

# Analytical and Interpretive Practices in Design and New Product Development

*Evidence from the Automobile Industry*

by

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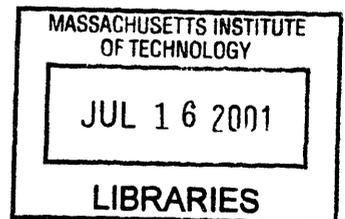
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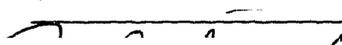
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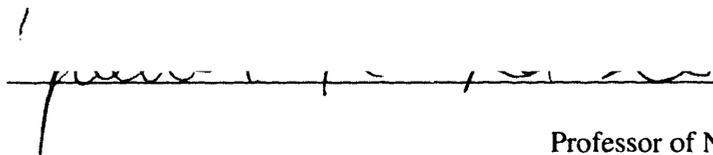
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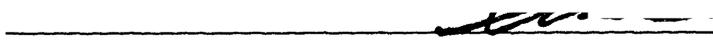
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## **Abstract**

Product design and development have been studied from both positivist and interpretivist paradigms. From the positivist perspective, design and product development are seen as technical transformation or production processes, which take customer requirements and existing technological possibilities as inputs and produce an objectively optimal product, one that is not influenced by the designer's preferences or biases. The result of this research is a focus on measuring the voice of the customer with "high fidelity", and on streamlining and optimizing this production process. From the interpretivist perspective, product design and development are seen as relatively open-ended discursive processes, to which human participants from different backgrounds bring their unique worldviews and prejudices. Models of these processes are seen as metaphors intended to help people come to understanding by shedding light on and thus bridging the different worldviews, not as mathematical constructs to be optimized. In real life, empirical evidence shows that practitioners rely on a number of approaches that do not fit easily into one or the other of these paradigms. As a result, many analytical models and methodologies need to be modified to make them useful in real-world applications and, conversely, empirical research that accurately captures the richness and complexity of the design and development process fits uneasily in these traditional paradigms which researchers feel compelled to use.

This dissertation addresses this shortcoming by developing a vocabulary for describing product design and development practices, which bridges the divide between the strictly positivist and strictly interpretivist views. The research approach used is one of theory building from case studies. The industry chosen for the case studies is the automobile industry. The thesis reports on three study sites. The first is an American manufacturer based in Detroit, known for its innovative product designs and its pioneering reliance on dedicated platform development teams. The second is the American design subsidiary of a Japanese manufacturer, one of the first to set up such a design operation in US. The

third site is the Japanese design and development organization of the same manufacturer, based in a technical center outside of Tokyo.

The theoretical framework presented in this dissertation, which co-evolved with the above case studies, takes the form of a taxonomy of product development practices. This taxonomy draws upon concepts from linguistics and the philosophy of language. In a first step, the distinction within linguistics between the structural sub fields (e.g., syntax and semantics) and the functional sub field of Pragmatics is used to sharpen the difference between analytical/structural practices on the one hand, and interpretive practices on the other. In a second step, two views of interpretation, one grounded in linguistics (Pragmatics, specifically), the other in the philosophical hermeneutics of Heidegger and Gadamer, are used to expand the interpretive category into two, referred to as pragmatic interpretation and hermeneutic interpretation, respectively.

Each of the three case studies provides a good illustration of a product development organization that relies predominantly on one of the types of practices and approaches captured by the taxonomy. The findings suggest a number of recommendations for design and product development managers and practitioners, as well as several directions for future research.

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In memory of my father,  
Moussa A. Malek



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This research would not have been possible without the participation of a number of respondents—designers, managers, and executives—at the companies discussed in this thesis, and at the companies studied in the course of a larger project at the MIT Industrial Performance Center on the organization of design and product development. By generously giving of their time, and by sharing their experiences and insights, they provided the empirical material in which this research is grounded. This thesis would also not have been possible without the generous financial support provided me by the MIT Industrial Performance Center.

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# Chapter I: Introduction

## Background

This dissertation is a study of certain practices in design and new product development, activities in which most industrial companies engage on an ongoing basis, and which are credited with a significant part of the success of many of them. In recent years, various studies have discussed the importance of the design and development phase of a given product. Studies carried out by Ford and Xerox have underscored the impact of the design and development phase on the cost and quality of a product, and on the time it takes to bring that product to market, all of which are critical factors in its ultimate performance in the marketplace (Ullman, 1992). The last decade has seen a dramatic increase in the number of studies, academic papers, articles and books published on the subject (Cooper & Kleinschmidt, 1986; Takeuchi & Nonaka, 1986; Hollins & Pugh, 1990; Clark & Fujimoto, 1991; Dougherty, 1992a; Wheelwright & Clark, 1992; Bowen, Clark, & al., 1994; Deschamps & Nayak, 1995). Even the popular business press has recognized the importance of product design as a source of competitive advantage. In 1988, an issue of *BusinessWeek* was dedicated to the subject and, starting in 1991, that periodical teamed up with the American Association of Industrial Designers to sponsor their yearly Design Excellence Awards and to publish the results in a special issue (Nussbaum, 1993; 1997).<sup>1</sup> These awards recognize the best product designs in a number of industrial categories, from automobiles to computers to kitchen utensils.

Designing and developing a new product is a complex activity, involving a wide range of tasks, including sketching, drafting, sculpting clay models, performing complex calculations and computer simulations, analyzing competitor's products, deciding on

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<sup>1</sup> See *BusinessWeek* issue dated April 11, 1988. Also see the issues on the Annual Design Awards, such as those dated June 17, 1991 and June 2, 1997.

product features, cost, and market positioning, to name a few. Perhaps one of the most important activities undertaken by product designers is finding out what the prospective users of their creation might be looking for in the new product, and learning about their needs, desires, and preferences. The importance of this activity is reflected in the findings and recommendations contained in the body of research of the last decade. For example, in their article on the importance of “product integrity”, Clark and Fujimoto define the external dimension of product integrity as “the consistency between a product’s performance and customers’ expectations” (Clark & Fujimoto, 1990, p. 108). And in his monograph on product development, Clausing warns against any “disregard for [the] voice of the customer”, and states: “High fidelity to the voice of the customer is a key success factor.” (Clausing, 1993, p. 12). The following examples describe two instances of product developers involved in interactions with their prospective customers, and suggest how complex these interactions are in reality.

### ***Example 1: A minivan development project***

This example concerns one particular decision in the development of the previous version of a popular minivan, the 1996-2000 Chrysler Minivan; specifically, the decision to give the minivan a fourth door, that is, a sliding door on the driver’s side of the vehicle. Previously, no minivan had offered such an option. The feedback that the designers were getting from their consumer research suggested that the fourth door would not be well received at all, that it would be a “loser”. Not only did the clinic participants feel that it was not needed, many of them were vehemently opposed to it on safety grounds, as they pictured their children jumping out of the minivan in the path of oncoming vehicles. The designers, on the other hand, believed that it would be a very useful and practical addition to the vehicle. They decided to go against their market research data and to include the fourth door as an option. After the vehicle was released, the fourth door quickly became a very popular option. Indeed, it changed the dynamics in that market segment, as competitors scrambled to redesign their minivans to offer a fourth door option too. Analysts were soon explaining the loss of market share by a competitor’s highly regarded minivan as a direct result of the unavailability of such an option (Phillips, 1998).

It should be noted that this does not appear to have been an isolated case at Chrysler. In a recent book, the then Chrysler vice-chairman, Robert Lutz, discusses some of the “laws” that made the company successful (Lutz, 1998). Among them: “The customer is not always right.”

### ***Example 2: Who’s still buying sports cars?***

The second example concerns another automobile development project, this one involving a new sports car. In the last decade, the market share held by sports cars in the US has declined steadily, to the point where one manufacturer after another abandoned the segment. In the process, some very well known and highly regarded models disappeared, such as Mazda’s RX-7, Nissan’s Z car, and Toyota’s Supra.<sup>2</sup> Tasked with developing a new sports car that would help reverse that trend, some designers at Nissan Design International chose an unusual way to learn about their potential customers. Instead of sending a questionnaire to current sports car owners or holding a focus group (Krueger, 1994), they decided to go around a number of parking lots in different parts of the country, choosing among the parked cars those sporty cars they deemed “interesting”, and leaving an envelope of “stuff” on the windshield, along with a letter of explanation and token compensation. These bags contained small pictures of a number of items ranging from chairs of different styles, to a miniature plastic hamburger and Aunt Jemima pancake syrup bottle, to apparel items and accessories such as sunglasses. The owners of these cars were asked to sort the items in the bag according to whether they liked, disliked, or simply did not care about them. Interestingly, the designers were aware of the biases their approach entailed, but were unconcerned about them. More importantly, when asked to explain their choice of the items included in the bag, their answer was that they simply liked these items or thought they were “interesting”. Similarly, they did not have any specific plan for analyzing the answers or for using the resulting information in their design work. However, they expected that by going through the material returned by the respondents they would understand them better, though they were not able to

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<sup>2</sup> This shift in consumer choice has been explained as resulting from the increased popularity of sport-utility vehicles and the changing demographics with the aging of the baby boomers, among other factors.

articulate that understanding beyond saying that a particular choice “makes sense” in light of the other choices made by that respondent.

Comparing his designers to the actor Anthony Hopkins who played the role of a cannibalistic murderer in the movie “The Silence of the Lambs”, the president of Nissan Design International explained that approach to consumer research thus:

*We're not designing for the customer. We are method actors. We get into the framework, into the mindset [of the customer] to the extent that's possible.*

\* \* \*

The first of these examples shows that faithfully following the voice of the customer is not necessarily the only way to a successful product, even where a well-defined design decision is concerned. The Minivan team did indeed “listen to the voice of the customer;” they simply chose not to obey it mechanically. This example also shows that focusing purely on meeting customers’ previously formulated expectations would not leave much room for surprising them with novel and innovative ideas.

The second example indicates that many designers do not see their work as simply soliciting the voice of the customer and following it with “high fidelity”. The information they seek about the customer is not specific, or it may be exploratory in nature and not targeted to particular issues or concerns that are well defined by the design team. The example also suggests that it is not obvious how that information is ultimately used in the design process.

## **A Paradox in the Literature?**

The examples in the previous section suggest that there are many ways in which designers and product developers learn about their customers and come to understand them and their preferences. The examples also show that there is more than one way in which designers use (or not, as the case may be) what they learn about their customers, to the point where, on the face of it, the admonition to “listen to the voice of the customer” means little. Beyond this, however, the examples also reflect a deeper paradox in the product development literature, which I outline below.

In their review of the management literature on product development, Brown and Eisenhardt identified three distinct streams of research (Brown & Eisenhardt, 1995).<sup>3</sup> The first stream, product development as rational plan (or the “rational stream”), is not particularly interesting for this discussion, as the relevant research tends to be largely atheoretical. The second stream, the “communication stream” (or product development as a communication web), is more interesting. Its basic premise is that greater communication among development team members, and between them and outsiders, leads to greater success.<sup>4</sup> Yet within this stream we find widely disparate notions of what communication is and how to describe and quantify it. At one end of the spectrum, we find the early work by Allen (Allen, 1971), the pioneering work from which this particular stream evolved, according to Brown and Eisenhardt’s classification. We also have the closely related work of Katz and Tushman (Katz & Tushman, 1981). In both of these studies, the level of communication is measured by asking the subjects (engineers, scientists, and managers) to keep track of, and report to the researchers, the number of communications they had over a given period of time. The content of the particular communication is not considered, nor its importance for the project (though respondents are asked not to report insignificant chats.) In fact, since every respondent was asked to

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<sup>3</sup> Following Adler, product development in the management literature is considered a subset of the literature on innovation (Adler, 1989). The latter is divided into two general areas of research. The first is innovation proper which is concerned with differences in patterns of innovation across sectors and geographical areas, with an economics orientation. The second, product development, is concerned with how specific new products are developed within particular organizations (Brown et al., 1995).

<sup>4</sup> The importance of communication and information in new product development stems from one of the defining characteristics of that activity, namely, the uncertainty that pervades it. As they seek to create and sell what does not yet exist, product developers face uncertainties from various sources. These include, among others, uncertainties about the market they are targeting, and the preferences, wants, and needs of their potential customers; uncertainties about changes in that market and these preferences during the gestation period needed to develop and introduce the product; uncertainties concerning the availability of the technologies they plan on using; and, of course, uncertainties about their competitors response and the products they will be introducing around the same time. Information plays an important role in helping developers deal with these uncertainties, based on a generally accepted relationship between information and uncertainty. That relationship holds that the likelihood of success of a design or, more generally, an uncertain endeavor or decision, is proportional to the information that is available to those undertaking that design or making that decision (Suh, 1990). More precisely, the likelihood of failure increases as the information gap, that is, the difference between the information needed for the design, and the information available, increases. Hence the focus in the literature on getting information from the customer, from the suppliers, and from the different technical specialists, and on coordinating the exchange of information between the various people and decision-makers involved in the development project. An important aspect of this relationship between information and risk reduction is that information is seen as an undifferentiated entity, with more of it, in whatever form, always being better. The association of information with uncertainty and uncertainty reduction is a basic tenet of communication or information theory (Pierce, 1980).

track his communications on one particular, randomly selected day of the week, it would not have been possible to say anything about how a particular communication fit in within, or how it impacted, any ongoing problem or issue that the team was dealing with.

The other end of the spectrum in this communication stream is represented by the work by Ancona and Caldwell (Ancona & Caldwell, 1992), and by Dougherty (Dougherty, 1992a). These researchers actually examine the content of these communications to develop a deeper understanding of how and why the different communication and integration mechanisms work. Dougherty's work, for example, is concerned with cross-functional integration in view of the different worldviews or thought worlds and systems of meaning of the different functional departments involved in the development project. She is concerned with the way in which people from different functional areas focus differentially on the various aspects of the product, how and why they interpret a given piece of information differently, and how their different perspectives ultimately come together in a successful project. Her research is not only concerned with the content of acts of communication between people, but also with a number of contextual factors within which they take place.

One could argue that these differences in the way researchers conceive of communication in product development is merely a reflection of the particular classification scheme used by Brown and Eisenhardt to organize the literature. I believe that the problem goes beyond that, however, as it is not uncommon to find discordant notions of communication showing up in the very same paper. A paper by Moenaert and Souder, in which they develop an information transfer model and use it to discuss different mechanisms for integrating the marketing and R&D functions in new product development projects, is one such example (Moenaert & Souder, 1990). The model of communication they present follows the information transfer practice of equating information with uncertainty reduction (Pierce, 1980; Suh, 1990). According to that view, information is pre-existent, in the sense that someone out there knows or has the information that is needed by someone else; as the authors put it: "... every individual is viewed as a pool of knowledge." The organizational integration challenge then is one of getting the relevant parties to exchange information in a timely and efficient manner.

From that perspective, all integration mechanisms end up being reduced to one metric, namely, their effect on the frequency and likelihood of information transfer. Integrative mechanisms ranging from the technical, such as task specification and planning, to the more interpretive boundary spanning mechanisms such as job rotations and the use of multidisciplinary teams, and even cultural change programs intended to improve harmony and trust within the organization, all become quasi-interchangeable. The authors simply assert that:

*In technological innovation, the major merits of each of the above discussed integration mechanisms consists of the improvements in the interfunctional information transfer that these mechanisms bring about. (Page 97.)*

And yet, in the same paragraph, the authors describe the role of these integration mechanisms in creating a social network in which people from the different functional groups become connected through a variety of relationships:

*Through these interpersonal linkages, [a]ffects, influence, information and goods and services will be exchanged.<sup>5</sup> (Page 97.)*

and

*Information transfer generates a mutual understanding of each other's roles and helps determine what is expected of everybody. (Page 99.)*

It is difficult to imagine how to reconcile the standard analytical information-transfer model of communication with the rich and complex social interactions from which such highly personal and emotional reactions as affect, mutual understanding, and influence might evolve.

This inconsistency in the use of key underlying concepts is not limited to the communication stream of the product development literature. It is also found in the third and last stream in Brown and Eisenhardt's taxonomy, which they refer to as the "problem solving stream" (or design as disciplined problem solving.) One of the best-known contributions in this category is Clark and Fujimoto's compelling study of product

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<sup>5</sup> "Effects" in the original. I believe that to be a typo.

development performance in the automobile industry (Clark et al., 1991). A key finding of this study is the critical role the “heavyweight product manager” plays in the success of Japanese automobile development projects. In the second chapter of their book, the authors explain how their research is based on an information-processing perspective of product development, as opposed to the more traditional material-processing perspective (pp. 20-22).<sup>6</sup> Later on, however, they prescribe the following qualifications and roles for the heavyweight project manager: he possesses “market imagination and the ability to forecast (...) based on ambiguous and equivocal clues;” he knows how and when to “initiate conflict” in order better to direct the evolution of the product design; and he is skilled at “envisioning the desires of the customer and interpreting them for the other members of the development team” (p. 343). From an analytical perspective, it is not clear what kind of information processing, be it a mathematical transformation or an algorithmic procedure, would be involved in initiating conflict between members of a development team, or in envisioning customer desires.

How might a reader, in particular a product development practitioner, react to these inconsistencies? The pragmatic reader, recognizing the limitations of the theoretical model, might simply discount the problem and move on to the more important and richer empirical findings. A more literal reader might take the claimed theoretical underpinnings at face value, see them as foundational, and view the empirical findings and recommendations through this information-transfer or information-processing lens. Such a reader would likely end up discounting some of the more insightful and significant findings presented by the authors, which do not readily fit this theoretical model. Still another type of reader might be concerned about the inconsistency between the theory and the empirical findings and, as a result, lose confidence in the otherwise excellent recommendations given. In any case, this mismatch between research findings and recommendations on one hand, and the theoretical models that are presumed to underlie them on the other, gives the former a rather ad hoc character, and makes it more difficult for the practitioner to assess their broader relevance and applicability.

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<sup>6</sup> It should be noted that Clark and Fujimoto themselves link their work to the communication stream of the product development literature. They trace the information paradigm they use to Allen’s and Marquis’ work (Allen, 1977; Marquis, 1982) (Ch.2, note 2.)

