associations. We conducted in-depth interviews with public relations consultants and advertisers ($n=15$), all of whom are educated in psychology and marketing. A third of this group comprised symbolic professionals employed by the bus-company (i.e. company spokesperson, marketing and public relations consultants). The others were individuals in similar professions with no formal contact with the company.

These diverse samples serve the inductive goal of the study since they allowed us to reach theoretical saturation (Strauss and Corbin 1990).

5.2. *Data analysis*

All interviews were tape-recorded and transcribed verbatim, yielding a large amount of qualitative, narrative data that was analysed inductively. Following the iterative process, recommended by Strauss and Corbin (1990) and Miles and Huberman (1984), we used the data to construct an emerging structure theoretical argument. Recurrent visits to the data helped us build and refine an increasingly coherent conceptual framework that captures and explains the richness evident in the data and also makes a sound theoretical contribution.

We began the inductive process with a theoretical framework that recognized the three aspects of an artifact (instrumentality, aesthetics and symbolism). Our search was for the relationship between these aspects and emotion. Initially, we scanned the data in search of dominant themes. Examples of themes identified at this stage are 'green symbolizes life and growth', 'green symbolizes hospitals', 'green is peaceful and tranquil', 'green is not safe as a colour for a car' and 'this hue of green is really ugly'. We identified more than 40 such themes, and, in support of our initial theoretical model, we confirmed that these themes could clearly be organized into three main categories.

The first, instrumental category, comprised themes such as ‘you can’t see the green colour at night’. The second, aesthetic category, comprised themes such as ‘this colour is dreadful, it is dull, uniform, and ugly’. The third, symbolic category, comprised themes such as ‘green reminds me of garbage trucks’. The authors and two graduate research assistants independently categorized the themes into the three categories. Only minimal disagreements were noted in this categorization process confirming that the conceptual structure of three dimensions, as represented in figure 1, provides a parsimonious vehicle for capturing the data.

During this categorization process, we noticed, however, that although we collected data from professionals who were selected according to and probed about their expert opinion on the three distinct elements of our model, data from *all* experts included *all three elements*. Thus, our data suggested that, although experts were professionals who presumably focus on one specific aspect of an artifact, they called up the other aspects in their analyses. In addition, we noticed that, although our data collection tools did *not* mention emotion in any way (see Appendix), our data contained a wealth of emotional reactions. Our original expectation was that emotional reactions would be reported by the aesthetic experts, because of the presumed link between aesthetics and emotion. However, our data countered this expectation, since emotional reactions evident throughout the data were noted by all three groups of experts and were elicited by each and every one of the three qualities of the artifact.

We then brainstormed alternative conceptual structures that would make sense of these data, to help us address our research question, namely—the manner in which emotional reactions are related to the three dimensions of artifacts. This brainstorming yielded the idea that there are multiple mechanisms through which artifacts produce emotions. Moreover, the three dimensions of the artifact could be identified as triggering three distinct mechanisms in which the artifact produced emotions. We specifically noted that aesthetic considerations of the artifact elicited a different emotional process than instrumental and symbolic considerations. The link between aesthetics and emotions in our data appeared to be direct and almost immediate (e.g. ‘This is a disgusting and ugly colour, I hate it, I can’t understand why they chose it’). In contrast, the link between a symbolic view and emotions involved a more complicated process, of associative interpretations (e.g. ‘green reminds me of a hospital, which reminds me of an emergency room, which reminds me of road accidents and makes me feel bad’).

The results of this iterative process of data analysis are summarized in figure 1. Once we agreed on this broad conceptual structure, which connects the physical qualities of the artifact to the emotional reactions expressed by multiple constituents, we classified the data into the multiple elements of the model. The classification produced a set of data that is the foundation of our findings, which confirm and illustrate the elements of our argument: (a) there are multiple expressions of emotion in assessments of artifacts; (b) these emotions emanate from multiple aspects of the artifact. Thus, as elaborated below, our analysis of the extensive set of qualitative data led to the thesis we advance in this paper, that three dimensions of an artifact—instrumentality, aesthetics and symbolism—elicit multiple emotions, through three different mechanisms.