## **Different Paradigms**

The inconsistency in the product development literature pointed out in the previous section reflects a deeper issue in the study of design and product development, namely, what the proper paradigm for such study ought to be (Kuhn, 1970).<sup>7</sup> The two major paradigms of relevance here, positivism and interpretivism, have already been hinted at in the previous section. In the case of communication for example, the former gives us the notion of communication as information transfer and formal, codifiable information processing, with a resulting focus on channel capacity, frequency of transmission and other similar analytical measures (Pierce, 1980). The latter leads us to view communication as an idiographic social exchange between complex human beings with distinct worldviews, concerns, interests, and affects. Different researchers in design and product development tend to pursue their work from within one of these two paradigms. What follows is a partial review of the literature from the perspective of these two paradigms. In the first subsection, I look at the design literature. In the second subsection, I return to the product development literature I began discussing in the previous section.

### ***The design literature***

In research on design in engineering and architecture, the logical-positivist paradigm has been dominant, starting with Simon's admonition to researchers to develop a 'Design Science' (Simon, 1981). Research that fits within this paradigm includes work on design methods by Simon himself, Alexander's early work (Alexander, 1964), and others' (Jones, 1981; Rowe, 1987). Other researchers working within this paradigm have focused on developing process models for design engineering (Pahl & Beitz, 1984; French, 1985; Pugh, 1991; Ullman, 1992). Still others have developed theories of design (Hubka & Eder, 1988; Suh, 1990).

Within the positivist paradigm, design activities and processes follow logical, quasi-formal models, which makes them particularly suited to codification in computer programs. As a result, much of the work within this paradigm has involved computer (artificial intelligence) systems. Examples include: the work on generative shape

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<sup>7</sup> Paradigm is used here in its social sense, as "the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community" (Kuhn, 1970).

grammars or 'algebras' (Stiny & Mitchell, 1978; Stiny, 1980; Mitchell, 1990; Wallace, 1991a); the work on capturing and codifying existing expert knowledge in rule-based and expert systems (Gero, 1989; Coyne, Rosenman, Radford, Balachandran, & Gero, 1990; Navinchandra, 1991; Tong & Sriram, 1992a, b); research that takes the connectionist approach to AI (McClelland & Rumelhart, 1988), such as (Coyne, Newton, & Sudweeks, 1993b); and research that uses genetic and evolutionary computational algorithms to perform design exploration and optimization (Coyne et al., 1993b; Gero & Kazakov, 1996; Funes & Pollack, 1997).

Within the same positivist paradigm, some researchers have focused on the human in the design process, and have used protocol studies to obtain detailed descriptions of the designers' activities (Ericsson & Simon, 1993). These studies involve observing, timing, and coding the activities and statements of designers working under controlled conditions, again for the purpose of codifying and developing analytical models of what they do (Akin, 1978; Akin & Lin, 1996; Dorst & Dijkhuis, 1996).

The interpretivist paradigm has been less prominently represented in the engineering and architectural design literature. Schön, in response to what he saw as shortcomings in the design methods approach advocated by Simon, showed the designer as someone involved in a reflective, interpretive practice, not merely a process of mechanistic information processing (Schön, 1983). Dorst has applied Schön's model of design practice in a comparative protocol study (although still using the positivist techniques of protocol analysis) (Dorst et al., 1996). Bucciarelli studied a group of engineers and described their work and interactions (Bucciarelli, 1994).

With the increasing importance of cooperative work and collaborative computing, many researchers have turned their focus on these aspects of design practice and their implications for the development of tools and environments for collaborative design (Snodgrass & Coyne, 1992; Fischer, Nakakoji, Ostwald, Stahl, & Sumner, 1993; Stahl, 1993; Coyne, 1995, 1998; Gallemore, 1998).

Researchers have also looked at industrial design from an interpretivist perspective (Krippendorff & Butter, 1989; Jonas, 1993). Krippendorff has described the role of the

various contexts—the context of genesis and the context of use for example—that affect the design of a product (Krippendorff, 1989).

### ***The product development literature***

Turning to the management literature on product development, we find an important body of work that falls within the positivist paradigm. This includes the research identified in Brown and Eisenhardt's review of the literature as falling under the "rational stream." This stream builds on the work of Myers and Marquis and the British SAPPHO studies (Myers & Marquis, 1969; Rothwell, 1972; Rothwell et al., 1974). More recent work in that stream includes work by Cooper and Kleinschmidt, and by Zirger and Maidique (Cooper & Kleinschmidt, 1987; Zirger & Maidique, 1990). I consider this research as positivist in nature more as a result of the methods used in the studies—statistical analysis—than of the findings or conclusions that result. Since this research tends to be atheoretical, there are no underlying models or metaphors of the product development process as a whole, or of communication or integration mechanisms.

Another body of work, not discussed in Brown and Eisenhardt's review, stems from the introduction of concepts and methodologies from engineering to address organizational issues in product development. These include: the use of system dynamics models of certain processes in product development (Kim, 1993); the use of stage-gate systems to organize the development process (Cooper, 1990);<sup>8</sup> the use of linear algebra models to represent the sequencing of tasks in a project (Eppinger, 1991; Eppinger, Whitney, Smith, & Gebala, 1994); and techniques used to plan for product modularity and part commonality (Robertson & Ulrich, 1998). I would also place in this category the techniques developed to map market research data into product features, such as 'Quality Function Deployment' (the 'House of Quality') (Hauser & Clausing, 1988; Clausing, 1993), and Burchill's 'Concept Engineering' process model (Burchill, 1993; Burchill & Fine, 1997).

Under the interpretivist paradigm, we find: the work by Dougherty, some of which was previously mentioned (Dougherty, 1990, 1992a, b; Dougherty & Heller, 1994); similarly,

the work by Ancona and Caldwell (Ancona & Caldwell, 1990; Ancona et al., 1992); and the work by Carlile on the use of ‘boundary objects’ by product development teams (Carlile, 1997).

One field of research related to product development in which both paradigms have been prominent is the field of consumer research. The methods of interpretivist research in that field are discussed a number of authors, among them: Hirschman (Hirschman, 1986); Hudson and Ozanne (Hudson & Ozanne, 1988); Thompson et al. (Thompson, Locander, & Pollio, 1989; Thompson, Pollio, & Locander, 1994); Arnold and Fischer (Arnold & Fischer, 1994); and Holbrook, who provides an example of the use of an interpretivist approach to understand movie going (Holbrook & Grayson, 1986).

## **The Opportunity**

In general, the literature on design and product development is reminiscent of Kuhn’s ‘rival paradigms’ in science: “incommensurate domains of discourse largely ignorant of each other...” (Kuhn, 1970; Coyne, 1995 p.206). Researchers within each paradigm have their own models and metaphors for conceiving of and studying design and product development. We also have debates over the proper paradigm for such studies (Snodgrass & Coyne, 1990; Coyne & Snodgrass, 1991, 1993a; Piore, Lester, Kofman, & Malek, 1994), reflecting similar debates in the broader area of management research (Morgan & Smircich, 1980; Beyer, 1992; Donaldson, 1992).

These are not idle debates among academics. Researchers engaged in their work stop seeing these models and metaphors for what they are, and start applying and propounding them literally, through a sort of “inversion of reality”, or what Meyer refers to as the “suspension of metaphoric thinking,” with the resulting transformation of “theories into myths” (Hesse, 1980; Meyer, 1984).<sup>9</sup> Yet these researchers are not philosophers or mathematicians arguing and debating within a closed community, removed from practical

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<sup>8</sup> The stage-gate model can be thought of as a mapping of Pahl & Beitz’ engineering design process model from the product domain to the domain of the organization developing it (Pahl et al., 1984).

<sup>9</sup> For a discussion on how metaphors shape our thinking in general, see Lakoff and Johnson (Lakoff & Johnson, 1980). For a more specific example relating to communication, see Reddy (Reddy, 1979) and Axley (Axley, 1984).

concerns. Their conceptions of design and product development shape the prescriptions they propound to practitioners, and affect how the latter come to understand what they do and how they should do it. Often, the result is a distortion of the design and development process as practitioners seek to reify the concepts and models presented to them by the researchers. This is particularly true in the case of the positivist paradigm, for two reasons. One is the privileged position in which detached, 'objective', Cartesian rationalism is held, especially among scientists, engineers, and many managers. The second reason is that interpretivist prescriptions, such as the use of metaphor, are not as easy to apply as the typical analytical methodology. Due to the idiographic nature of that research, the creative burden of coming up with the appropriate metaphor and of 'operationalizing' it remains for the practitioner to bear (Dougherty, 1992b; Coyne, 1995).

For example, a positivist perspective can lead to an understanding of design and product development as transformation process, with the needs and desires of the customer, along with the technical possibilities available to the firm, as exogenous inputs to that process. The role of the development organization is one of an ideal transformer carrying out a purely technical, mechanical translation process. This understanding leads researchers to develop prescriptions and methodologies for: a) obtaining that precious first input, the 'voice of the customer', with a high degree of "fidelity"; and b) for faithfully translating that input without adding any distortion or spurious inputs of one's own (Burchill, 1993; Clausing, 1993; Ulrich & Eppinger, 1995). In turn, this leads practitioners who follow these prescriptions to "rely on research, not opinion" and to view designers who are too attached to their product as a liability to the organization, not an advantage (Connelly, 1994; Automotive News, 1995; Child, 1996a).<sup>10</sup>

Certain researchers have presented "multi-paradigm" studies of design and product development, in which models and metaphors stemming from the different paradigms are proposed (Snodgrass et al., 1990, 1992; Jonas, 1993; Coyne, 1995; Dorst et al., 1996). In

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<sup>10</sup> Reactions to such claims from product developers who see themselves as following a more pragmatic approach tend to be equally extreme: they compare listening to the voice of the customer to "looking through a rearview mirror," and they prefer to trust their intuition over any consumer clinic (Stout, 1995; Child, 1996b; Yung, 1997; Lutz, 1998).

general, the result is a juxtaposition of perspectives, suggesting that one can look at design and product development through different lenses, each of which remains embedded within its own worldview, but one of which is privileged. Effectively, the practitioner is presented with an exclusive choice; the different perspectives remain incommensurate, with no clear way for bridging the chasm between them. This is not surprising, given the very definition of paradigm.

Aside from this situation of “rival paradigms” in design and product development, we also find many instances of what could be termed “confused paradigms”, where the vocabulary and concepts from different models of product development are mixed in a muddled way. This situation, and the problems it can engender, were discussed in the previous section, in the context of the use of the information transfer and information processing models by Moenert and Souder and by Clark and Fujimoto (Moenert et al., 1990; Clark et al., 1991). This situation is more likely to arise in empirically-based product development research as in the cases above, than in more theory-driven work where models are less likely to clash with the reality of the empirical observations. The fact is that most practitioners, notwithstanding the claims and stated beliefs of some of them, do not work within one paradigm, or according to one model or metaphor. They deploy various models and metaphors, and engage in a range of activities, some of them positivist, others interpretivist, as they face different situations. They pragmatically use whatever tool or approach they feel they need in any given situation, as the two examples at the beginning of this chapter showed.

### ***Research questions***

The question this dissertation poses, and attempts to answer, is the following: is it possible to develop a vocabulary for describing the activities in which designers and product developers engage in the course of their work which would bridge the gap between the current positivist and the interpretivist metaphors? Is there a way to discuss product development practices without placing them at one or the other end of the positivist – interpretivist dichotomy? If we were to allow ourselves, for a moment, to abuse the notion of incommensurability of paradigms, could we think of a taxonomy that

classifies practices along a continuum, from the highly analytical or positivist, to the highly interpretive? What form might such a taxonomy take?

From the preceding sections, the advantages of developing such a vocabulary or taxonomy are clear. Instead of thinking of the various types of approaches as exclusive, it would be possible to think of them the way practitioners use them in real life. It would become possible to ask questions about, and discuss, the relevance and applicability of different types of practices to a given design or product development situation. By the same token, such a typology would enable researchers and practitioners better to assess the applicability of the various tools and methodologies to the problems they face. Some of the questions one could pose: Are there different aspects of a given product for which one type of approach is better suited than another? Are certain types of activities more relevant at different phases of the development process? What demands do the different types of approaches place on the practitioner and on the organization as a whole? Are certain types of organizations better equipped to use one versus another type of approach?

In his critical contribution to our understanding of the work of designers and other professionals as interpretive practice, Schön described the professional alternating between action and reflection on the situation or problem he or she faces (Schön, 1983). With the proliferation of tools, methodologies, and best-practice recommendations available to them, I believe it is important for practitioners to be able to reflect not only on the design situation at hand, but also on the tools and approaches they are using. A vocabulary that can describe these approaches and practices as practitioners use them would represent an important step towards extending Schön's concept of reflection-in-action from the task domain to the realm of practices.

## ***Approach***

The approach I use in this dissertation is one of theory building from empirical case studies, as described by Eisenhardt (Eisenhardt, 1989). That approach draws on ideas from grounded theory and case study research among others. It is particularly appropriate here given that the aim of this research is not to test some hypothesis or to extend an existing theory, but rather to develop new understanding. Theory building starts with the

research questions posed above, and involves repeated iterations between theory formulation and data analysis, within cases and across cases. In this regard, the work to be reported in the thesis fits within the context of a larger study of the organization of product development (Piore et al., 1994).

For the theoretical framework, I draw mainly upon ideas from the fields of linguistics and the philosophy of language to develop a taxonomy for classifying and describing the various interactions and activities found in product development projects.

For the empirical research, I elected to study the automobile industry, mainly because of the complexity of the product itself and the richness of its interface to the customer (Clark et al., 1991). The design follows embedded multiple-case format, and the main research instrument was qualitative, open-ended interviews.

## **A Preview of the Dissertation**

The content of this thesis is organized in six chapters, including the present one. In this introduction, I have introduced the research project, explaining the motivation behind it and its objectives. I also presented an overview of the relevant literature and located this work within it.

The next chapter, Chapter II, is a description of the research approach and methods I used in this work. In it, I discuss the reasons for selecting the particular industry and research sites for the empirical part of this study. I also briefly present the larger research project of which this dissertation is part.

Chapter III deals with the theoretical concepts from linguistics and the philosophy of language upon which the theoretical framework of this research is based. This chapter is intended to be a self-contained presentation, to make it accessible to product development students and practitioners who may not have a background in these topics. The relevant levels of linguistic analysis are presented and discussed. The topics of Pragmatics (from linguistics) and Hermeneutics (from the philosophy of language) are of particular interest in the research, and particular attention is paid to the differences between them. A typology of design and product development approaches and practices that is based on

these concepts and that is illuminated by earlier empirical findings from the larger research project is presented. The chapter closes with an illustrative application of this typology to two bodies of research in product development methodology, the stage-gate process and the design structure matrix.

Having laid out the theoretical framework for the dissertation, I report the empirical findings from the various case studies in the chapters that follow. Each chapter corresponds to one of the research sites. Chapter IV covers the cases conducted at the Chrysler Corporation.<sup>11</sup> One case study deals with a new minivan development project. (Example 1 at the beginning of this chapter offers a preview of that case.) Another study focuses on Chrysler's Corporate Design Office.

Chapter V reports on the studies conducted at Nissan Design International (NDI) in San Diego, a subsidiary of the Nissan Motor Company of Japan.<sup>12</sup> The cases at NDI covered the design of a midsize sedan design project (the Nissan Altima), the work of a market research lab, and the work of the color and fabric studio (which provided the material for example 2 above.) In addition, we also studied the NDI organization as a whole, its inception, and the philosophy and organizing principles of its president.

Chapter VI reports the findings from the study conducted at Nissan's Japanese design center, located at the Nissan Technical Center outside of Tokyo. Here again, the Altima project was used as a focus for the interviews, but these covered a set of wide ranging topics.

Finally, Chapter VII synthesizes and discusses some of the findings from the case studies. It presents some conclusions and recommendations both for researchers as well as managers and practitioners in product development. It also suggests a few avenues for future research.

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<sup>11</sup> Since the case studies were conducted at the Chrysler Corporation, the company has merged with Daimler-Benz A.G. The combined company is now DaimlerChrysler A.G.

<sup>12</sup> Recently, NDI's name was changed to Nissan Design America, or NDA.



## **Chapter II: Research Approach**

This chapter discusses the research approach used in this dissertation. I start by describing the larger research project on the organization of design and product development, of which this dissertation constitutes one part. Following that, I briefly discuss the theory building approach used throughout the larger project, and its implications for the choice of research methods and sites. Finally, the choice of industry and the selection of specific sites for this dissertation are discussed.

To begin, the objective of the dissertation as it was developed in the previous chapter is briefly restated. That objective is to develop a taxonomy of design and product development practices. My purpose in doing so is to bridge the gap between, on the one hand, the rich and diverse range of activities which practitioners undertake in the course of their work and, on the other hand, the models and metaphors commonly found in the literature. The latter tend to be embedded within one of two paradigms—the positivist and the interpretivist—or to be couched in the limiting and sometimes misleading languages of these paradigms. The activities I am interested in are those touched upon in the previous chapter. These are integration activities that involve communication and information transfer or processing on the one hand, and interpretation, understanding and “sensemaking” on the other (Weick, 1995). More specifically, I am interested in these integration activities as they take place across two distinct kinds of boundaries. The first are those between the product development organization and its customers, actual or potential; this I refer to as external integration. The second kind are those found within the organization itself, between different functions or groups; this I refer to as internal integration. This usage is somewhat idiosyncratic, as some authors use external integration in the context of the interactions between the development team and the larger organization and use internal integration to refer to what goes on within the team itself.

## The Larger Project

The work presented in this dissertation is part of a larger project on the organization of design and product development. More generally, the objective of the project is to develop insight into the processes and mechanisms of organizational integration under conditions of radical uncertainty. Such situations cannot be modeled in terms of a set of likely outcomes, each having a likelihood assigned to it based on some a priori calculation or based on historical precedent (Knight, 1957). Rather, these situations are too ill defined and equivocal, to the point where possible outcomes cannot be adequately described at the outset. Since this is one of the defining characteristics of design and product development projects, these were chosen as exemplars for such situations and served as the focus of research in that larger project.<sup>13</sup>

A key aspect of the larger project is the theoretical framework it employs. Its basic premise is that interpretation in general, and the field of hermeneutics in particular, offers rich and meaningful metaphors for the processes that organizations use effectively to address and manage situations of radical uncertainty. It identifies two types of integrative approaches, the analytical and the interpretive. The analytical approach views design and product development as structured problem solving, a process with well-defined stages—including a beginning and an end—and governed by clearly defined means-ends relationships. The interpretive approach on the other hand is more process oriented and views integration as an ongoing process of coming to understanding, based on the hermeneutic notions of the circle and the fusion of horizons (Palmer, 1969). (Please refer to Chapter III.) This theoretical framework was presented in Piore et al. (Piore et al., 1994).

The larger project was centered on a set of cross-national, cross-industry empirical studies. These have included a study of the cellular telephone equipment industry, the fashion apparel industry, and the medical devices industry. These studies have covered companies in the US, Japan, and Europe. In the first study, the two main sources of uncertainty companies faced were the technological developments and the changing

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<sup>13</sup> There are many design and development situations where the outcome is not equivocal as described above; these include routine design or parametric design, where the new artifact is the result of applying slight modifications to an existing design.

industry and government and international standards. That study suggested a shift from interpretive to analytical approaches connected with the lifecycle of a technology, in particular that of cellular telephony. Early on in that lifecycle, as the possibilities afforded by the technology and the nature of the market for it were still evolving and being developed and defined, companies were more likely to rely on an interpretive approach to product development and decision making in general. As the technology evolved and matured, however, and the uncertainty associated with both the technology and the market decreased, companies tended to shift to a more analytical approach to managing the development process (Piore, Lester, & Malek, 1995). In that particular industry, however, the technology does not appear to follow a monotonic evolutionary path, but seems rather to go through a series of punctuated equilibria (from mobile phones to portable phones and, more recently, web enabled phones.) This suggests that companies need the ability to switch from one approach to the other, something few are capable of doing.

The second study, which dealt with fashion apparel, and the uncertainty that comes from changes in fashion trends, highlighted the role played by certain key individuals in the development and dissemination of these trends within an industry. That role is best described as one of interpretive boundary spanning (Piore, Lester, & Malek, 1997b). Interpretive boundary spanning goes beyond the dissemination of information across organizational boundaries. Well-connected suppliers played a role of interpreting and re-interpreting new ideas and developments from one client firm to the other, in a situation where copycat solutions would not have been acceptable. In one case, the same supplier who excelled at playing such an interpretive role also performed a more analytical function of disseminating best-practice information among the client's various plants.

The third study focused on the biotechnology and medical devices industries. In this case, uncertainty is related to scientific discoveries, technological development, and the FDA approval process.<sup>14</sup> This case highlighted the open-ended partnership agreements one biotech company entered into, in order to maintain its position at the center of a wide

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<sup>14</sup> FDA: Food and Drug Administration, part of the U.S. Health and Human Services Administration ([www.fda.gov](http://www.fda.gov)).

R&D network, even though it did not know at the outset what scientific or technological developments the partners would contribute. In the case of medical devices, one interesting finding was the important interpretive role of “evangelist” played by thought leaders in a particular medical field on the dissemination and acceptance of a new technology (Piore, Lester, & Malek, 1997a).

Finally, some of the findings from this research were abstracted into a set of metaphors intended to help managers deal with ambiguous and equivocal situations (Lester, Piore, & Malek, 1998).

## **Theory Building and Case Studies**

The research approach used in this dissertation is the one used successfully in the larger project, namely, theory building using empirical case studies, as described by Eisenhardt (Eisenhardt, 1989). That approach draws on established qualitative research methods from grounded theory (Mintzberg, 1979; Strauss, 1987) and inductive case study research (Yin, 1994), among others. It is particularly appropriate in this case given that the aim of this research is not to test certain hypotheses, but to provide a fresh perspective on a topic that has been previously researched and to develop a new understanding and new categories grounded in the empirical data.

Theory building starts with the broad research questions posed in Chapter I and summarized above, and proceeds through repeated iterations between theory formulation and empirical data analysis. In this respect, the work reported in this dissertation fits within the context of the larger study presented earlier. The theoretical framework and constructs developed in the next chapter should be viewed as the next iteration on, or a refinement and extension of, the framework initially developed for the larger study. Similarly, the case studies reported in the subsequent chapters represent a subset of the cases developed for the larger project.

The definition of “theory” as used in this dissertation (and the larger project) is an expansive one, so as to encompass the wide range of theoretical representations from the different paradigms used to study design and product development—“any coherent description or explanation of observed or experienced phenomena” (Gioia & Pitre, 1990).

Eisenhardt points out that theory building takes a positivist view of research in that “the process is directed towards the development of testable hypotheses and theory which are generalizable across settings.” (Eisenhardt, 1989, p. 548). She contrasts theory building with the ethnographically oriented research approaches proposed by Strauss (Strauss, 1987) and van Maanen (Van Maanen, 1988.) where the desired outcome is “a rich and complex description of the specific cases under study”, or what Geertz calls a “thick description” (Geertz, 1973). The work presented in this dissertation combines aspects of both. I present a set of hypotheses at the end of the dissertation. However, the theory that emerges from this work is in the form of a classification scheme intended to help researchers and practitioners gain a new perspective on their work, and an effective way of achieving that goal is indeed by providing a rich and convincing description of those empirical findings that instantiate the different types of practices. The case reports in this dissertation are written with that objective in mind, that is, to provide a rich enough description of certain aspects of a case or a certain anecdote to help “achieve intersubjectivity about a set of observations and their interpretation within an experience collective” (namely, researchers and practitioners) (Butler, 1997).<sup>15</sup>

The dissertation then has both a theoretical component and an empirical component that are intricately connected to one another, in the sense that they co-evolved. Although the theoretical component, in the form of a taxonomy of design and product development practices, is presented first, the reader should keep in mind that these categories emerged as a result of the empirical findings from the case studies. In turn, the theoretical framework illuminated the interpretation of the empirical cases. For that reason, I use both the terms “typology” and “taxonomy” to describe the classification scheme developed in the dissertation. Given the nature of theory building, it would be inaccurate to distinguish between a conceptually derived and an empirically based approach in this case (Bailey, 1994, quoted in Staudenmayer, 1997).

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<sup>15</sup> “Theory building seems to require rich description, the richness that comes from anecdote” (Mintzberg, 1979).

## ***Theoretical Framework***

The theoretical framework presented in the next chapter was motivated by some of the empirical findings from the cases in this dissertation, as well as the findings from earlier case studies. From those cases, it became clear that the analytical and interpretive classification was too coarse to adequately describe the range and subtleties of design and product development practices.

The framework I propose draws on ideas from the fields of linguistics and the philosophy of language. First, the division between the structural and functional areas of linguistics is a particularly useful one (Akmajian, Demers, Farmer, & Harnish, 1995). Syntax and semantics, two important sub-fields of structural linguistics, offer a good model or metaphor for analytical practices that are closed and self-contained, which are well-suited for organizing and exchanging information within well-defined, well-circumscribed domains in which all the interlocutors share a common pre-understanding. Concepts from pragmatics, the functional area of linguistics, and from hermeneutics are used to flesh out the elements of interpretive practice described earlier by Piore et al. (Piore et al., 1994). My sources for material on pragmatics are the texts on linguistics by Akmajian et al. and by Mey [Akmajian, 1995 #199; Mey, 1993 #201; I also refer to the work of Givón for a broader, more abstract understanding (Givón, 1989). In hermeneutics I rely on Palmer's overview of the topic and on Gadamer's *Philosophical Hermeneutics* (Palmer, 1969; Gadamer, 1976), with occasional references to Dreyfus' commentary on Heidegger's *Being and Time* (Dreyfus, 1991). Pragmatics and hermeneutics provide rich descriptions of what is involved in the process of coming to understanding in situations that require the reliance on contextual factors, situations that are more open-ended and where the interlocutors may come from different backgrounds or have different day-to-day concerns. Table III.3 in the next chapter summarizes the elements that distinguish analytical and interpretive practices.

Within the realm of the interpretive, I also distinguish between situations depending on the role of the interlocutors and the purposiveness of the interaction, following Dascal (Dascal, 1989).

## ***Empirical Research***

### **The choice of industry**

The case studies in this dissertation are drawn from a single industry. I chose to study the automobile industry for a number of reasons. Chief among them is the high level of complexity of the product and its interfaces, which are discussed at length later in this section. Another reason is the level of maturity of the industry. This is an industry that has seen a number of different trends in the last few decades, and one where a range of organizational approaches and integrative mechanisms have been tried. A few that come to mind: Ford's attempts to design a "world car" and to otherwise integrate its worldwide design and development resources; GM's various reorganizations and its recent reliance on "brand management"; Chrysler's use of dedicated platform teams and increased reliance on its suppliers; the use of the tools and methodologies of the Total Quality Management movement. This level of experience makes the industry a potentially rich source of ideas and empirical evidence, an important requirement in theory building. A related reason that makes the automobile industry interesting is the wealth of research that has targeted it in the last several years, and the corresponding richness of secondary research material available. A final reason is personal interest and a familiarity with the product, having worked in the industry for several years.

The automobile industry is a good complement for the other industries studied in the context of the larger project. Although it is subject to a host of regulations regarding safety and pollution control, a new automobile design is obviously not subject to the same level of regulatory uncertainty that is common in the pharmaceutical and medical devices industry. Nor does it involve the uncertainty that accompanies the introduction of a totally novel technology, as in the case of the cellular telephone industry. It does however share one aspect with the apparel industry, namely, the uncertainty that comes with shifting fashion trends. This goes beyond the obvious areas of interior and exterior styling and color, to the area of product categories that seem to gain and lose popularity for no predictable reason. Recent examples include the rise in the popularity of sport utility vehicles or SUVs in the 1990s, and the sudden collapse of the market for sport coupés earlier in that decade. (Bennet, 1995; Flint, 1996; Maskery, 1996).

An automobile, unlike an item of fashion apparel, is a very complex and expensive product. Its design and development typically requires a relatively long lead time, ranging from a year and a half to three years. Producing it requires expensive and specialized tooling that must be amortized over a production run exceeding three years and tens of thousands of copies. This makes it very costly to misjudge the market or make a design mistake, and it puts a lot of pressure on the designers and developers to “get it right.”

Despite this industry focus, the object of this dissertation is not to develop a theory of product development practices specific to the automobile industry, but one that is more broadly relevant. Towards a similar end, Clark and Fujimoto present a framework for describing product complexity along two dimensions, internal and external (Clark et al., 1991, pp. 10-11). The first represents the complexity of the internal product structure, which depends on the number of components that make up the product, on how many of these interface with one another, the nature of the interactions at these interfaces and the “severity of the tradeoffs” between the components (idem). The second dimension, external complexity, reflects the complexity of the interface between the product and its producer on one side, and the user of that product on the other. External complexity varies with the number and specificity of the criteria the customer uses in judging the product. It also depends on whether these criteria can be considered individually or whether they are used in a holistic assessment, and on whether the criteria involve dimensions that can be measured objectively or ones that are typically judged idiosyncratically.

As an example of internal complexity, and the design challenges that go with it, consider the problem of reducing the level of noise and vibration in a vehicle interior. The “NVH” (for noise, vibration, and harshness) characteristics of a vehicle depend on the characteristics of a large number of components, among them the following: the structure of the vehicle, including its stiffness and damping properties (which may depend on such an unlikely component as the anti-corrosion coating used); the engine, its architecture (number and layout of cylinders), its internal mechanical components (such as the camshaft drive mechanism), the design and tuning of its air intake and exhaust systems; the fuel system including the fuel pump and its mounting hardware, and even the fuel

injectors; the arrangement used to attach the powertrain to the chassis, and the characteristics of the mounts; the suspension design and its tuning, including the characteristics of the springs, dampers, mounting bushings, and tires, most of which are highly nonlinear; the door seals; the thickness of the windshield and other glass; the properties of the materials used in the interior such as the carpeting, headliner, and upholstery. These components involve complex and non-obvious interactions, with a source of vibration in one component often setting off a resonance in another, such as when engine vibration at idle causes the steering column to shake. Furthermore, many of these components are involved in some of the more difficult tradeoffs in designing and tuning a vehicle. The obvious one is the tradeoff between using additional amounts of sound deadening material and the loss of performance that results from the increased weight. Another tradeoff is the tuning of the suspension components: softer springs and bushings generally reduce the level of NVH at the cost of less precise handling and tracking. Similarly, softer powertrain mounts typically afford better isolation of engine vibration, but they cause unpleasant jerkiness at the throttle tip-in and tip-off (when the throttle is opened and closed.) Needless to say, cost plays an important factor in the severity of these tradeoffs: more complicated and therefore more expensive systems such as adaptive suspensions or adaptive intake and exhaust systems can always be used to move from one tradeoff curve to another one that is more advantageous. In any case, these situations are made all the more difficult by the fact that choosing a particular point along any of these tradeoff curves is not a simple objective decision, but one that involves subjective assessments by development engineers and managers, who rely on their experience, knowledge of the competition's offerings, and their understanding of their customers' expectations. Which brings us to the external complexity of the automobile.

Typically, few people choose between different automobiles purely on the basis of their ability to provide basic transportation for a given number of people and a given amount of luggage. An auto purchase is often an emotional decision, in which "fantasy and imagery" play an important role (Clark and Fujimoto, 1991, *op. cit.*). Again, sports cars and SUVs provide excellent examples. A typical modern two-door coupé offers few advantages in terms of weight or aerodynamics, when compared to an equivalent four-door sedan. Yet, the typical buyer ascribes a higher level of performance to the two-door

version, as well as an image of freedom, playfulness and individualism. In terms of performance, many high-performance sports car offer levels of acceleration and speed that dramatically exceed what is usable on public roads, even by a competent and experienced driver; yet, to many of their buyers, any less performance would seriously detract from the value proposition these products present. Similarly in the case of SUVs: research consistently indicates that most of their owners rarely take them off-road. SUV buyers are not choosing these vehicles for their off-road capabilities, but, in many cases, for the sense of security they perceive as a result of the rugged appearance of these vehicles (Bennet, 1995; Malek, 1996). Interestingly, some the fantasy and imagery on which some automobile buying decisions are based can be traced to a point in time when the buyer was not even of driving age. Needless to say, much of this imagery is socially constructed, with significant support provided by the marketing departments of the manufacturers, through their various advertising campaigns. Obviously, such factors are notoriously “difficult to translate into technical specifications” for a new product (Clark and Fujimoto, 1991, op. cit.). Clark and Fujimoto mention other aspects of the customers’ wants and needs that contribute to the complexity of the external interface of the automobile. One is the fact that “car consumers are often unable to articulate their future expectations, although they can tell which products they like when they see them.” This is particularly true when it comes to exterior and interior styling and color. In essence, market needs in the case of the automobile are “subtle, latent, equivocal, and inarticulate” (ibid.).

In view of the high level of internal and external complexity that is characteristic of the automobile, it is reasonable to assume that designers and developers in that industry are likely to have evolved approaches and practices that are interesting and worth studying. The automobile industry seems to present fertile ground for theory building research. Furthermore, to the extent that other products involve one or the other of the two kinds of interface complexity described above, the types of approaches uncovered by this research here for dealing with such complexity would be relevant.

## **The cases**

Case selection in theory building does not follow the concepts of statistical sampling, where the concern is finding several matched research sites where findings are likely to be duplicated, thus lending them more validity. In theory building, research sites are selected based on the notion of “theoretical sampling”, in order to “provide examples of polar types” for example (Eisenhardt, 1989). Selecting sites that are diverse decreases the likelihood of developing theory or categories that are specific to one particular type of organization. The three sites I selected are a US company in Detroit (Chrysler), the Southern California design studio of a Japanese company (Nissan Design International, or NDI), and the Japanese parent company itself (Nissan Technical Center, or NTC). Aside from the difference in national origin and location, Chrysler and Nissan had different fortunes at the time when the studies were conducted. After coming close to bankruptcy, Chrysler was riding a wave of success (Taylor, 1994). Conversely, Nissan, which had been relatively successful in the late 1980s, was doing poorly at the time (Thornton & Armstrong, 1997).

Another criterion I used in selecting the study sites was that the companies and their products be “interesting.” I believe that each of the two companies selected qualifies. Chrysler has been a design innovator in the industry, both with its mainstream offerings and with the unusual specialty models introduced in the last few years. Examples of the former include the original Neon subcompact, the Cirrus compact sedan, the LH sedans with their “cab-forward” styling (e.g., the Dodge Intrepid), and the Dodge Ram Pickup truck (Fleming, 1991; Bennet, 1994; Taras, 1994; Nussbaum, 1995; Flint, 1997). Examples of the latter are the Dodge Viper roadster and the more recent Plymouth Prowler, two products that do not fit into any previously established product categories (Connelly, 1990; Bohn, 1993; Keebler, 1993). Products aside, Chrysler is an interesting study site from an organizational and management perspective, as it was one of the first companies in Detroit to rely on dedicated platform development teams and to shift significant engineering responsibility to its suppliers (Vasilash, 1991; Flint, 1992; 1997). In addition, the management team at Chrysler, during the time when the study was conducted, included a few interesting personalities, such as Bob Lutz, the chief operating officer, and Robert Eaton, Chrysler’s Chairman (Gelsi, 1996). These factors allowed the

company to achieve high levels of profitability without relying on radical cost cutting measures, such as plant closings, like some of its competitors (Taylor, 1994).

Nissan has also produced some remarkable products, although none as radical as Chrysler's Viper or Prowler. The mid to late 1980s was a prolific period for the company, resulting in the original Nissan Pathfinder SUV, the 300ZX sports coupé, the Maxima sporty sedan, as well as some of the Infinity models such as the original Q45 sedan and the later J30 with its unusual ovoid shape (Armstrong, 1991; Bryant, 1992). Another unusual design is the original Nissan Altima subcompact sedan, elements of which appear inspired by the J30 (Clements, 1992; Taylor, 1993). Nissan was also one of the first foreign automobile manufacturers to establish a design studio in Southern California, a move that was followed by others, including the US manufacturers (Barron, 1998). NDI is itself an interesting organization because it has always seemed somewhat independent of its parent company, acting more like one of the well-known Italian design houses (ItalDesign or Pininfarina) than the captive design arm of a large Japanese manufacturer. It has undertaken a number of outside, non-automotive projects, and it is led by an outspoken president who is well known in the industrial design community (Armstrong, 1991; Washington, 1995; WSJ, 1999). The designs developed at NDI are often in competition with work done at the Nissan Technical Center in Japan (Armstrong, 1991, *op. cit.*), where most of the engineering and development work is performed to productionize these designs in any case. It is therefore only natural to complement the NDI study with a study of NTC. NTC has also developed a few specialized models on its own, some of which were not sold in the US (such as the be-1 and Escargot minicars of the late 1980s), and others than did not go beyond the prototype stage.