6. Findings

6.1. Overview

Our data comprised experts' assessments of and reactions to the green colour of a public transportation bus and included distinct references to three aspects of the green colour as well as a rich set of emotions. Although we expected and explicitly asked experts about distinct interpretations of the colour (e.g. functionality, symbolism and aesthetics), their responses consistently referred to more than one and typically to all three aspects. Thus, even experts who are trained to use one professional lens for analysing the green colour implicitly recognize the multiple implications of this colour. Classifying this simple artifact—the green colour of a bus—into one category (e.g. aesthetics), which is what previous analyses of artifacts implicitly endorsed, would have missed a big part of the impact of the artifact. Indeed, perhaps this was the pitfall that led the studied organization to overlook the public relations havoc that the new colour would create. Regarding emotion, our data were even more diverse. We found the three dimensions of the artifact to elicit emotion through conceptually distinct processes, as summarized in figure 1.

As figure 1 summarizes, instrumentality of the green colour produced emotion primarily through a disruptive process of bringing about unpleasant emotions when it was judged as dysfunctional. Our data suggest that proper functionality of an artifact (e.g. the green colour) may at best produce neutral emotion, but is not likely to be noticed or to produce positive emotions. Thus, instrumentality of an artifact is suggested to have emotional effects similar to those of hygiene factors of a job on employee motivation (Herzberg 1966). In sharp contrast, aesthetic aspects of the colour are suggested by our data to produce emotion through a non-mediated, sensory process of direct impact on the senses. Here, the artifact itself is sensed as pleasant, arousing, boring or annoying, with no mediation involved. Emotion is also elicited by symbolic aspects of an artifact, through the associations the artifact elicits. When the green colour drew positive associations, pleasant emotions were reported. When associations were undesirable, emotions such as disgust, anger or anxiety were reported.

In describing our findings, we first document the three dimensions of the artifact in our data. Then, we illustrate the existence of emotional reactions and the mechanisms underlying the relationship between each of the three dimensions and emotions.

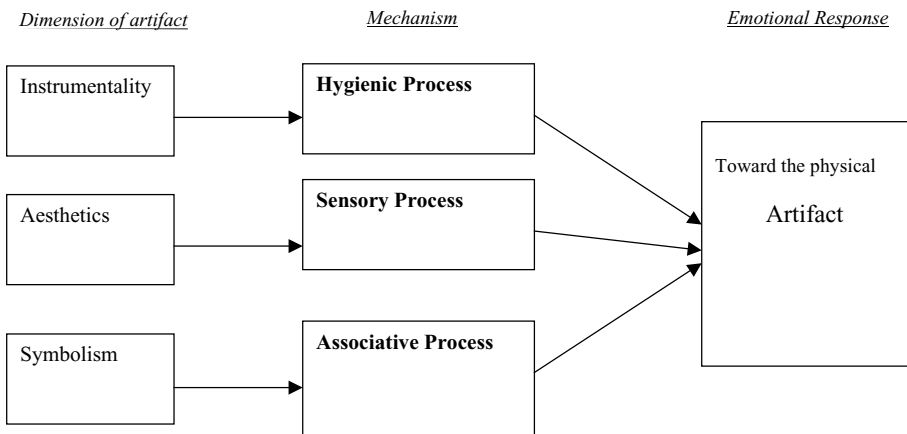


Figure 1. A model of the impact of physical artifacts on emotions.

6.2. *Evidence of three dimensions of artifacts*

Experts discussing the green colour used their professional tools or language in their analyses. To illustrate, a transportation engineer described the bus colour in terms of its safety (or lack thereof). Note how he uses technical terms from his field of expertise:

The green colour is relatively dark. The colour is clearly damaging to the passenger, the drivers on the road and the other users of the road, because the dark green is not visible. An important element in visibility is contrast. Contrast is accomplished by a difference between an object and the background. So, when you pass a junction in the dark and a large black object 12 m long passes by, it is not good. ... In general, white would be more different, contrasting, from most areas in this country, which are brown, yellow and green.

In contrast, an aesthetics expert (a designer) described the same artifact using language and concepts from her field of expertise:

In a country such as ours with colourful vividness, to impose such a full colour on a bus, on a complex such as a bus, on such a big complex such as a bus, and such a green, it is simply appalling. ... why not colours that communicate movement, transportation ... blue, red, purple. Not green.

A symbolism expert provided yet a third professional perspective of the artifact. This perspective called up symbolic features of the colour:

Green symbolizes nature, symbolizes environmental friendliness, greenery, shrubbery, this is what the advertisers wanted to communicate because they wanted to change the image from an image of an environmental polluter to an image of a body that is environmentally friendly.

However, experts in all three groups also referred to the other dimensions of the artifact. Such references were much shorter than when experts were talking about their area of expertise but, as illustrated by tables 1–3, all types of experts clearly turned to all of the aspects of the artifact. Thus, the data in tables 1–3 support our first argument—that an analysis of an artifact, even if it is merely the colour of a bus, necessitates simultaneous reference to three dimensions, rather than categorizing the artifact into one of these dimensions.

6.3. *Emotional reactions to the artifact*

Our data collection intentionally did *not* mention or emphasize emotion in any way, because we wanted to see whether and how emotion would arise naturally. Indeed, our data contained a wealth of emotional reactions. To illustrate, one of the drivers noted: ‘This colour is a real shame. It is repulsive and disgusting’. Similarly, a designer noted:

This green colour is awful. It does not create a relaxed or safe atmosphere of tranquility, but rather a stressful and irritating and noisy atmosphere.

And an advertiser stated:

We don’t want a colour that creates fear and anxiety. This is a bus and a transportation company should convey power and security.

The emotions elicited were not necessarily negative. Nor was there a clear relationship between the informants’ area of expertise and their affective assessments.

Table 1. References to instrumentality of artifact by multiple experts.

Category of expertise that expert represents	Source of data	Data
Instrumentality	Bus driver	The colour is not really safe. <i>Green</i> buses cannot be seen at night.
	Engineer	The heat inside a bus is a function of its colour. The lighter the colour the more light it reflects, the darker it is the more light it absorbs. The <i>green</i> causes an elevation of up to 4°. This will undoubtedly cause a loss of energy in the summer.
	Engineer	The <i>green</i> makes it difficult to see in the dark for drivers and pedestrians. This can lead to road accidents.
Aesthetics	Designer	Buses cannot be seen and cannot be identified at night. The colour is recognizable when it is light out, not when it is dark.
Symbolism	Company spokesperson	We have been criticized that the <i>green</i> is not safe at night. That it cannot be seen. This is nonsense. Red cannot be seen any better at night.
	Advertiser	The <i>green</i> is problematic because it does not stand out at night. In the dark, the bus seems to be black.

Table 2. References to aesthetics of artifact by multiple experts.

Category of expertise that expert represents	Source of data	Data
Aesthetics	Designer	The colour is ugly and unnecessary. They should have left some parts white or in different shades of <i>green</i> to avoid the total effect which is unpleasant and stifling.
	Designer	The colour, bluish <i>green</i> , is connected to the environment and local scenery. To the artificial scenery of signs, and to the natural scenery of the sky, the grass and the trees.
Instrumentality	Bus driver	The colour is simply ugly.
Symbolism	Engineer	For me, the <i>green</i> hue is too dark.
	Advertiser	There is a very dark <i>green</i> and a light <i>green</i> . I prefer the lighter. It is nicer.

Thus, a different designer described the new colour as ‘communicating movement and flow. It invites participation, less subordination and is not imposing’. Two engineers saw the colour as conveying an atmosphere that is ‘tranquil and relaxed’ and ‘gay and friendly’.

Emotions also surfaced in the context of instrumental and associative analyses. To illustrate, two engineers noted emotions produced by the association between the green colour and hospitals:

The green colour is identified with a hospital emergency room, which creates unpleasant associations with road accidents.

The green colour elicits negative connotations like a visit to a hospital.

Table 3. References to symbolism of artifact by multiple experts.

Category of expertise that expert represents	Source of data	Data
Symbolism	Advertiser	The decision of <i>green</i> was because of the image of environmental awareness. This is very popular today.
Instrumentality	Bus driver	The <i>green</i> is not connected to the People of Israel who are identified by the colours of blue and white.
	Engineer	The <i>green</i> has a positive connotation connected to environmental awareness. It is a lively colour, which creates identification with nature and with caring for the environment.
	Engineering student	<i>Green</i> has different meanings. For example a <i>green</i> car means a garbage truck in certain countries, <i>green</i> sportswear represent certain sports teams, and <i>green</i> symbolizes jealousy in some countries.
Aesthetics	Designer	I assume that their intention is to communicate to people that they keep things clean and do not pollute like they have been accused of doing. That is why the colour is <i>green</i> .
	Designer	If the intent was to connect to the Greens and to environmental awareness there was a big miss here. The <i>green</i> should be lighter and not metallic which is connected to iron and synthetic materials and not to natural and recycled materials.
	Designer	In this country the immediate connotation of a vehicle that is coloured completely <i>green</i> is the military. A camouflage colour.