The design of the case studies follows Yin's embedded multiple-case format (Yin, 1994). Each of the three cases involves several units of analysis. At one level, I use a particular product to anchor each of the cases: a new Minivan project at Chrysler, and the second generation Altima at Nissan. However, other products were discussed at some length during the studies, such as the Viper and Prowler in the case of Chrysler, and a future sports car and a small SUV in the case of Nissan. These were typically covered in the course of studying particular units within these companies—the Design Office in the case

of Chrysler, and the Design Context Laboratory and Color Studio in the case of NDI. The sub-cases include: design studios in Detroit, California, and Japan; a color studio in California; a “Design Context Lab”, also in California; a multidisciplinary platform development team in Detroit; an interior supplier in Detroit. (For a complete list of the cases and the interviews, please refer to Table II.1 below.) I believe that the range and richness of these embedded cases, which were inspired by the notion of theoretical sampling, contributes to the relevance and range of applicability of the findings

Table II.1: The case studies sites

Site	Chrysler	Nissan Design Int'l.	Nissan Tech. Ctr.
Location	Detroit, MI	La Jolla, CA	Atsugi, Japan
Product(s)	Minivan (Dodge Viper) (Plymouth Prowler) (LH sedans)	Altima (Future mini SUV) (Future sports car)	Altima (Various)
Sub-cases / Interviews	<ul style="list-style-type: none"> <li>• Design Director (Corporate Design Office) (1)<sup>16</sup></li> <li>• Minivan program manager (1)</li> <li>• Minivan team managers and various Executive Engineers (4)</li> <li>• Director of Advanced Manufacturing Engineering and Body Engineering Executive Engineer (2)</li> <li>• Supplier VP and personnel (Lear Seating) (5)</li> </ul>	<ul style="list-style-type: none"> <li>• President of NDI (1) (2 interviews)</li> <li>• Design Studio (Altima) heads (2)</li> <li>• Color Studio head (1)</li> <li>• Design Context Laboratory manager (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Shukan &amp; ex-Shukan (now Department Manager of Product Design Administration Dept.) (2)</li> <li>• Head of Exterior Design Studio #2 (2)</li> <li>• Head of Product Experiment Dept.#2 (Marketability testing) (1)</li> </ul>

<sup>16</sup> Number of respondents present at interview.

The main research instrument I rely on is qualitative, open-ended interviewing (Piore, 1979; Rubin & Rubin, 1995). Given the nature of the research questions, open-ended interviews with design and PD managers and practitioners represent the most appropriate approach. They allow the important issues facing the practitioners, and the ways in which they conceive of them and approach them, to emerge during the interview. Given the broad range of activities in design and PD, and the wide variation between the different sites, different informants will have different areas of concern, making a more structured approach inappropriate. This approach also makes it possible to capture the practitioners' description of their practices using their own terms and distinctions, instead of forcing their responses into predefined categories, as is likely to happen with other, more structured research instruments (Mintzberg, 1979). The interviews were initially given a general direction (market, customer, interaction with other functions or departments, selection of design), but then were allowed to proceed according to the subject matter uncovered. For the same reasons, I do not use any intensive detailed coding techniques (such as computerized coding), which could risk destroying the meaning of the empirical data (Eisenhardt, 1989, p. 534).

The reports and analysis of the findings at the three sites, Chrysler, Nissan NDI, and Nissan NTC, are presented in Chapters IV through VI.

## Chapter III: Theoretical Framework

### *A Taxonomy of PD Practices Inspired by Linguistics and the Philosophy of Language*

This research is concerned with the interpretive communicative processes and practices which people involved in design and product development deploy when interacting with their customers and with each other. The aim is to gain a better understanding of these processes and to develop a vocabulary that would make them more understandable and more accessible to the PD practitioner.

Interpretation is an activity that humans engage in constantly as they face the countless situations that make up their daily lives. In the introduction of his book on hermeneutics, Palmer describes “the ubiquity of interpretation” and asserts that living, at least for humans, is itself a “constant process of interpretation”(Palmer, 1969, pp. 8-9).

*Consider for a moment the ubiquity of interpretation, and the generality of the usage of the word: The scientist calls his analysis of data “interpretation”; the literary critic calls his examination of a work “interpretation.” The translator of a language is called an “interpreter”; a news commentator “interprets” the news. You interpret—or misinterpret—the remark of a friend, a letter from home, or a sign on the street. In fact, from the time you wake in the morning to the time you sink into sleep, you are “interpreting.” On waking, you glance at the bedside clock and interpret its meaning; you recall what day it is, and in grasping the meaning of the day you are already primordially recalling to yourself the way you are placed in the world and your plans for the future; you rise and must interpret the words and gestures of those you meet on the daily round. Interpretation is, then, perhaps the most basic act of human thinking; indeed, existing itself may be said to be a constant process of interpretation.*

Consider in particular the case of a designer interacting with potential customers for a product he is working on, for the purpose of learning and assessing what these customers want from the product, what they expect, what they might or might not accept, what they are likely to find pleasantly surprising or totally unresponsive to their needs. Whether the interaction is direct or indirect—in other words, whether it involves reading a marketing brief, studying the results of a survey, or talking directly to a group of customers—the designer is constantly interpreting what he is reading or hearing. Similarly, as designers and product developers interact with one another in order to understand what one functional group needs or expects from another, what they might be willing to accept or able to change, and how they might be convinced to do so, they are also constantly interpreting what they are being told by their interlocutors. If we accept, provisionally, that interpretation may be the “most basic act of human thinking”, then it must follow that interpretation is pervasive in a creative activity such as product development.

Although the interactions mentioned in the previous paragraph are described in linguistic terms, interpretation itself is not limited to the linguistic world. For example, Palmer describes whatever process an animal undergoes as it sees a piece of food in front of it as interpretation; and he describes migratory birds interpretation of a variety of inputs as a sign that they should fly south (Palmer, *ibid.*). Returning to humans, we all know how to interpret a hand gesture as a greeting, or a certain look as a sign of anger. In reality, as designers interact with customers and with one another, they rely on a number of different media. Most often, the discussions and conversations in question are not limited to linguistic exchanges. They also involve such things as pictures, sketches, drawings, graphs, data tables and plots, as well as models and prototypes, whether physical or in the form of computer generated representations. For example, an automotive consumer clinic will typically feature several current production vehicles as well as one or two prototypes of the proposed model. And it would be hard to imagine engineers from different functional groups discussing a design without looking at some drawings, whether over a drawing board or a CAD screen. Some of these artifacts play a crucial role in bringing the interlocutors to a common understanding, and they have been the subject of various research projects, such as the study by Carlile on the role of boundary objects in product development (Carlile, 1997).

The theoretical framework developed in this chapter is derived from linguistic concepts. Still, the claim here is that the presence of these non-linguistic elements in the interactions in question, and the importance of the role they play, do not detract from the relevance and applicability of the framework. One way to make this claim reasonable is to point out that although the framework does indeed start with linguistic concepts, it ultimately deals with interpretation in general, which has universal relevance as was pointed out earlier. But a better explanation would be to point out the importance and universality of language itself to our existence as human beings, and the peculiar role it plays in our knowing and understanding.

Palmer argues that language shapes how man sees his world, how he thinks, and even how he feels; then, using ideas from Heidegger and Gadamer, he describes language as “the ‘medium’ in which we live, move, and have our being” (Palmer, *ibid.*, p. 9). He also discusses Heidegger’s increasing emphasis, in his later writings, on “the linguisticity (Sprachlichkeit) of man’s way of being” (that is, on man’s way of being human, or “Dasein”) (Palmer, *ibid.* p. 155).

Gadamer discusses the inseparability of human knowledge and language in his essay on “Man and Language”:

*... in all our knowledge of ourselves and in all knowledge of the world, we are always already encompassed by the language that is our own. We grow up, and we become acquainted with men and in the last analysis with ourselves when we learn to speak. (Gadamer, 1976, p. 62).*

And later:

*Hence language is the real medium of human being, if we only see it in the realm that it alone fills out, the realm of human being-togetherness, the realm of common understanding, of ever-replenished common agreement... (Gadamer, *ibid.*, p. 68).*

On a less philosophical level, researchers in cognitive science and linguistics have written extensively on the connection between language and thought. For example, such a seemingly purely linguistic construct as metaphor turns out to be pervasive in the way our thoughts and actions are structured (Lakoff et al., 1980). Similarly for metonymy, another

construct, which is not only linguistic but cognitive as well, since it is found to underpin an important area of how humans combine things in categories (Lakoff, 1987).<sup>17</sup>

In the next section, I introduce the basic areas of linguistics, focusing in particular on syntax, semantics, and pragmatics. (Although I have used hermeneutic ideas from Gadamer and Heidegger to motivate the focus on language, there is no inconsistency in turning now, temporarily, to some of the more analytical, structural aspects of language study.) I then introduce, in another section, some concepts from hermeneutics, occasionally comparing pragmatic interpretation to hermeneutic interpretation. In the third section of this chapter, I present and explain the classification framework proper, as well as an example of how it may be used.

## **Background I: Linguistics**

Linguistics, the study of human natural language and communication, is a far ranging field. Its concerns include such disparate areas as the origin of words, the rules used to construct proper sentences, the physics of sound formation through the vocal chords, the study of brain function during speech, and the evolution of dialects in different parts of the world. Here, we are interested in language proper, not in its physical, neurological, or ethnological aspects. In general, the study of language is divided into two broad categories, the structural and the functional.

### ***Structural linguistics***<sup>18</sup>

Structural linguistics comprises the sub-fields of morphology, phonetics, phonology, syntax, and semantics. Akmajian et al. note the common theme that runs through these sub fields:

*... the structural analysis of human language can be stated in terms of (1) discrete units of various sorts and (2) rules and principles that govern the way these discrete units can be combined and ordered. (Akmajian et al., 1995, p. 3).*

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<sup>17</sup> Metonymy refers to the situation where the name of an object or concept is used to refer to another to which it is related or of which it is a part (Random House, 1992).

<sup>18</sup> The presentation of structural linguistics draws heavily on the textbook by Akmajian et al., (1995).

These sub fields are concerned with developing descriptive rules, that is, regularities and generalizations observed in the structure of language, not with prescriptive rules on the proper usage of language, such as the rules of grammar.

An important aspect of structural linguistics is that although a finite number of rules and principles are used to describe the system, it nevertheless remains unbounded in scope. In other words, there is no limit to the new words or sentences that can be formed, or the kinds of things that can be talked about. This principle of “effability” points out a similarity between language and design, namely, the unboundedness of the range of products of what is basically a creative human activity.

Morphology is the study of words and the basic building blocks they are made of; how these elements are put together to form more complex words, and how the meanings of these more complex words are related to the meanings of the parts, and the relations between words.

The field of phonetics deals with how speech sounds are produced, focusing on their production in the vocal tract in the case of articulatory phonetics, or on the physical properties of the sound waves thus produced in the case of acoustic phonetics.

Phonology deals with the patterning of sounds in natural languages, either comparing the structures and patterns of sounds between languages, or looking for universal properties that are common to natural language sound systems.

Of more interest to us are the two remaining areas of structural linguistics, syntax and semantics, because they focus on phrases and sentences, the basic building blocks of communication, instead of looking at sounds or words only.

### **Syntax**

Syntax is the study of phrases and sentences, the basic elements of linguistic communication. Here, the focus is on the patterns of formation of phrases and sentences from words, and on the rules used in the formation of grammatical sentences in a language. Since the publication of Chomsky’s seminal work on the subject, “Syntactic Structures”, in 1957, the field has been dominated by the transformational grammar paradigm (Chomsky, 1957).

A grammar consists of a finite set of rules and principles that reflect the regularities found in the language, and that enable a speaker “to produce and comprehend the unlimited number of phrases and sentences of the language” (Akmajian et al., op. cit., p. 137). It should be noted that “comprehend” is used here in the sense of making grammaticality judgments about sentences, not in the sense of understanding the meaning of these sentences; that falls in the domain of semantics, which is covered later.

A critical element of any grammar is a lexicon that provides a classification for the building blocks of the language, i.e., the words of the language, into specific categories.

To get an idea about the kinds of rules involved in a theory of syntax, we can look at an informal theory of syntax proposed by Akmajian et al. (op. cit.). In that introductory theory, the authors identify a few basic aspects that are reproduced and explained below. The first three deal directly with the internal structure of sentences:

*Structural properties:*

- a. The linear ordering of elements. This property reflects the fact that the ordering of words or elements (e.g., noun phrases) in a sentence is not arbitrary. Changing that order will affect whether the sentence is seen as well-formed or not, grammatical or not; to say nothing of how a change in the ordering might affect what the sentence may mean;
- b. The labeling of elements into morphological or lexical categories (also known as “parts of speech”.) This labeling resolves whether a particular element in a sentence is a noun, a verb, an article, and so on. These lexical entries that are needed for every word in the language are separate from the meaning or denotation of the word. (These aspects will be covered in the next section, which deals with semantics.)
- c. The grouping of elements into structural constituents or phrases. A sentence element can itself be a linear grouping of other elements; for example, a prepositional phrase can consist of a preposition and a noun phrase which itself is composed of an article and a noun.

Another set of elements of the grammar presented in this informal theory relates to how certain phrases function, grammatically, within a sentence. Examples of these are the

concepts of subject and object in a sentence. At first sight, these relationships may seem to fall outside the purview of mere syntax, as they require the speaker or hearer to make a judgement concerning who is undertaking the act described by the verb and who is being subjected to it. However, these grammatical relationships can indeed be reduced to structural descriptions (with some help from the lexical entries for the verbs) as follows:

*Grammatical relations:*

- a. Subject (a noun phrase that precedes a verb phrase, within a given sentence.)
- b. Object (a noun phrase that follows the verb in a verb phrase.)

What we have then is a self-contained system that is purely structural in nature. It allows us to decide, given a sentence, whether it is correct or not. It also allows us to generate any grammatical sentence in the language using a finite set of transformation rules. It does not tell us anything, however, about what these sentences might mean. And the process of generating these sentences can be purely mechanical; it does not require any of the mental abilities of a thinking human being, or any intentionality.<sup>19</sup>

Before moving on to semantics, it may be useful to look at what a formal theory of syntax looks like. A basic phrase structure grammar (generative grammar) would consist of a number of phrase structure rules (PS rules), such as the following:

$$S \rightarrow NP \text{ Aux } VP$$
$$NP \rightarrow (\text{Art}) N$$
$$VP \rightarrow V (NP)$$

Where S refers to sentence, and P to phrase. N, V, Aux, and Art refer to the lexical categories noun, verb, auxiliary, and article, respectively. And the parentheses indicate an optional constituent. The arrow is used to indicate a “consists of” relationship or rule. The first rule indicates that a sentence S consists of a noun phrase NP, followed by an auxiliary Aux and by a verb phrase VP. And the second relationship gives the rule for the formation of a noun phrase NP: it consists of an optional article (Art) and a noun.

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<sup>19</sup> Intentionality is used to refer to “things that are about other things” such as mental states and beliefs, but also, indirectly, sentences (Audi, 1995).

The importance of the lexical categories is clear from the relation between lexical categories and phrasal categories, namely: For X, X a lexical category (N, V, A, P), we can form a phrase of type X with X as its head, such as:  $XP \rightarrow \dots X \dots$

### **Semantics**

Semantics is concerned with the study of meaning and reference in language. It is intended to provide an account of what linguistic units—phrases and sentences—mean, and what they refer to. There is a difference in emphasis between semantics as used in linguistics, and as it used in logic. Reference, that is, denotation and truth conditions, finds greater emphasis in the latter.

Until the early 1960s, the inclusion of semantics in a grammar, that is, a system of rules specifying a language, was considered “not quite respectable” (Akmajian et al., op. cit., p. 213), and the “waste-basket of linguistics” (Mey, 1993, p. 5). That is no longer the case: linguistic competence is now viewed as including meaning, and semantics, like syntax, is now considered a legitimate part of a grammar.

When dealing with the issue of meaning, a basic distinction must be made between linguistic meaning and speaker meaning. The former is the literal meaning of an expression, that is, its strict, non-figurative meaning in the language. The utterer’s or speaker’s meaning, on the other hand, may or may not match the linguistic meaning, depending on whether the speaker is speaking literally or not. Examples of nonliteral meaning are those involving irony or sarcasm, as well as the use of metaphor.

Beyond this basic distinction, the field of semantics has had to deal with the lack of a consensus among researchers as to what meaning really is. Several theories of meaning have been proposed over the years. The easiest ones to grasp are those theories that conceived of meaning as an entity. For example, in the Denotational Theory, the meaning of an expression is the actual object denoted by that expression. In the Mentalist Theories of meaning, the relevant entities are the ideas that are associated, in the mind of the speaker, with the expression in question. In the Image Theory of meaning, it is mental images. All these theories suffer from various breakdowns under different conditions.

To deal with the problems stemming from the conception of meaning as an entity, Frege introduced the idea of meaning as sense. The meaning of a sentence became its satisfaction condition, that is, the condition that makes the sentence true (Akmajian et al., op. cit., pp. 221-222).

Later on, Wittgenstein introduced the Use Theory of meaning, which held that the meaning of an expression is determined by how it is used in the community that uses the language in question, the meaning of an expression being specified by specifying its use (idem., p. 223). This conception of meaning is more useful and less limiting than the others, but it comes closer to notions that are the purview of Pragmatics, which are discussed later under functional linguistics.

These are only a few of the conceptions of meaning that have been proposed over the years, and that have served as the basis for various researchers and their semantic theories. For more detailed treatment, the reader is referred to (Audi, 1995, pp. 471-476). Although Akmajian et al. (op. cit., p. 223) state "... it is fair to say that researchers do not have a very clear idea what meaning is." it is still possible to lay out a set of issues of concern in semantics, and to describe the elements that a semantic theory must explain or account for.