The emotions evident in our data did maintain a consistent pattern, with each of the three aspects eliciting emotion through a distinct mechanism. As summarized in figure 1, our inductive analysis leads us to propose three different mechanisms through which artifacts influence emotions. Two mechanisms are cognitive in nature. The third is sensory in nature, implying an emotional response that is *not mediated* by a cognitive assessment process, but rather reflects the direct impact of the artifact on one or more of the senses.

6.4. *Instrumentality of an artifact and emotion*

Instrumentality of an artifact is the extent to which it helps advance designated organizational or individual goals. In the case of a bus, respondents recognized the goal as safe travel between two points. Some respondents saw this goal as the *only* relevant criterion for evaluating the new colour. A bus driver, for example, noted:

The colour really does not matter to you as a passenger. You should not care. What is important is that the driver is polite and professional and drives safely.

Similarly, a designer noted:

The function of the bus is to transport passengers comfortably. From a functional perspective, the colour doesn't matter.

However, a focus on the extent to which an artifact accomplishes a goal does not necessarily preclude emotional reactions. What our data suggest is that when an artifact is assumed to promote goal accomplishment, little if any emotion is expressed. However, if or when the artifact is viewed as hampering goal accomplishment, extremely negative emotional reactions emerge. In this vein is the following, non-affective response of a designer, who saw the artifact as positive and functional:

The logo on the bus is white on green, affording the highest degree of readability. The green is in green hues with blue elements. The script is in white. On the road, the colour of signs is white on green and white on blue. The colour of the buses combines these two hues. It is green with blue elements. You can't miss the buses and it blends in with the traffic and the colour of traffic ... I don't see any problems.

However, intense and negative emotions were reported by those who perceived the green colour as *not* facilitating or as damaging the accomplishment of organizational goals. The company spokesman reported, for example, very negative sentiments expressed by constituents assessing the green colour as maladaptive:

The responses to the green criticize the colour. We received many furious emotional reactions from different bodies and from the general public about the safety hazards of the new colour and that it is difficult for semi-blind people to see it.

Similarly, a bus driver described the colour as 'Catastrophic from a safety standpoint'. An advertiser noted: 'The green colour is problematic. It does not stand out at night. In the dark the bus appears to be black, sort of a huge monstrous block'.

This pattern leads us to suggest that instrumental aspects of an artifact impact emotion in a fashion similar to the impact of 'hygienic' factors on employee motivation. Hygiene factors were defined by Herzberg (1966) as factors such as supervision, salary and working conditions, that when adequate in a job placate workers, but do not necessarily lead to greater satisfaction. When these factors were inadequate, Herzberg argued, people would be dissatisfied. When there is no inadequacy, according to Herzberg, dissatisfaction will be reduced but satisfaction will not be elevated. A different set of factors, including responsibility, recognition and growth, were suggested by Herzberg as allowing for increased satisfaction. We suggest a similar dynamic with goal-promoting or instrumental properties of an artifact: Their presence does not promote positive emotion, but some inadequacy or the presence of inappropriate properties or of properties that somehow hamper performance, elicits extreme negative emotion. Hence, a hygiene mechanism as noted in figure 1.

6.5. *Aesthetics of an artifact and emotion*

Aesthetic aspects of an artifact are the direct impacts of the artifact on one or more of the senses (Nasar 1994) or the direct impact of the green colour on constituents. What our analyses suggest here is that emotion is evoked directly by the sensual impact of the artifact, with no cognitive mediation. The sensual experience that an artifact elicits is, thus, suggested to directly produce an emotional reaction of, for example, pleasantness, tranquility or fear.

Producing emotion through aesthetics is complicated by the potential gap between the intended sensual effect of an artifact and the actual emotional effects. This was a critical issue in the case of the green colour. The company spokesman and several consultants described the choice of the dark green colour as motivated by a quest for evoking aesthetic pleasantness. Indeed, an engineering student noted the

pleasantness of the hue and saw it as a trigger of positive emotions; He stated: ‘The public now feels more pleasant riding in a bus that looks good’. However, not all respondents saw the green hue as positive or pleasant. Our data includes other far less positive emotions, suggesting what may be labelled ‘an aesthetic mistake’, wherein the design of an artifact produces unexpectedly negative emotions. An advertiser (who was approached as a symbolism expert) described this mistake:

I consider the dark green a mistake. I thought they intended to use a lively, brighter, grassy green, a green with more yellow in it. This impoverished green, cypress green, it was a mistake.

An aesthetics expert elaborated on the nature of this ‘aesthetic mistake’:

From the aesthetics of it, there is something depressing about it. The green is clearly a most silent colour as far as the eye is concerned. This is why green boards are used in schools. It is not a rich green but rather an overall very monotonous green, so the eye does not have the pleasant emotions that were intended. Overall, non-positive energy is continuously produced by the colour.

Note that the aesthetic mistake does not refer to the design itself, but rather to the emotions brought about by the design. When the evaluation of the design is turned to the emotions it produces, the gap between what was intended and what actually happened with the artifact becomes apparent.

Similar negative emotions were evident in the responses of all types of experts. Our data included references such as ‘ugly, dull and unpleasant’ and ‘awful, lacks any design logic, appalling’. A particularly vivid emotional reaction, from an aesthetics expert, was as follows:

This green is not happy. It is a bit melancholic, too dark, too heavy, too serious and not appropriate for the vividness we have here on our roads. I would go to something light, bright, happier. Unpleasant uniformity is not a matter of artistic style. It is simply a huge mass, uniform, dark, riding the road and it does not add happiness to our gray and yellow roads.

Similarly, an engineering student, presumably an instrumentality expert, reported negative emotions that he linked to aesthetics: ‘The colour is very loud and dominant, it can turn people off’. And a bus driver stated: ‘The colour is disgusting, repulsive, ugly, dark ... I totally can’t understand how they could come up with such a colour’.

In short, multiple informants linked aesthetic qualities of the artifact with emotions. Although multiple and different emotions were noted by different informants, the emotion noted in relation to aesthetic properties was always directly linked to the impact of the artifact on the senses, with no mediating cognitive process.

6.6. *Symbolic aspects of the artifact and emotion*

Symbolic aspects of an artifact are the set of meanings that it can be viewed as representing. Our data confirmed that even the simple notion of the colour of a bus can trigger multiple, and at times contradictory, associations. Regardless of the specific meanings, however, we propose that the symbolism of an artifact arouses emotion through an indirect *mediating* process, wherein the *associations with the artifact* (e.g. what the artifact is seen as representing) produce emotion. Consider, for example, the following responses, one from each group of experts:

Now it is fun to get on these buses. This colour communicates cleanliness and freedom (Instrumentality expert: Engineering student).

The colour is crude, appears warlike and military, communicating bad vibes (Aesthetics expert: Designer).

Green represents the delight of spring and flowers and blooming (Symbolism expert: Advertiser).

The artifact appears here to be an encoded message, an intended meaning translated into a specific content. However, the message gleaned by a target audience depends on the decoding process, which may produce a different message from what was intended (Davis 1984). The choice of green by the company we studied was not random, since it reflected an attempt to convey environmental friendliness, joining a popular trend of 'Organizational Greening' (Bansal and Roth 2000). The company spokesman explicitly positioned this association as the reason why the green was selected:

We began the process with the intent of conveying commitment to quality of life and quality of service. The green represents environmental friendliness.

However, here again an error occurred, since environmental values are only one set of associations that the green colour elicits. There are other associations to the colour and each of these associations brought about a different set of emotions. From the company's perspective, the other associations to the artifact are a form of communication gaps or errors. The failure to recognize these alternative associations or the communication errors produced unexpected emotions. Extreme evidence of the error was the negative reactions of respondents who associated the colour with the colour favoured by a local terrorist group. Conflicts are a constant background to our respondents, since they all live in Israel, and the colour green is often used as a symbol of local terrorist groups. Informants who made this association saw the colour as offensive. For example, one engineering student noted:

The bus is in a dreadful [name of the terrorism group] colour, simply disgusting ... disgusting! It's an awful colour.