One of the most important elements in a semantic theory is a lexicon. A semantic lexicon goes beyond the one described under syntactic theory. Whereas the latter need only provide "part of speech" information for every word (i.e., *is a noun, is a verb*, and so on), a semantic lexicon must somehow represent the meaning of all the meaningful words of the language. For example, such a lexicon would tell us that *brother* means *male sibling*. It would also identify words that are synonymous, words that have several related meanings (polysemous). With that information, it becomes possible to identify expressions that are lexically ambiguous, redundant, or anomalous, as a result of containing a word that is ambiguous (e.g., *she can't bear children*), a word that already includes the meaning of another (e.g., *my female sister*), or words that are incompatible (e.g., *he slowly ran up the stairs*), respectively.

A critical element in understanding the meaning of a sentence is determining whether it is an assertion, an order, or a question. A semantic theory should therefore be able to

account for the communicative potential of sentences: is the question a declarative, an imperative or an interrogative sentence? Sentences of these different types have different structures, and that structural information is therefore part of a semantic theory.

A semantic theory must also account for certain truth properties and truth relations of sentences, such as entailment, where the truth of one sentence guarantees the truth of the sentence that it entails. An example, from Akmajian et al. (op. cit.): the sentence *The car is red* entails the sentence *The car has a color*. Another relation is semantic presupposition, where if a presupposed sentence is false, then the presupposing sentence cannot be said to be either true or false. For example, saying that *My watch is five minutes too slow* presupposes that *I have a watch* or that *My watch is running*; if either of the latter statements is false, then one can no longer say whether my watch is or is not slow.

At this point, the reader might be wondering about the connection between such detailed and specific examples of linguistic semantics, and communication and knowledge in product development. These examples are needed to show the reader what can seemingly be accomplished with a grammar, a closed system consisting of a finite number of rules and a lexicon. A semantic theory can tell us that a red car has color without ever having experienced or seen anything that is red, purely based on its rules and the entries in its lexicon. In other words, one can program a machine with the rules and lexical entries of semantics, and that machine could then figure out that a particular sentence is a question or a constation, whether two sentences are synonymous or not, and that Chomsky's famous "colorless green idea..." is a "meaningless" expression. "Meaning" in semantic theory is therefore a highly specialized and limited version of what the average thinking human being might understand by that term.

### ***Functional linguistics***

In structural linguistics, human language is viewed as an abstract coding system having a number of structural properties, such as the two levels briefly described above, syntax and semantics. Functional linguistics is concerned with how languages are used by humans, that is, how people use language to communicate in real life situations.

Specifically, we will look at Pragmatics, “the study of language use in relation to language structure and context of use” (Akmajian et al., p. 340).

### **Pragmatics**

As we saw earlier, the focus in semantics is on the linguistic meaning of phrases and expressions, that is, their literal meaning. Very often in normal language use, however, literal meaning and speaker meaning do not coincide, because people speak nonliterally, such as when they communicate using sarcasm or metaphor. In pragmatics the focus is on speaker meaning. The interest in pragmatics increased because of a sense of dissatisfaction with structural linguistics as being too removed from real world language use (Mey talks about “the collapse of earlier theories and hypotheses, in particular of the ‘pan-syntacticism’ of Chomsky and his followers (Mey, op. cit., p. 19).) For example, syntax and semantics tell us that ambiguity is rampant, due to structural ambiguity (the structure of a sentence allowing for different interpretations, as in *The mother of the boy and the girl will arrive soon*), as well as lexical ambiguity (a word having different meanings, as in *I can’t bear children*.) Yet, in real life language use, ambiguity is rather unusual, if we do not count those cases that involve purposeful evasiveness. In both of the above examples, it is more than likely that the hearer will know exactly which of the possible meanings is operative, from the context in which the expressions are uttered. It is practically impossible to imagine a real situation in which these expressions would show up—be uttered—in complete isolation, the way they appear above.

Another, more technical example of the shortcomings of semantics is the case of presuppositions, briefly mentioned in the previous section. Mey gives the following example, loosely paraphrased here (Mey, op. cit., p. 29). Consider the following two sentences: *John regrets that he failed the exam* and *John doesn’t regret that he failed the exam*. Regret being a factive verb, it presupposes the clause that follows it; in other words, whether he regrets it or not, the presupposition in both sentences is that John has failed the exam. As a result, on a semantics account, the sentence *John doesn’t regret that he failed the exam, because in fact he passed!* would involve a logical contradiction. Yet one can imagine a situation in which this last sentence might be uttered without sounding illogical. Consider the scenario where one person might have just stated that John did

poorly on the exam, to which another responds by saying that John must regret failing the exam; the first person could then utter the semantically questionable sentence, and it would make perfect sense. As Mey points out, in this situation, the false presupposition was the second person's alone, not the first person's (the speaker's) too, and it is therefore not a semantic presupposition but a pragmatic one. It is important to note that, here again, the scenarios in which that expression would make sense involve interactions between speakers, not the isolated utterance of a sentence.

Akmajian et al. tie the limitations of the pre-Pragmatics view of communication to the Message Model of communication, effectively the same as the model of communication as information transfer that was discussed in the introduction (Chapter I) (Akmajian et al., pp. 346-348). According to that model, the speaker typically has some message in mind that he wants to communicate to the hearer; the speaker therefore encodes that message into language and utters the corresponding sounds. The hearer receives the message by hearing these sounds and decodes the utterance, identifying its syntax and meaning using his knowledge of the language. The hearer finally recomposes the meanings received into the original message. According to that model, successful communication takes place when the message decoded by the hearer is the same message that was initially encoded by the speaker. In the Message Model of communication, language is seen as a bridge for ideas or, to use the common metaphor of the communication channel, language is a "conduit for ideas" (Reddy, 1979).

The authors then identify a number of limitations of the Message Model as a representation of human communication. First, there is the previously mentioned problem of disambiguation, for which semantics does not account, as it offers no rules or principles that might govern it. And yet, the fact that most people seem to manage the process successfully most of the time indicates that it cannot be random, that it must follow some principles.<sup>20</sup> One such principle is the presumption by the hearer of the

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<sup>20</sup> The shift from using the term "rules" in describing the regularities of the language, to using the term "principles", is connected to the shift from a focus on generative transformational grammars. In a grammar, rules are supposed to "predict which sentences are correct", and to "establish ('generate') the entire set of correct ('well-formed') sentences of a language..." Starting with semantics, and more so in pragmatics, rules became "rules of usage, not of prediction." The focus on meaning, and in particular on speaker meaning, make the concept of well-formedness "controversial" (Mey, op. cit., pp. 54-55).

contextual appropriateness of the utterance. A second limitation stems from the fact that meaning often is not sufficient to determine what an expression is referring to, and yet, successful communication requires the hearer to determine what that reference is. The example given in Akmajian et al. is that of the phrase “shrewd politician”, which always means the same thing, but which could be used on one occasion to refer to, say, Winston Churchill, and on another to Richard Nixon. A third limitation is again one where successfully decoding the meaning of the utterance is not sufficient for successful communication; in this case, it is the communicative intent that is underdetermined. For example, the utterance “I’m coming tonight” could be a threat, a promise, or simply a prediction. In all three cases, the meaning of the utterance is the same, but the speaker obviously intends to communicate different things. A fourth limitation of the Message Model is that it does not account for nonliteral communication, where the speaker means something other than the literal meaning of his utterance, as in the case where sarcasm is used. Another case where communication involves more than decoding the meaning of an utterance is indirect communication. For example, saying “I’m hungry” when what I really want to communicate is my desire to eat. Finally, the sixth limitation of the Message Model is that it does not account for those cases where the purpose of an utterance is not to communicate a message, as in institutional speech acts or perlocutionary acts. For example, when a boss tells an employee “You’re fired”, the institutional act of changing the employment status of the employee is arguably more important than the act of communicating it to him. And in the case of perlocutionary acts, the speaker may say certain things to persuade the audience of something or to deceive that audience; unlike communicative acts, where the communicative intention is intended to be recognized by the hearer, in this case the speaker hope to hide his intentions.

The various thrusts of research in pragmatics came in response to these limitations. The common thread in all these areas of pragmatics is the role of the context in communication. One example is the inferential theory of communication of Bach and Harnisch (Akmajian et al., op. cit., pp. 352-368). That theory holds that “linguistic communication works because the speaker and hearer share a system of inferential strategies leading from the utterances of an expression to the hearer’s recognition of the speaker’s communicative intent” (Akmajian et al., op. cit., p. 352). The interlocutors

however share more than strategies; they also share a “system of shared beliefs.” Instead of the rules and conventions of a language or code connecting sounds and messages, pragmatics proposes “systems of *intended inference* and *shared beliefs*” or presumptions that are at work during real life communication, and that we learn “in the course of learning to speak our language”. A basic presumption is the Linguistic Presumption, whereby “the hearer is presumed capable of determining the meaning and referents of the expression in the context of utterance.” Another is the Communicative Presumption; here, “the speaker is assumed to be speaking with some identifiable communicative intent” unless there is evidence to the contrary. A third is the presumption of literalness, by which, “unless there is evidence to the contrary, the speaker is assumed to be speaking literally.” These shared presumptions result in the hearer and speaker having a “fairly specific set of conversational expectations” that enable the successful operation of the shared system of inference strategies. These strategies are used by the hearer to determine whether the speaker is communicating directly, literally or nonliterally, or indirectly. In each case, the test that helps the hearer choose the appropriate strategy is a test of *contextual appropriateness*. To use an example from Akmajian et al. (op. cit., p. 364), it would be strange to assume that someone who just pulled into a gas station and reported that he wants ten gallons of gas is not actually, in so doing, making an indirect request for those ten gallons of gas.

Another area of pragmatics deals with speech acts, or acts that are performed by uttering expressions, such as the perlocutionary acts mentioned above. In addition to perlocutionary acts, where an act is performed *by* uttering something (as when one is attempting to intimidate or persuade), speech acts include illocutionary acts, in which an act is performed *in* uttering something (such as when one is promising or asking something), among others (Akmajian et al., op. cit., pp. 376-380). In this area of pragmatics, the aspect of context that is the focus of attention is the purposive context, that is, the goal or purpose of verbal acts (Givón, 1989, p. 27). The complexity of the issues involved in speech act theory has resulted in this area making significant contributions to pragmatics, such as Searle’s theory of the Background (with a capital B to indicate the use of the term in a specific technical sense.) The Background reflects the complex framework of social and institutional conventions within which we grow up as

humans, and upon which we draw when interpreting performatives and other speech acts (Searle, 1985).

### **Pragmatics, more generally**

#### ***Pragmatics as a perspective***

In the previous section, pragmatics was generally presented as a branch or sub-area of linguistics, just like morphology, syntax, and semantics. Many linguists do indeed view pragmatics that way. Others, however, see pragmatics as a wholly different perspective on linguistics. For example, Mey talks of a pragmatic perspective on phonology “that will emphasize the societal aspects that are inherent in a certain phonological system” (Mey, p. 46). This distinction goes beyond a matter of disagreement about the boundaries of one or another sub-area of linguistics, and it is not of one sub-area involving more than one level of analysis. (In semantics for example, one can look at the meaning of a morpheme, a word, a phrase, or a sentence, as the principle of compositionality connects the latter to the former.) Mey traces the view of pragmatics as another of the branches of linguistics to the “component view” of linguistics, popularized by Chomsky and the researchers who followed him in the field of generative transformational grammar. The “component view” holds that the mind has a number of distinct, independent but cooperating, faculties (Mey, p. 45). Along that view, each of the components or “modules” of linguistics “works within a properly delimited domain, with proper, well-defined objects, and with properly established, specific methods” (Mey, p. 46). From the description of the previous section, one can see that it may be difficult to clearly circumscribe the domain of pragmatics, to delimit the notion of context, or to think of it in terms of “well-defined objects.” (Mey quotes Östman, a pragmatician, who describes the unit of analysis for pragmatics as being the whole “*functioning of language*”.) Alternatively, the two views could coexist side by side, as “they both are metaphors, designed to expand, not to narrow our epistemological horizons” (Mey, p. 47).

#### ***The universality of pragmatics; framing it using systems theory and logic***

Pragmatics is more than a component of linguistics or even a perspective or “umbrella” for the study of linguistics and language use. Givón defines pragmatics as follows:

*Pragmatics is an approach to description, to information processing, thus to the construction, interpretation and communication of experience. At its core lies the notion of context, and the axiom that reality and/or experience are not absolute fixed entities, but rather frame-dependent, contingent upon the observer's perspective (Givón, 1989, p. xvii).<sup>21</sup>*

Givón traces the roots of pragmatics from “pre-Socratic Greek dialecticians, then via Aristotle to Locke, Kant and Pierce, eventually to 19<sup>th</sup> Century phenomenologists” and on to Wittgenstein (ibid.).

In Givón, the role of pragmatics in relating the meaning of an expression to its context is presented as only one of different ways of looking at the role of perspective or frame of reference, and it is presented as a metaphor. Other metaphors he uses: description and point of view (a description being incomplete (“uninterpretable”) if it does not include the point of view from where it is taken); picture and frame (a picture being not fully specified unless its frame is also specified.) The author explains the role of pragmatics using notions from systems theory and logic, and he frames the issue in terms of two predicaments. His explanation is paraphrased here.

*The three core metaphors for the pragmatic method given above—point of view, frame, and context—may be further generalized via the notions of systems and meta-levels. [...] The system, as a hierarchic entity, is made out of a progression of levels, each one acting as a meta-level [...] thus the context for the sub-levels embedded within it. For purely practical reasons, if the system is to remain finite (i.e. describable within finite time, space and means), the last—highest—meta-level must remain context-less; it lacks its own meta-level. In terms of our picture metaphor, the last meta-level is the frame, yet itself remains un-framed, therefore, not fully-specified (Givón, op. cit., pp. 2-3).*

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<sup>21</sup> The use of the expression “information processing” may be confusing here, as information processing is generally thought of as an analytical, structured process that is more akin to the descriptions of transformational-generative grammars. Often, authors will set up the analytical information processing view in opposition to the more interpretive, practice oriented views of human thought and behavior (see, for example, Carlile, 1997.) There is no reason why, however, interpretation cannot be viewed as a kind of information processing, as in the above quote. In that case, information processing is a more general use of the term, whereas the information processing view of communication or interaction should be understood as a particular perspective on these types of activities (Carlile, 1999). That view fits within the reductive, logico-deductive view discussed later.

This leads to what Givón calls the first predicament of pragmatics, the **predicament of completeness**, which states that “So long as a system is fully specified, i.e., closed, it must remain in principle incomplete.”

This framing of pragmatics using systems theory is useful; for example, it can easily, and in a clear fashion, account for a previously mentioned characteristic of semantics that seems paradoxical, namely, the fact that every word in the lexicon is explained using other words in the lexicon. Such a “closed”, “fully-specified” system might have intuitively struck the reader as lacking, as being circular or somehow “incomplete”.

Another way of looking at the problem of completeness from a systems theory perspective is to focus on the inputs and outputs at the boundary of a system. When analyzing a system, one would normally pick a level of analysis and decide on the parts of the system, or the aspects of its behavior, that are to be included or modeled, and those that are to be left out. The result of this selection process is a definition of the system, its boundary, and its environment (technically, everything in the universe that is not part of the system.) The problem then is that all interactions between the system and its environment must be fully characterizable as a finite, well-defined set of inputs and outputs across the boundary. In the case of physical systems, energy considerations (or frequency separation considerations) offer crucial guidance to the analyst in deciding what to include inside the boundary and what to leave out, and in deciding which inputs are significant and which can be neglected. No such considerations exist in the case of information systems, and especially in those cases where information is to be processed in non-mechanistic ways. For example, in trying to explain a concept, or when trying to create a novel design, a small, seemingly insignificant, piece of information could offer a radically different way of framing the situation or problem, and therefore a totally new explanation or design. (The idea of assigning some measure of importance to information, based on the contribution of that information in reducing uncertainty, as briefly discussed in Chapter I, can be understood as an attempt to develop for information something akin to energy.)

The second element in Givón’s motivation of pragmatics is **the predicament of consistence** which he states as: “So long as one is allowed to switch meta-levels—or

points of view—in the middle of a description, the description is logically inconsistent.” Givón traces this to Bertrand Russell’s observation “that the classical paradoxes of logic, such as *the liar’s paradox* (‘I never tell the truth’) are all instances of a more general phenomenon, that of self-inclusion.” By constraining logical descriptions to a single specified meta-level, Russell eliminated deductive logic “as a serious contender for modeling, describing or explaining human language—or mind”, in the process of “rescuing” it “as a closed, internally-consistent, coherent system” (ibid.).

But the problem is not deductive logic per se; the predicaments of closure and consistence present serious difficulties for all attempts at describing language and the human mind. Givón explains:

*Neither language nor mind abides by the requirements of closure, except perhaps temporarily, for limited tasks. Both mind and language are necessarily **open systems** that constantly expand, add meta-level, learn and modify themselves. Equally, both language and mind are notoriously promiscuous in violating Russell’s constraint on self-inclusion and reflexivity. Consciousness is indeed forever adjusting its frame, shifting meta-levels; it keeps **re-framing** and reflexively framing itself. This propensity [...] is a precondition for the mind’s ability to **select**, evaluate, file, contextualize and respond appropriately to mountains of information.*

### ***More on context***

It should be clear, from the previous discussion, that context in pragmatics is not an easily circumscribed or fixed entity. Akmajian et al. describe the context of an utterance as “an expandable notion” (Akmajian et al., p. 370). Depending on the particular situation and on the utterance itself, the relevant context could simply consist of the preceding utterances, along with the few ones that are yet to come. This is referred to as the co-text of the utterance(s). Mey defines “the co-text of a (single or multiple) sentence as that portion of text which (more or less immediately) surrounds it.” And he points out that there is “no agreed limit” as to how far it extends (Mey, p. 184).

Beyond co-text, context can extend to the “immediate physical and social environment” within which the sentence is uttered (Akmajian et al., ibid.). In other words, it could include details about where and when the utterance took place, who was present there, what the weather was like, and so on. Such contextual information would be useful in

resolving ambiguities related to the use of deictics (such as *he, we, here, etc.*) for example. It would help resolve questions as to whether an expression such as *Nice weather!* was meant sarcastically or not.