The strong emotions in this statement are clear and illustrate how an artifact can trigger powerful and dangerous emotions through unintended associations.

In sum, the symbolism of an artifact regards the multiple associations the artifact can represent, not only the associations formally intended by an organization. Emotions can and are likely to be evoked by any association, and emotional pitfalls lay in failures to recognize this.

7. Implications

Our analysis illustrates that artifacts are more than mere instruments with functional implications, since they can be symbolic and are also likely to be assessed aesthetically. Our theoretical framework further suggests that instrumental, symbolic and aesthetic aspects of artifacts bear significant emotional consequences for multiple constituents. We see this analysis as advancing three key points: (1) To fully understand the impact of an artifact it should be assessed on three dimensions. (2) A focus on only one of the dimensions can lead to an impoverished understanding of the artifact. (3) Each of the three dimensions provokes emotions. These three points are of critical importance to ergonomics professionals who are trained to focus primarily on usability or instrumentality of an artifact.

The design of an artifact can be motivated by one primary aspect. Although human factors professionals tend to focus on ergonomics, in the case we studied the motivation was symbolism: The colour green was chosen because of management's desire to improve organizational image and the association between the colour green and the environment. The assumption was that this association would improve the organizational image, because it would associate the organization with the pleasant and positive notions of environmentalism. We suggest that the focus *only* on symbolism was a mistake as it led to overseeing of instrumental and aesthetic issues. The other dimensions of the artifact became transparent when any expert was consulted, even if the dimension was not in his or her area of expertise. These other dimensions are likely to be what brought about unexpected reactions when the artifact was put to use.

At least two dimensions of our model were not sufficiently recognized in the choice of the green. Instrumentality was essentially ignored. The dark green was described by engineers and drivers as unsafe, because it blends in with the colour of the road and cannot be seen at night. Symbolism was also not sufficiently recognized. The colour was selected because of symbolic properties, but it embodies additional symbolic aspects beyond the assumed environmental friendliness associations sought out by management. Thus, maintaining only one lens brought about artifact havoc, which could have been avoided had multiple dimensions been recognized and assessed. The analysis we conducted could have been conducted before the artifact was selected. Had the three aspects of the artifact been considered, instrumental implications such as problems of safety and temperature, and alternative symbolic associations, such as hospitals, garbage trucks and terrorist groups could have been foreseen.

This is an important and highly applicable message to any professional group. Any view through only one lens (or dimension) can be misleading. Yet, professional training often assumes one dimension as *the* most important or the *only* important lens. Ergonomics favours instrumentality considerations. Marketing is a profession that tends to emphasize symbolism, at the cost of overlooking instrumentality and aesthetics issues. Designers, on the other hand, favour aesthetics and creativity over functionality, potentially supporting pretty but useless artifacts. As Forty (1986) notes, designs do not work well if they do not embody ideas that potential users share. Yet, Lloyd and Snelders (2001: 246) describe a lemon squeezer designed by an acclaimed designer, Phillippe Starck, as follows:

Phillippe [Starck] likes it, it's what he intended. But people begin to criticize it. They say it doesn't work. It doesn't fulfil the function of a lemon squeezer, they argue. 'Look! The pips get squeezed out with the juice, who wants to chew on a lemon pip?'

Between the colour of a bus and a lemon squeezer lie all artifacts and their design, which should combine considerations of usability and functionality, symbolism and aesthetics. To the human factors audience of this journal, the message is that features other than functionality can be critical determinants of reactions to an artifact. The historical case of the Edsel car, which was manufactured and marketed by the Ford auto company in 1958, is considered a benchmark of design failure, yet the car ran properly. Its failure has been attributed to aesthetics and symbolism. Some people argue that the Edsel car manifests universal standards of ugliness. Others argued that it had a grille that looked like a female vagina. The bottom

line is that the Edsel was a car that did not sell in the US, although as far as engineering and human factors were concerned it could run just fine. Thus, from a disciplinary perspective, one dimension may appear to be more important than others. However, the impact of an artifact on users can evolve from any one of the three dimensions.