The third level of context encompasses all kinds of general knowledge, such as that relating to general social and institutional practices. The following two examples will help clarify what kind of knowledge is embodied in this level of context. The first is an example from Levinson (reproduced in Mey, p. 186), and it involves the following exchange:

*A: I have a fourteen year old son*

*B: Well that's all right*

*A: I also have a dog*

*B: Oh I'm sorry*

This exchange would not be properly understood unless one knew about such social and institutional facts and practices as property, housing rental, rules that some property owners may want their tenants to abide by, and so on.

The second example paraphrases one given by Searle as he lays out his theory of the Background. Consider the following exchange:

*A: One cheeseburger and a small fries*

*B: That will be four ninety-nine*

In order to understand this exchange, one has to know, among other things, about restaurants, fast food restaurants in particular, about what constitutes food, about the practices of buying and selling, about the institution of using paper money, what value is, and so on and so forth.

Depending on the situation, the outer level of context may involve knowledge that is not only general but also, paradoxically, somewhat particular to the practice within which that situation happens to fall. For example, the first example above is tied to the practice of real estate and housing rental; the second to the practice of eating out. It is easy to

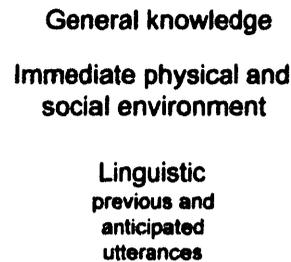
imagine exchanges that fall within more specialized practices, and that would therefore require the specialized knowledge that is part of these practices; for example, a conversation between two engineers, or between a nurse and a medical doctor. This connection between the 'general' context and practice is what led Searle to compare his notion of the Background to Bourdieu's *Habitus* (Searle, 1992, p. 177).<sup>22</sup>

A note of caution is in order at this point. Akmajian et al. characterize the three levels of context described above as "concentric circles". That description, which is represented schematically in Figure III.1 below, is intended to indicate the decreasing specificity and the increasing distance between the utterance itself and the different contexts. However, it may conjure up a number of images that would be misleading. First, it shows the three levels as concentric, implying that the outer ones contain the inner ones; that view is simplistic and seems at odds with the point made earlier that language is the medium of being. Another problem with this representation is that it shows every circle as having a crisp boundary, and in particular, it shows the outer one, general knowledge, as clearly circumscribed. It should be clear from the foregoing discussion that context does not lend itself to a finite description. Another issue is the implicit distinction that is made between the linguistic context in the inner circle, and the extra-linguistic contexts outside it. Many linguists, in particular those who view pragmatics as an all-encompassing perspective, are opposed to that distinction (Mey, p. 188). That distinction is normal to linguists coming from the structuralist tradition of transformational generative grammars; it is at odds, however, with the phenomenological tradition of pragmatics. (It is interesting to note that an important area of pragmatics has to do with categorization. In opposition to the rationalist view of categories as being discrete and absolute, pragmaticians have proposed other models that agree better with findings from psychology and cognitive science.

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<sup>22</sup> Searle has developed an intricate theoretical framework for explaining intentional phenomena, that is, phenomena that point to or are about other things. Meanings, understandings, interpretations, but also beliefs, desires, and experiences, are all intentional phenomena. Searle framework distinguishes between the "Network" and the "Background". The first comprises the set of other intentional states that are necessary for the intentional phenomenon of interest to function. The "Background", on the other hand, is a set of capacities that are needed for the network to function, but these capacities cannot themselves be viewed as more intentional states. Furthermore, Searle distinguishes between "deep Background", which encompasses those features that are common to all human beings, and "local Backgrounds" or "local practices", which includes those features that relate to local, cultural practices.

These include Wittgenstein's notion of family resemblance, Rosch's concept of a central prototype, and Lakoff's fuzzy concepts (see Givón, op. cit., Chapter 2.)



#### The Concentric Circles of Context

*Figure III.1: Schematic of different levels of context (based on description in Akmajian et al., 1995)*

Dascal (1989) offers a slightly different perspective on context in pragmatics. Instead of 'co-text' and 'context', he prefers 'meta-linguistic' context and 'extra-linguistic' context ('meta' being used here in the sense of 'along with' or 'among'.) As Dascal explains it, this terminology better reflects the fact that the linguistic context of a sentence or utterance does not only consist of the text or utterances surrounding it, but also includes the interlocutors knowledge 'of' as well as knowledge 'about' language. Like Akmajian et al., he also distinguishes three levels of context; thankfully, he does not use their problematic "concentric circles" metaphor. His view of context can be summarized in a table, as follows.

Table III.2: The different kinds and levels of context (based on Dascal, 1989)

Levels of context ↓	Kind of context →	Meta-linguistic (linguistic)	Extra-linguistic (situational)
	<b>Specific or immediate environment of production/interpretation</b>	The preceding and following utterances or text	Who is speaking, to whom, where, when; the state of affairs being referred to
	<b>Intermediate (shallow)</b>	Assumptions about the structure of kinds of texts, e.g., a poem v. an office memo	Assumptions about given set of situations (in AI terms, the frame or script of a given activity) <sup>23</sup>
	<b>General background knowledge and beliefs</b>	Knowledge about the functioning of verbal communication	Beliefs about people in general, their habits and culture; interlocutor's 'theories' about each other

***“Dynamic” v. “static” context, abduction, and the provisional nature of understanding***

Early on in his presentation of pragmatics, Mey cautions against what he calls a “static” view of context. According to that view, espoused by some linguists, context is “the sum and result of what has been said up to now, the ‘prehistory’ of a particular utterance [...] including the prehistory of the people who utter sentences” (Mey, op. cit., p. 8). He explains that it is not enough to take an utterance, look at everything that has come before it, and predict what it is supposed to mean. To illustrate his point, he offers the following example. Two colleagues are walking together; one asks the other whether he knows the way to the dining hall, and offers to drive him there. It is only later during the encounter that they realize that each had understood that the other did not know the way to the dining hall, and thus needed directions, when in reality they both knew the way. Mey’s point is that at the time of the first ambiguous utterance (*Do you know the way to the dining hall? We can go in my car.*), no amount of a priori contextual information would have resolved the ambiguity or predicted the illocutionary force of that utterance (that is, whether it is a question, an invitation, or an offer to exchange directions for a ride.) As Mey explains:

*... such a concept on 'context', if established independently of the ongoing interaction between the interlocutors, is completely useless: it is precisely the dynamic development of the conversation that gives us the clue to understanding. Such a development cannot be predicted, as it depends entirely on the individuals and their individual choices at every moment.*

The above example highlights one of the pillars of pragmatics, namely, the mode of knowledge or inference that C.S. Peirce (the founder of pragmatism and “the acknowledged godfather of modern pragmatics” (Givón, p. 20)) called abduction. In abduction, “one reasons by hypothesis from instances or general rules to their wider context” (Givón, p. 238). “This mode of **hypothesis** often involves **analogical reasoning**, and thus the pragmatic, context-dependent notions of *similarity* and *relevance*” (Givón, p. 20).<sup>24</sup> This mode of inference is particularly interesting for us because of its obvious relevance to creative activities, of which design and product development are prime examples.<sup>25</sup> The first mode of inference, deduction, by which specific instances are inferred from general rules, and which is emphasized by rationalists, cannot account for new knowledge. To Wittgenstein, deductive reasoning (more generally, the propositions of logic) is connected to tautologies or contradictions, that is, to absolute epistemic certainty (Givón, pp. 7, 18, 20, 238-242). The second mode of inference, induction, involves the discovery of (presumably) general rules from a set of representative specific cases, and is the mode of choice of empiricists. However, to Peirce (and, later, Wittgenstein), even this mode of inference cannot account for new knowledge by itself, because induction involves an element of abduction (Givón, pp. 242-244).

Finally, the example from the beginning of this section also highlights an important aspect of pragmatics, “the fallible and tentative character of every pragmatic interpretation” (Dascal, 1989, p. 250). This is an aspect pragmatics shares with

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<sup>23</sup> For a description of frames and scripts, see, for example, Marvin Minsky’s “The Society of Mind” (Minsky, 1988).

<sup>24</sup> Peirce’s mode of abductive inference is similar to the mode Aristotle called “reduction” or “apagoge”, in which “... the particular facts are not merely brought together but there is a new element added to the combination by the very act of thought by which they are combined... The pearls are there, but they will not hang together till someone provides the string...” (Aristotle, *Posterior Analytics*, as quoted in Givón, 1989, p. 14.)

<sup>25</sup> Givón also describes it as proceeding “by hypothesis, guesswork or intuition, often by analogy.” “It is thus, in principle, unconstrained” (Givón, 1989, p. 7).

hermeneutics, another phenomenological theory of understanding and knowing that is the subject of the next section.

## **Background II: Hermeneutics**

Beside linguistics, the framework that is presented later in this chapter draws on ideas from the field of hermeneutics. Hermeneutics is defined as “the art or theory of interpretation, as well as a type of philosophy that starts with questions of interpretation” (Audi, 1995, p. 323). Hermeneutics was initially concerned with the interpretation of sacred texts, but over time, this narrow concern broadened considerably. Hermeneutics now refers to an important position of German philosophy in this century, a position that has influenced the French philosophers of the last several decades (e.g., Ricœur and Merleau-Ponty.)

The following description of hermeneutics, from David Linge’s introduction to Gadamer’s “Philosophical Hermeneutics” hints at the potential usefulness of hermeneutics to the PD problems that are the concern of this research (Gadamer, 1976):

*Hermeneutics has its origin in breaches in intersubjectivity. Its field of application is comprised of all those situations in which we encounter meanings that are not immediately understandable but require interpretive effort. The earliest situations in which principles of interpretation were worked out were encounters with religious texts whose meanings were obscure or whose import was no longer acceptable unless they could be harmonized with the tenets of the faith. But this alienation from meaning can just as well occur while engaging in direct conversation, experiencing a work of art, or considering historical actions. In all these cases, the hermeneutical has to do with bridging the gap between the familiar world in which we stand and the strange meaning that resists assimilation into the horizons of our world.*

This section is a brief look at hermeneutics that focuses on some of the key concepts that will be used in the classification framework that follows. This section draws heavily on Palmer’s presentation of the subject (Palmer, 1969).

The word hermeneutics is derived from the Greek term for interpretation (the verb *hermeneuein*, which is translated as ‘to make clear’, or ‘to interpret’), which is itself

related to the Greek god Hermes. In Greek mythology, Hermes, who, interestingly, is credited with discovering language and writing, was the messenger and herald of the other gods, “associated with transmuting what is beyond human understanding into a form that human intelligence can grasp.” These roots of the word hermeneutics suggest the process of “bringing to understanding” in particular through the medium of language (Palmer, op. cit., p. 13).

### ***The three meanings of hermeneutics***

In its ancient usage, ‘hermeneuein’ had associated with it three related meanings, or “three basic directions of meaning.” These are ‘to say’, ‘to explain’, and ‘to translate’. The following quick look at these three ‘directions of meaning’ of hermeneutics will introduce the basic concepts of hermeneutics, and the issues that the field is concerned with.

#### **Interpreting as ‘saying’**

The first meaning, ‘saying’ or ‘expressing aloud in words’, suggests that an important aspect of interpreting something involves simply saying it or asserting it. That sense of interpreting is intuitively obvious in the case of a performance, be it a reading, a play, or a musical performance, and it contains within it the notion of ‘style’, the way of expressing that is particular to the performers. This sense of interpreting as ‘saying’ already points a few key aspects of hermeneutics. First, there is the notion that interpretation as a creative act. Palmer explains this using the case of oral interpretation, or reading aloud, which he compares to a musical performance:

*Consider the act of reading aloud. Oral interpretation is not a passive response to the signs on the paper like a phonograph playing a record; it is a creative matter, a performance, like that of a pianist interpreting a piece of music. Any pianist can tell you that a musical score itself is a mere shell; the “meaning” of the phrases must be grasped to interpret the music.*

Another important notion in hermeneutics is the circular character of coming to understanding. Again, using the case of oral interpretation, it is clear that one must grasp

the meaning of what one is about to express in order to be able to express it properly, with the proper emphasis and intonation. As Palmer explains:

*Oral interpretation thus has two sides: it is necessary to understand something in order to express it, yet understanding itself comes from an interpretive reading—expression.*

Finally, interpreting as ‘saying’ provides another perspective on the limitations of information transfer/information processing view of communication that were discussed in the introduction. According to Palmer, understanding information is not the same as communicating a message; it is a different use of language:

*“Information” is a significant word [...]. It appeals to the rational faculty and not to the whole personality; we do not have to call upon our personal experience or risk ourselves in order to understand information—and information does not suffer much from silent reading.*

### **Interpreting as ‘explaining’**

Whereas the first sense of interpretation focused on its expressive aspect, this second sense places the emphasis on the explanatory dimension of interpretation, on the fact that words are generally used to say something about something else, be it to explain it or clarify it or rationalize it. If ‘saying’ or ‘expressing’ can be thought of as a first moment in interpretation, then ‘explaining’ would be “a second moment of interpretation.”

Explaining emphasizes the discursive aspect of understanding, an aspect that draws on reasoning and the intellect, not intuition. However, Palmer cautions against thinking of this second moment of interpretation in terms of logical analysis. In making that point, he relies on Aristotle’s definition of interpretation as ‘enunciation’, “the primary operation of the intellect in formulating a true judgment about a thing” (Palmer, op. cit., p. 21).<sup>26</sup> As such, interpretation falls into a particular category of Aristotle’s operations of the intellect, one that comprises operations of composing and dividing, a category that is distinct from the one that comprises operations of reasoning from known things to unknown things, that is, the category of logical analysis.

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<sup>26</sup> This is somewhat counterintuitive, as ‘enunciation’ seems closer in meaning to ‘saying’ and ‘expressing’.

This distinction hints at a number of related and important concepts in hermeneutics, such as Heidegger's rejection of intentionality and the distinction between subject and object that it presupposes (Dreyfus, 1991, pp. 46-54). More directly, it shows up in his description of the different ways that one encounters objects and tools, in which the analytical stance becomes operative in situations where the transparency of equipment is lost as a result of a breakdown (Dreyfus, op. cit., p. 70).

Although logical analysis is itself a form of interpretation, it is a derivative form, since logic works by comparing already enunciated statements. The idea that a prior or preliminary interpretation serves as the basis for another interpretation points out another notion in hermeneutics, related to the problem of the subject/object dichotomy. It is the rejection of the idea that method and object can be separated, which Gadamer addresses in *Truth and Method*. Palmer explains the issue thus:

*... method has already delimited what we shall see. It has told us what the object is as object. For this reason, all method is already interpretation.*

This idea of one level of interpretation framing another level brings us to a very important issue in hermeneutics, one that it has in common with pragmatics, namely, the role of context in understanding. Given the rejection of the separation between subject and object, then it is not possible for an object to have any significance in itself, "outside a relationship to someone", that is, apart from a perceiving subject. Similarly, an explanation is always for someone; "all explanatory interpretation assumes intentions in those to whom the explanation is directed" (Palmer, p. 24). This context of already given meanings and intentions, that is, of "assumed understanding", is referred to in hermeneutics as 'preunderstanding', or the 'horizon' of the person seeking the explanatory interpretation.

In hermeneutics, explanatory interpretation, or coming to understanding in general, involves a merging of horizons: the horizon 'inhabited' by the literary work, or the work of art, or the interlocutor, on the one hand; and the horizon of the interpreter, that is, his "world of intentions, hopes, and preinterpretations", on the other.

Finally, the notion of preunderstanding provides another reminder of the ‘hermeneutical circle’, through which one comes to understanding: some understanding is always necessary for further understanding.

### **Interpretation as ‘translation’**

This third ‘direction of meaning’ of hermeneutics—interpretation as translation—is a special case of the process of bringing to understanding. Here, the contrast or clash between the horizon of the interpreter and the horizon of that which is being interpreted is readily obvious. At a basic level, this could result from the work being written in a foreign language. Since language itself is “a repository of cultural experience”, the interpreter as translator has to bring what is initially foreign and unintelligible into the world of his or her own language. The process of translation is therefore a process of mediation.

The clash of horizons or perspectives that makes interpretation more like translation does not only occur when there is language difference. It could be the result of large difference in time, as when interpreting ancient texts. In this case, the process of mediation does not only take place through language, but also through history. In this case, “an effort of historical imagination” is required to envisage the world of the work (Palmer, p. 31).

The notion of translation is relevant even when there is no difference in language nor time, but where the conflict of horizons is the result of very different worldviews, as might exist between scientists and marketers for example. The challenge in explaining scientific issues to marketers, or vice versa, remains one of bringing what is “strange, unfamiliar, and obscure in its meaning into something meaningful that speaks ‘our language.’” This involves an explication of the ‘other’ worldview, and an explication of its significance to us.

### ***The evolution of the field***

Palmer identifies six modern definitions of hermeneutics that are connected to the evolution of the field, at least since 1654. These six definitions are not only different stages of historical development; they also reflect different approaches to the problem of interpretation.

The first definition, hermeneutics as a theory of biblical exegesis, reflects the original concern of the field with developing a body of rules and methods, a system, for interpreting Scripture. In the second definition, that of hermeneutics as a methodology for philology, the focus remains on rules and methods of exegesis, but the scope of the field is broadened from the strictly religious to any text. Since it coincided with the development of rationalism, this stage is characterized by an effort to eliminate advance judgments in interpretation. Interpreters focused on looking beyond the (inferior) “accidental truths of history”, and finding in the text the (superior) “truths of reason” that would be “relevant to the enlightened rational man.” The task of the interpreter thus became a historical one, as only full knowledge of the historical context of the work would make it possible for the interpreter to purge the historical elements in it and grasp the spirit behind it.

The third definition is of hermeneutics as the science of linguistic understanding, a phase associated with the philosopher Schleiermacher. He is credited with creating a modern general hermeneutics, a “science” or “art” of understanding in general. Instead of an assemblage of rules for philology, he sought a hermeneutics that would describe the conditions for understanding in all forms of dialogue. Following Schleiermacher, Dilthey sought to make hermeneutics the methodological foundation for the *Geisteswissenschaften*, that is, the arts, humanities, and other disciplines that focus on man’s actions. This fourth definition of hermeneutics was again focused on interpretation as requiring an act of historical understanding, an act that drew upon the interpreter’s personal knowledge of what it is to be human.

The fifth definition listed by Palmer is “hermeneutics as the phenomenology of *Dasein* and of existential understanding.” This definition of hermeneutics is associated with Heidegger and, later, with Gadamer. Unlike the previous approaches to hermeneutics, which were epistemological in nature, Heidegger was concerned with the ontological problem of man’s ‘everyday being-in-the-world’ (*Dasein*, which literally translates to “being there”, and colloquially means “everyday human existence”, is used by Heidegger in a special way. He uses it to denote ‘human being’, i.e., man’s ‘way of being’, as well as ‘a human being’, but not in the Cartesian way in which the individual plays the central

role of conscious, “meaning-giving transcendental subject” (Dreyfus, 1991, pp. 13-14).) In Heidegger’s analysis, interpretation and understanding are fundamental ways of man’s being. Dasein’s way of being, that is, the way of being that is shared by human beings, institutions and cultures, is unique because it “embodies an understanding of what it is to be”, i.e., the capacity for self-interpreting (Dreyfus, p. 15). It is his notion of this ontological significance of understanding that makes Heidegger’s contribution to hermeneutics revolutionary (Palmer, p. 42).

Gadamer developed and refined Heidegger’s system, focusing on the role of language in being, and the linguistic character of human reality (ibid.).

This fifth definition of hermeneutics is the one most relevant for the purpose of developing the classification framework of PD practices. I will return to it in greater detail in the next section.

Finally, the sixth definition of hermeneutics, according to Palmer, is as a system for the interpretation of signs and recovering their hidden meanings. This marks a return to the role of hermeneutics in exegesis, except that in this case, the ‘text’ can be any symbol, myth or dream. This definition, most strongly associated with Ricœur, is not directly relevant to our interests here.

The brief description above of the different modern definitions of hermeneutics not only shows the shift in the focus of hermeneutics over time: it also highlights the significant differences in the philosophical concepts that underlie these different definitions. Generally, this difference can be summed up in terms of the two competing positions in modern hermeneutics. According to the first position, represented by Dilthey, interpretation is a method for the human sciences, focusing on rules and criteria for extracting from the text the original meaning its distant author intended. This is similar to the notion of speaker’s meaning that we saw earlier in linguistics. The second position, following Heidegger, views interpretation “as an ‘ontological event,’ an interaction between interpreter and text that is part of the history of what is understood.” An example of this notion of interpretation is what happens when a court or a judge interprets a law in the context of a case: through that process of interpretation, the law is itself invariably transformed (Audi, p. 323).

So far, this overview of hermeneutics has been rather general. Before we can use hermeneutics in the theoretical framework to follow, we need to take a closer look at some of the key concepts of the field. This is the objective of the next section.

### ***Key elements of hermeneutic interpretation***

This section expands on some of the key aspects of hermeneutics that were briefly described in the previous sections. The focus here is on Heidegger's and Gadamer's 'philosophical hermeneutics'. This presentation is, by necessity, partial and biased towards the goal of this chapter.

Before proceeding, another caveat is in order. The concepts and principles of hermeneutics, based as they are on Heidegger's conceptions of thinking, human experience, and history, may seem counterintuitive, despite the fact that they were intended to better describe and reflect real-life human experience. The reason is our tendency to lapse back into the more familiar scientific cognitive conceptions of understanding and interpretation. Another source of difficulty is that these concepts are interrelated, and it is difficult to present them in a clear, linear, hierarchical way, or, more generally, as a set of mutually exclusive, collectively exhaustive set of principles. Palmer cautions that "we can only gradually enter into the circle of his [Gadamer's] consideration." And that "the obstacles to understanding Gadamer's thought are formidable" (Palmer, p. 166).

It might be worthwhile, before proceeding, to summarize what Gadamer's hermeneutics is about. Gadamer's major contribution was transforming hermeneutics "from a sub-discipline of the humanities concerned with the techniques of interpretation of theological and classical texts ('classical' hermeneutics) and from the distinctive methodology of the *Geisteswissenschaften* ('romantic' hermeneutics) into a reflection on the fundamental and universal conditions of experience" (Dascal, 1989). To him, understanding "is always an historical, dialectical, linguistic event," whether in the humanities, in the sciences, or in any other arena of human endeavor (Palmer, p. 215). Understanding is no longer conceived as the act of a human subjectivity against an object, as in the traditional Cartesian conception. And Gadamer calls into question the status of method as the way to truth. Methodical forms of consciousness, be they aesthetic, historical, hermeneutic (in

the classical, narrow sense), or scientific can only capture parts of our experience in the face of the corresponding 'objects' (works of art, historical events, texts, scientific experiments.) Method invariably involves a certain reductionism and therefore cannot account for those aspects of experience that fall outside the scope of the method (Dascal, op. cit.).

This section is organized following Dascal's approach in his paper comparing pragmatic and hermeneutic interpretation (Dascal, op. cit.). Certain elements of Gadamer's philosophical hermeneutics are presented as contextual factors that play an important role in interpretation; others are presented as crucial characteristics of the process of interpretation itself.

### **Contextual factors in hermeneutic interpretation**

Dascal identifies three contextual factors that play a role in understanding: a) the question that implicitly motivates every statement, utterance, text, or more generally, work; b) the prejudgments or horizon of the interpreter; and c) the role of language as the universal medium of all human experience, of the 'heritage'. The present discussion will focus on the first two factors (Dascal, op. cit., p.243).

#### ***The motivating question***

To Gadamer, every experience has a dialectic character, by virtue of its encounter with negativity. Palmer quotes the following from *Truth and Method* (Palmer, p. 196):

*Experience is a matter of multisided disillusionment based on expectation: only in this way is experience acquired.*

And:

*Every experience runs counter to expectation if it really deserves the name experience.*

The connection between this encounter with negativity and questioning is clear:

*... in all experience, the structure of questioning is presupposed. The realization that some matter is other than one had first thought presupposes the process of passing through questioning. (From Truth and Method, as quoted in Palmer, p. 198.)*

The central importance of questioning is clear in the following quote from Gadamer's essay entitled *The Universality of the Hermeneutical Problem*, describing the *Urphänomen* (the original, primal phenomenon) of hermeneutics (Gadamer, 1976, p. 11):

*No assertion is possible which cannot be understood as an answer to a question, and assertions can only be understood in this way.*

Dascal understands that to mean that being "somehow aware" of the question that motivates a statement is necessary for understanding that statement, thus giving the motivating question a context-like role. In that way, the role of 'the question' in hermeneutics is similar to that of 'conversational demand' (an element of co-text) and 'pragmatic appropriateness' in pragmatics (Dascal, op. cit., p. 244).

The concept of 'the question', and its contextual role, is not restricted to utterances and conversations. In view of the dialectical character of all understanding, it can apply equally to a whole text, a theory, or any non-linguistic action. But Dascal points out that as one moves away from the "relatively clear-cut case of an actual conversation", the concept of 'the question' becomes vague and difficult to identify, finally becoming subject to interpretation itself, instead of being a reference to be used in interpreting:

*Furthermore, rather than a contextual given that can be relied upon for the interpretation of a problematic utterance, 'the question' becomes itself something that, like the interpretation one is seeking, must be inferred from the utterance and other contextual information, and thereby loses much of its usefulness as an aid to interpretation (Dascal, op. cit., p. 245).*

This criticism is somewhat misplaced, on the following two (related) counts. First, it doesn't take into account the circular nature of understanding (although Dascal does discuss the hermeneutic circle later on, as one of the characteristics of the hermeneutic interpretation process.) Secondly, the statement discloses a highly instrumental view of 'the question' as a contextual object to be used; that view is at odds with Heidegger's and Gadamer's thinking.

Because of his focus on 'the question' as a contextual *object* and, more generally, his intention to compare the notion of context in hermeneutics to that of pragmatics, Dascal does not discuss some of the more interesting aspects of the question and the dialectics of

understanding. These relate to Gadamer's conception of what genuine questioning is. Starting with a quote from *Wahrheit und Methode*, Palmer describes the characteristics of genuine questioning as follows:

*"In order to be able to question one must will to know, and that means, however, to know that you do not know." When one knows he does not know, and when he does not therefore through method assume that he only needs to understand more thoroughly in the way he already understands, then he acquires that structure of openness characterizing authentic questioning. [...] The openness of questioning, however, is not absolute, because a question always has a certain direction. The sense of the question already contains the direction in which the answer to that question must come, if it is to be meaningful and appropriate (Palmer, op. cit., pp. 198-9).*

Genuine questioning, therefore, presupposes a certain openness, namely, the desire to know, possibly in a different way; it also involves specifying certain boundaries. Genuine questioning involves a dialogue between the interpreter and the text, or the interpreter and the work of art, or, in our case, the interpreter and his or her interlocutor. Palmer describes a dialogue as the opposite of an argument: whereas in the latter, one tries to defend and hold on to the opening point or response, a dialogue requires openness and readiness to move from the initial position into unforeseen directions. Palmer quotes from *Truth and Method* (Palmer, op. cit., p.199):

*A dialogue does not try to argue down the other person, but one tests his assertions in the light of the subject itself.*

This point hints at another element that is critical to 'authentic questioning', namely, the total immersion by the interpreter in the subject matter. "According to Gadamer, there is only one way to find to find the right question, and that is through immersion in the subject itself" (Palmer, *ibid.*). This total immersion in the subject matter, as opposed to the traditional Cartesian stance of a subject querying an object, reminds us of an important hermeneutic principle. It also reminds us of Gadamer's concept of the game, which he uses to describe the total immersion necessary for understanding. The following is from Linge's introduction to *Philosophical Hermeneutics*:

*This element of buoyancy—of being borne along by the subject matter—is illuminated by a second phenomenon that Gadamer describes in support of this theory of understanding, the phenomenon of the game or playing. Even more strongly than the analogy of the conversation, Gadamer's phenomenology of the game suggests the inadequacy of trying to comprehend understanding from the perspective of the subjectivity of the author or the interpreter. [...] For what reveals itself as most characteristic of the phenomenon of playing is that the individual player is absorbed into the back-and-forth movement of the game, [...] and does not hold back in self-awareness as one who is "merely playing." The person who cannot lose himself in full earnest in the game or give himself over to the spirit of the game, but instead stands outside it, is a "spoilsport," one who cannot play (Gadamer, 1976, pp. xxii-xxiii).*

Given the importance of genuine questioning to hermeneutics, it would have been equally appropriate to deal with it later in this section, as one of the characteristics of the process of interpretation, instead of presenting it as a contextual factor.

### ***Prejudgment or 'prejudice'***

Schleiermacher and Dilthey, whose hermeneutic position was mentioned earlier, identified the meaning of a text or an action with the subjective intention of its author. In this view, "understanding is essentially a self-transportation or imaginative projection whereby the knower negates the [...] distance that separates him from his object [...]" (Gadamer, op. cit., p. xiv). Meaning can only be achieved through a careful and thorough reconstruction, and full awareness of the original life-context or life-world of the author. The knower's own present situation is "a source of prejudices and distortions that block valid understanding" (ibid.).

Although they were concerned with historical texts, one can see the similarity to a contemporary line of thinking in product development, which emphasizes the importance of 'becoming one with the customer', or which asks marketers to 'think like engineers' and vice versa.

Gadamer's objection to the 'romantic' hermeneutics of his 19<sup>th</sup> century predecessors centered on their neglect of a critical dimension in understanding (according to his own hermeneutics), namely, the reflexive dimension. The following is from *Truth and Method*:

*The self-interpretation [Selbtbesinnung] of the individual is only a flicker in the closed stream of historical life. For this reason the prejudgments of the individual are more than merely his judgments; they are the historical reality of his being (Palmer, op. cit., p. 182).<sup>27</sup>*

Therefore, asking the knower to alienate himself from his own historicity is asking for the impossible, since one's historicity is not accidental (nonessential) but rather ontological, that is, constitutive of one's being. The result is that there can be no "presuppositionless" interpretation or understanding. The fact that we are tied to our present horizons, and the distance that separate us as knowers or interpreters from our object of interpretation, are in fact "the productive ground of all understanding rather than negative factors or impediments to be overcome" (Gadamer, op. cit., p. xiv). In talking about our historicity and finitude, Gadamer uses the term "prejudice". not in the negative sense of an unfavorable opinion or feeling, but in the "literal sense":

*It is not so much our judgments as it is our prejudices that constitute our being. This is a provocative formulation, for I am using it to restore to its rightful place a positive concept of prejudice that was driven out of our linguistic usage by the French and the English Enlightenment. [...] Prejudices are not always unjustified and erroneous... (Gadamer, op. cit., p. 9).*

He goes on to describe the productive role of prejudices:

*In fact, the historicity of our existence entails that prejudices, in the literal sense of the word, constitute the initial directedness of our whole ability to experience. Prejudices are biases of our openness to the world. They are simply conditions whereby we experience something—whereby what we encounter says something to us (ibid.).*

The issue of prejudice is summarized by Dascal as follows: first, the interpreter cannot free himself from the multitude of prejudgments and categories which are constitutive of his being; secondly, interpretation is impossible if the interpreter is a "tabula rasa", devoid of conceptual categories, values, and prejudgments (Dascal, op. cit., p. 245).

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<sup>27</sup> Gadamer apparently uses "Besinnung" to mean reflection (on). The more common meaning of Besinnung is consciousness.

Before closing this section, it is worth noting the connection Dascal makes between the interpreter's prejudgments as a contextual factor in hermeneutic interpretation, and the typology of contexts presented in the section on pragmatics. Prejudgments would seem to fall most naturally within the category of 'extra-linguistic background'. He points out however that "in light of Gadamer's [effort] to generalize and extend both notions [the 'question' and 'prejudice'], each of them can finally come to apply to any of the levels and kinds of context discussed above" (Dascal, op. cit., p. 248).

As was the case with the 'question', focusing on 'prejudice' as a contextual factor is not the most productive use of the concept. The power of the notion of prejudice lies in its implications for the role of the interpreter (which Dascal does examine.) These are discussed in the next section.

### **Prejudice and the constitutive role of the interpreter**

One of the most central, yet most difficult, problems in hermeneutics is the problem of meaning of the text or of the work, and the challenge of fidelity to the meaning. In Linge's words, "The customary way of defining the meaning of a text has been to identify it with the subjective act of intending of its author." On that view, the problem of understanding becomes one of recovering the original intention of the author. That view also makes it possible to talk about a "canonical interpretation, the one that captures *the* correct [meaning] and banishes all competing interpretations as incorrect" (Gadamer, op. cit., p. xxiv). This notion of meaning requires that we distinguish between the various explications of the significance a text may have to us on the one hand, and the one unique meaning that its creator had in mind, and that he put in the text on the other. This distinction does not hold against the test of history: over time, people have not only differed on the significance of a text to their lives; they have also had fundamental disagreements "on what they thought they saw in the text..." (ibid.). Gadamer therefore rejects this traditional view that restricts the meaning to the *mens auctoris* (the author's mind.)

*The meaning of a text surpasses its author not occasionally, but always. Thus understanding is not a reproductive procedure, but rather always a productive one... It suffices to say that one understands differently when*

one understands at all. (*Quoted by Linge from Wahrheit und Methode, in the introduction to Gadamer, op. cit., p. xxv.*)

Understanding therefore has a creative element, according to Gadamer. This is counter to the traditional view which, by confining meaning in the *mens auctoris*, reduces understanding to a “transaction between the creative consciousness of the author and the purely reproductive consciousness of the interpreter” (Gadamer, op. cit., p. xxiv).

According to Dascal, this aspect of hermeneutic interpretation represents the most significant difference between hermeneutics and pragmatics (Dascal, op. cit.). In both, incorporating the relevant contextual factors is key to achieve understanding. In pragmatics the focus is on the ‘context of production’, that is, on “the historicity and situation-boundedness of the author, speaker, or text...” (ibid.). However, by highlighting the positive role of prejudice in creating meaning and coming to understanding, hermeneutics effectively shifts the emphasis to the ‘context of interpretation’. In other words, the focus now is on the historicity and situation-boundedness of the interpreter or addressee. This shift has clear and important implications concerning the role of the interpreter:

*The picture that emerges from this shift is that of an interpreter who is not only active in the sense of gathering all the contextual information that contributes to understanding the meaning that is in the text (presumably by having been put there by the author), but, more fundamentally, in the sense of someone who creates meaning and is constitutive of meaning through his very activity qua interpreter (Dascal, op. cit., p. 246).<sup>28</sup>*

In the case of music and drama, the contribution of the interpreter to the generation of meaning is even more significant, as a result of what Gadamer calls “the excess of meaning that is present in the work itself” (Gadamer, op. cit., p. 102).

Dascal’s characterization of this shift in emphasis may reflect the significance of the impact he foresees hermeneutics having on his field of pragmatics. However, it probably overstates the emphasis of hermeneutics itself. It is not that hermeneutics shifts the emphasis from the ‘context of production’ to the ‘context of interpretation’, as much as it

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<sup>28</sup> Qua: Latin adverb meaning “as”, “as being”, “in the character or capacity of”.

shows that the historicity and situation-boundedness of both author and interpreter play equally important roles in bringing creating meaning. This can be clearly seen in the concept of the 'fusion of horizons', one of the aspects of hermeneutic interpretation that are discussed later in this section.

### **Some important aspects of hermeneutic interpretation**

As was clear in the previous section on contextual factors, it is difficult to separate these factors from the process of interpretation itself. Similarly, it is difficult to separate the different aspects of hermeneutic interpretation from one another and discuss them separately. Nevertheless, Dascal identifies four "crucial aspects of the process of interpretation" as conceived by Gadamer. These are the 'circular' and provisional nature of understanding; the fusion of horizons that takes place when interpretation is successful and the interlocutors come to understanding; Gadamer's concept of 'effective-historical consciousness' or 'authentically historical consciousness' and its role in interpretation; and, finally, tradition and its role.<sup>29</sup>

The notion of the hermeneutic circle deals with the difficulty one faces in coming to understanding, as a result of the fundamental relationship between the whole and the component parts of the thing to be understood. This difficulty is aptly captured in the following quote from Friedrich Ast, a philologist concerned with old texts from Greek and Roman antiquity, and to whom capturing the spirit or *Geist* of the period was essential to understanding its ideas and feelings (Palmer, op. cit., pp. 76-77):

*One can only rightly grasp the combined unity of the spirit of antiquity if one grasps the individual revelations of it in individual ancient works, and on the other hand, the Geist of an individual author cannot be grasped apart from placing in its higher relationship [to the whole]. (As quoted in Palmer, p. 77.)*

The hermeneutic circle operates at all levels of understanding. The previous quote deals with a case where the whole happens to be the spirit of an age, but the common

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<sup>29</sup> The first expression is Dascal's translation; the second is Palmer's (Dascal, op. cit., p. 249; Palmer, op. cit., p. 191). Gadamer's original expression is *wirkungsgeschichtliche Bewußtsein*, which can be translated literally as "'consciousness in which history is ever at work,' or 'historically operative consciousness.'" (See Palmer, *ibid.*)

description of the circle operates at the level of words, the whole being the sentence formed by these words. The sentence cannot be understood unless one grasps the meaning of the individual words; yet the words derive their meaning from the immediate context in which they find themselves, the sentence itself.