Our analysis cannot provide insight about what to do with problematic artifacts. Rather, it is suggested as a tool for pre-empting problematic designs through recognizing multiple aspects of an artifact and foreseeing how each might impact users. Thus, it is critical to consider all three dimensions during the process of planning, designing and evaluating an artifact. Even when various professional consulting agencies are drawn in to facilitate decisions regarding an artifact, the decisions should not overlook the perspectives of other disciplines. Artifacts cannot and should not be considered according to any one aspect but rather should simultaneously consider task performance, aesthetic properties and symbolic associations.

Each of these dimensions is important, especially because it can help unravel emotions toward the artifact. The study of artifacts must recognize that emotions toward the artifact and evoked by the artifact can emanate from multiple aspects of the artifact: whether it promotes the functions it is intended to help accomplish (and especially when it doesn't), the sensory experience it ignites (and the immediate emotions these sensations set off) and the meanings it represents (and the emotions they trigger). Researchers tend to suggest that artifacts can be classified into categories. In the case of the colour of buses, such classification is what led the company to see the new colour as symbolic. What our analysis documents is how this narrow view is risky, because it overlooks multiple emotions evoked by alternative views of the same artifact. A human factors approach might overlook the impact of aesthetic qualities of a design as well as the impact of symbolism afforded by a design. Yet, both of these avenues can provoke powerful emotions.

However, as Golden-Biddle and Locke (1997) eloquently argued, qualitative studies tell a story and the story we have told is that of a relatively simple artifact. Additional research is essential to corroborate and extend this story. We hope future research will examine the versatility of our model to other artifacts and other cultures. Such research should also examine the temporal stability of the relative impact of the three dimensions, since this may change over time. Because our study was qualitative and inductive, we could not document the relative importance of the different dimensions or whether the balance of impacts changes over time. Our data were collected when the colour was first introduced, yet we feel confident that some of the impact of the artifact will remain. The symbolic associations cannot go anywhere and the dysfunctional elements necessarily continue to hamper performance. However, some parameters may change. For example, the pleasantness of the greening association may penetrate and people may come to like the mellow dark green.

In sum, in this work we attempted to provide a model for analyses of artifacts and for understanding how they impact emotions. We hope future research and practice will find our model useful.

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Appendix: Interview protocols

Instrumentality experts

A. *Engineers*

- (1) Have you seen the green buses? Please describe in detail what you saw and what you think about this colour.
- (2) What can you see in the new design in comparison to the old design? Please elaborate.
- (3) Based on your academic and professional knowledge, what do you think about the functionality of the green bus colour?
- (4) What functions does the green colour serve? Why?
- (5) If you were asked to redesign the buses, what would you suggest? Why?
- (6) Is there anything else you would like to tell us about the colour?
- (7) To what extent do you use public transportation? Do you ride buses?

B. *Bus drivers*

- (1) What do you know about the colour of the buses? Please elaborate.
- (2) Why do you think the colour was selected?
- (3) What do you think about this colour?
- (4) Have you observed reactions to the green colour? Of passengers? Of drivers?
- (5) Do you have any other comments about the colour?

Aesthetics experts

- (1) Have you seen the green buses? Please describe in detail what you saw and what you think about this colour.
- (2) What can you see in the new design in comparison to the old design? Do you see a change in artistic style? Please elaborate.
- (3) Based on your academic and professional knowledge, what do you think about the green colour?
- (4) What do you think the green colour symbolizes? Please explain.
- (5) What do you think about the functionality of the green bus colour? What functions does the green colour serve? Why?
- (6) If you were asked to redesign the buses, what would you suggest? Why?
- (7) Is there anything else that you'd like to tell us about the colour?
- (8) To what extent do you use public transportation? Do you use buses?

Symbolism experts

- (1) Have you seen the green buses? Please describe in detail what you saw and what you think about this colour.
- (2) What can you see in the design? Please elaborate.
- (3) Based on your academic and professional knowledge, what do you think about the symbolism of the green bus colour?

- (4) What do you think that the green colour symbolizes? Please analyse the message it should transmit and explain your analysis.
- (5) What do you think about the functionality of the green bus colour? What functions does the green colour serve? Why?
- (6) Have you seen any examples of bus designs in other countries? Please elaborate. What do you think of these examples?
- (7) If you were asked to redesign the buses, what would you suggest? Why?
- (8) Do you have any other comments about the colour?
- (9) To what extent do you use public transportation? Do you use buses?