Clearly, the concept of the hermeneutic circle has a built in logical contradiction: "if we must grasp the whole before we can understand the parts, then we shall never understand anything" (Palmer, op. cit., p. 87). This is the reason why the hermeneutic circle appears like a vicious or impenetrable circle. One answer is that logic cannot fully explain how this process works. To Schleiermacher, for example, understanding involves a comparative dimension (where we compare the new to something that we already know), as well as an intuitive. With these dimensions, it is possible to think of a "leap" into the hermeneutic circle whereby we understand the parts and the whole together (ibid.).

In Gadamer's hermeneutics however, this logical contradiction is a non-issue. Speaking of whole and parts already assumes a subjective process involving man over and against a number of objects (viz., the whole and its parts.) But as we saw earlier, Gadamer's philosophical hermeneutics (following Heidegger) rejects such a notion of understanding, seeing understanding as man's main ontological process. Dascal explains it as follows:

*Given the constitutive role of the interpreter's 'prejudgments,' which implies that there is no such thing as 'the meaning' of a text to be 'discovered,' coupled with the fact that such pre-judgments are themselves not fixed, but shifting (among other things due to the 'resistance' of the 'thing itself' expressed in the text) in the course of the process of understanding so that the interpreter himself is shaped by the process, the hermeneutic circle must be understood as an ontologically basic level prior to the distinction between subject and object (Dascal, op. cit., p. 249).*

According to Dascal, this "radicalization" of the concept of the hermeneutic circle, that is, ascribing to it a "positive ontological role," is what makes it finally possible to resolve the seeming contradiction associated with it:

*... the circle is, in fact, a spiral of successive, more encompassing understandings. These are achieved not by 'neutralizing' the interpreter's horizon of 'pre-judgments' nor by ignoring the text's contextual horizon,*

*but by taking full advantage of the interplay between both, leading to a 'fusion of horizons' (Dascal, op. cit., p. 250).*

This process is one where “partial understanding is used to understand still further...” (Palmer, op. cit., p. 25). Whatever understanding is achieved at a given point is subject to revision as the ‘knower’ moves outwards along the spiral. Understanding is therefore speculative and always provisional, “likely to be revised or entirely replaced as in light of contextual factors previously overlooked” (Dascal, op. cit., p. 249). The ‘knower’ starts from his present situation, a situation that does not hold a privileged status, as was the case with the prejudice-free position of the older, “scientific” hermeneutics. Rather, this present situation is “a fluid and relative moment in the life of effective history...” (Linge, in Gadamer, op. cit., p. xix). This situation, or moment, is disclosive, since it provides the pre-understanding of the subject matter that makes communication at all possible: it is also productive, because of the constitutive role prejudice plays in the event of understanding. But that moment is soon tested through the encounter with the subject matter, and, “like all others before it, will be overcome and fused with other horizons” (ibid.). The process of fusion of horizons is illustrated by Gadamer’s example of a successful discussion (as quoted in Dascal, op. cit., p. 251):

*We are continually shaping a common perspective when we speak a common language and so are active participants in the communality of our experience of the world. Experiences of resistance or opposition bear witness to this, for example, in discussion. Discussion bears fruit when a common language is found. Then the participants part from each other as changed beings. The individual perspectives with which they entered upon have been transformed, and so they are transformed themselves. This, then, is a kind of progress—not the progress proper to research in regard to which one cannot fall behind, but a progress that always must be renewed in the effort of our living (Gadamer, 1981).*

This quote underscores, again, the ontological nature of understanding in Gadamer’s philosophical hermeneutics. But in order fully to understand it, we need to talk about the role of language according to Gadamer (and Heidegger before him), something that was touched upon early in this chapter. Our prejudices, which, on Gadamer’s account, are critical to our ability to understand, are embedded in and passed on through our language. Or, as Linge explains: “Since our horizons are given to us prereflectively in our language,

we always possess our world linguistically” (Gadamer, 1976, p. xxviii). And later, he talks about Gadamer’s agreeing with Heidegger “that language and understanding are inseparable structural aspects of human being-in-the-world, not simply optional functions that man engages in or does not engage in at will” (ibid., p. xxix). Understanding and its conception as involving a fusion of horizons is therefore “an essentially linguistic process.”

The above description of the spiral progression of understanding highlights the dialectical nature of the process (an aspect that was discussed earlier in the context of ‘the question’.) In this, Gadamer is compared to Hegel, “who saw that knowledge is a dialectical process in which both the apprehending consciousness and its objects are altered” (Gadamer, 1976, p. xxxix (Linge’s introduction)). Hegel’s view of new knowledge as “a mediation or refocusing of the past within a new and expanded context,” and Gadamer’s conception of understanding as a fusion of horizons both share the same “dynamic and self-transcending character” (ibid., pp. xxxix-xl). The result is an ever-increasing consciousness.<sup>30</sup>

### **“Effective history”**

This consciousness that is ever expanding is “conceived by Gadamer as a self-critical awareness of the historicity—hence finitude but openness, limitation but changeability—of the different but not entirely alien horizons involved in understanding” (Dascal, 1989, p. 250). Gadamer’s concept of ‘effective history’, or of the ‘historical-effective consciousness’, is critical to his hermeneutics. But how useful or necessary is it for our purpose here?

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<sup>30</sup> There are at least two critical differences between Gadamer’s and Hegel’s dialectics. One is that Hegel starts from a subjectivist viewpoint, that is, he takes “the human subjective consciousness and the certainties of reason based on it, as the ultimate point of reference for human knowledge” (Palmer, 1969, p. 164). In other words, whether something is seen as true or false depends on the beliefs, wants and hopes of the ‘knower’. Gadamer, following Heidegger, rejects the subject-object dichotomy, and views thinking as part of being, where one lets himself be guided by the thing being understood itself. Palmer’s insistence on the subjectivism of Hegel seems strange, as Hegel had argued against the priority of the individual, self-conscious subject. His notion of *Geist*, or human ‘spirit’ is indeed in opposition to the individual subject: still, it can be thought of as a ‘collective subject’ (Audi, 1995, p. 314). The second important difference between Gadamer’s and Hegel’s dialectics lies in the latter’s belief in an ‘Absolute Spirit’, that is, the possibility of the full and complete of human self-knowing (ibid.). Gadamer, on the other hand, the ‘elevation to a higher universality’ one reaches through understanding, and through

First, we need to understand the concept of 'effective history' somewhat better. Gadamer intends to stress the temporal character of interpretation; one of his main concerns was to make clear that "[U]nderstanding is not reconstruction but mediation," and a "genuinely productive" experience (ibid., p. xvi). In other words, 'knowers' and interpreters are "conveyors of the past into the present" (ibid.). Gadamer emphasized "the fundamental continuity of history as a medium encompassing every such subjective act [of understanding] and the objects it apprehends. Understanding is an event, a movement of history itself in which neither interpreter nor text can be thought of as an autonomous part" (ibid.). Therefore, against the notion of the past as "a collection of objects to be recovered or duplicated by the interpreter" Gadamer proposes his concept of the past as an 'effective history', the medium that "alone makes possible the conversation between each new interpreter and the text or event he seeks to understand" (ibid., p. xvii).

It is tempting to see Gadamer's focus on history as a reflection of his initial concern with old texts, and with bridging the temporal gap between these texts and modern interpreters. In that case, the concept of 'effective history' would have limited usefulness in the framework proposed here. But 'effective history' is critical to Gadamer's concept of 'tradition', the most important contributor to the 'commonality of understanding' which is one of the conditions for entering the hermeneutic circle. Dascal explains this relationship as follows:

*Historical-effective consciousness does not purport to free us from the bounds of 'tradition'—an impossible task—but rather to make us aware of it and, thus, to put us in a position to ascend the spiral of understanding through a full exploitation of the 'hermeneutical experience' (Dascal, 1979, p. 250).*

Perhaps the best way to utilize the concept of historical-effective consciousness in the framework that follows is to return to Gadamer's typology of the 'I-thou' relationship, which he uses "to help situate and thus clarify the nature of the historically operative consciousness (Palmer, 1969, p. 191). Gadamer uses three typologies: a) thou as an object within a field, b) thou as reflexive projection, and c) thou as tradition speaking.

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following the spiral outwards, "remains finite and surpassable and is not to be equated with Hegel's absolute knowledge in concepts." (See the introduction by Linge, in Gadamer, 1976, p. xl.)

The first I-thou relationship is that of scientific objectivity and methodological knowing. The thou is seen in an instrumental way, as something specific, an object within one's field of experience that can be used as a means to achieve one's objectives. In this case, the thou is understood in terms of universals, that is, the set of characteristics that are common to all objects that are members of this class (ibid.).

In the second I-thou relationship, the thou is seen as an individual person, but "Gadamer shows that this 'personal' relationship can still remain imprisoned in the I and actually is a relation between the I and a reflexively constituted thou (as in "I feel your pain") (ibid.). In this case, historical awareness "knows the otherness of the other, not in relatedness to the universal" as was the case with the previous I-thou relationship, but in all its particularity. This is the kind of awareness that Gadamer critiqued, because it claims to be objective and to fully know the other (ibid.).

The last type of I-thou relationship does not project the meaning from the I. It "is characterized by authentic openness to the thou" (ibid.). Here, the I, through his authentic openness, "allows something to be said *to* him", to use Gadamer's terms. This "is the kind of openness that wills to hear rather than to master" and, most importantly, "is willing to be modified by the other" (ibid.). This kind of I-thou relationship is the one that characterizes Gadamer's historical-effective consciousness.

This concludes the section on hermeneutics. With this background material, we can now turn to the heart of the theoretical framework of this thesis, the taxonomy of communication and integration practices in design and product development.

## **The Typology<sup>31</sup>**

The objective of this chapter is to develop a typology of practices in design and product development, using some of the concepts from linguistics and hermeneutics presented in the foregoing sections. The practices we are concerned with are those communicative practices whose objective is to provide tighter integration between the development

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<sup>31</sup> As discussed in Chapter II, this typology should be viewed as a cross between typology and taxonomy, as it is the result of a joint iterative process that involved both an analytical theoretical element (some of which is captured in this chapter) and a significant body of grounded empirical work (some of it described in the case study reports of the next three chapters).

organization and its customers, and between the different parts of the development organization.

First, a preview of the typology is in order. As alluded to in the introduction, a key distinction must be made between interpretive and non-interpretive practices. The latter will be referred to as analytical or structural and, occasionally, mechanistic. Following the example of linguistics, structural or non-interpretive practices could further be divided into the syntactic and the semantic; at this point, such subdivision does not seem useful, for reasons that are explained later. An important distinction will be made, however, between two kinds of interpretive practices, those that will be called pragmatic, and those that will be referred to as hermeneutic. This distinction is one of the key contributions of this typology. What we have then is a trichotomy consisting of structural (“syntactico-semantic”), pragmatic, and hermeneutic practices.

It is worthwhile to contrast this typology with other similar ones, such as Charles Morris’ “famous trichotomy of syntax, semantics, and pragmatics,” described in Akmajian et al. (Akmajian et al., 1995, p.343). That typology, discussed at length in the background section on linguistics, sought to classify the different ways of studying sign systems in general, and language in particular. (The same definitions that we looked at in the case of language apply to other sign systems in general: pragmatics focuses on the way humans or animals use the signs in real life; semantics studies the relations between the signs and their meanings, and syntax studies the relations among the signs themselves, abstracting from both meaning and use. (See Audi, 1995, p.799.)

Another similar typology is one given by Jantsch, where he applies the syntactic, semantic, and pragmatic trichotomy to information (Jantsch, 1980, pp. 50-53). He describes as syntactic the kind of information based on Shannon and Weaver’s information theory, which was touched upon in the introduction and briefly in this chapter, in the context of the conduit metaphor of information transfer (Shannon & Weaver, 1949). Syntactic information flows in one direction only (the functions of sender and receiver are clearly defined), and the amount of information to be transmitted is given à priori, and it can only decrease due to noisy transmission. Most importantly, “new information is [...] primarily considered to reconfirm and strengthen existing

information structures” (ibid., p. 51). He associates syntactic information with closed systems, systems with fixed structures. His explanation of semantic information is less clear. He associates that type of information with self-organizing systems that are open and therefore capable of getting rid of entropy, and he describes it as being exchanged in a circular fashion, and “within the context of a particular meaning” (ibid.). Finally, he describes pragmatic information as going beyond semantic information in the sense that it is “geared to make a certain effect.” It is information that changes the receiver. He associates this type of information with autopoietic systems, that is, self-renewing systems whose structure is not necessarily fixed (ibid.). Whereas syntactic information was characterized by a high degree of confirmation and little novelty, semantic information combines both novelty and confirmation in “equal” amounts.<sup>12</sup>

Unlike the typology to be presented here, all these trichotomies distinguish between the syntactic and semantic levels or types, and relegate all else to the pragmatic level. At this point, a word of caution is in order, concerning the proposed distinction between pragmatic and hermeneutic levels. That distinction is not a natural one, as pragmatics and hermeneutics come from different traditions, as mentioned earlier. Yet, in his paper comparing pragmatic and hermeneutic interpretation, Dascal ascribes to pragmatics the same objective as hermeneutics (using Gadamer’s words): “Pragmatics, too, purports to explain ‘what always happens’ in the process of interpretation. In some respects, its account is similar to that of hermeneutics” (Dascal, 1979, p. 250). This makes distinguishing between the two a difficult task, a fact underscored by the title of a recent paper by Coyne, in which he refers to “Heidegger’s pragmatics” instead of Heidegger’s hermeneutics (Coyne, 1998). Furthermore, it should be pointed out that one of Dascal’s objectives, in the above mentioned paper, in comparing pragmatics and hermeneutics is “making each more assimilable by whoever belongs to the other tradition” (Dascal, 1979, p. 240). Later on in the paper, having identified one aspect (among others) of hermeneutic interpretation that distinguishes it from pragmatic interpretation (at least as conceived at that point in time), he goes on to explain that “nothing prevents pragmatic

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<sup>12</sup> Compare to the pragmatic and hermeneutic notion of understanding presented earlier, where understanding of the novel or alien could not take place without the interpreter bringing his pre-knowledge (the old) to bear on the situation.

theory from appropriating this insight in its own terms” (ibid., p. 248). It is therefore important that the reader understand that the terms used in the typology presented here—structural, pragmatic, hermeneutic—are being used in the specific technical sense set out below. The linguist interested in evolving and expanding his field may wish to see these distinguishing features co-opted into that field; for the purposes of this research, however, it is important to maintain and underscore these differences.

### ***Analytical or structural practices***

The first classification of design and PD practices is inspired by the positivist theory of language that underlies the models of syntax and semantics presented earlier in this chapter. These practices are either directly based on such reductionist models, or reflect such a reductionist, Cartesian worldview. Because of their characteristics, and because the term “practice” conveys a sense of situatedness that is not applicable to these analytical approaches, it may be more accurate to talk of tools and methods; for the sake of simplicity, however, I will continue using “practices”, and sometimes “approaches”. A number of the important features that characterize these structural or analytical practices are listed below.

As with semantics, structural approaches to PD are based on a particular model of the system to be understood and analyzed. That system is seen as closed or self-contained, in the same way that semantics contains its own fixed lexicon.<sup>33</sup> Any changes to the lexical entries as the language evolves are external to semantics per se. At a minimum, the system is fully defined and clearly circumscribed at any given point in time and for the duration of the analysis.

Structural or analytical approaches follow the example of semantics, where the lexical meaning of a sentence is derivable from the lexical meanings of its component words and the rules for combining and ordering them. Similarly, in structural approaches to PD, a problem or situation can be easily reduced to its constituent or atomic subproblems. The manner in which these parts can be combined and ordered to form the whole and the way

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<sup>33</sup> Whether the lexical entry for each discrete unit (word) refers to its part-of-speech property or to its lexical meaning is unimportant for our purposes, because we are abstracting from syntax and semantics their high-level characteristics.

in which they interact follow clear, specific governing rules and constraints; in other words, going from parts to whole is not problematic (see next paragraph.) Very often the structural approach is presented as a methodology, in which case the relation between the different steps and the progression from one to the next follow a specific ordering and specific rules.

Since these are rules based on deductive or inductive logic, as opposed to, say, heuristics, there is no room for ambiguity or contingency. The rules apply always, and always yield the same repeatable outcome. No appeal to context or other external factors is needed to reach an answer or a solution. We are dealing with universals, with objective knowledge: the outcome is not dependent on time, on the particular individuals involved, their history, their norms or their values, nor on the particular path followed. In other words, the rules, their validity, and their applicability do not depend on the “content” of the situation. In fact, it is by virtue of this repeatability (which they achieve at great cost) that structural approaches can claim to have predictive power (at least within their limited, circumscribed world), a feature to which they owe much of their attractiveness and success.

Structural or analytical practices and approaches to PD have their basis in Cartesian thinking, with its clear distinction between subject and object. These approaches are not situated in human action, but they are conceived by the subjective mind acting against clearly identified external objects. The stance of the thinking subject is therefore the objectivity of the natural sciences. There is no place for prejudice (prejudgment) and pre-understanding, even if partial, and there is no place for reflection.

The model for these analytical practices is that of scientific theories which “state deworlde d relations between deworlde d data”, to use Heidegger’s term (Dreyfus, 1991, p. 207).<sup>34</sup> Unlike the study of human as self-interpreting beings, which “requires interpretation within the *full hermeneutic circle* of shared significance,” analytical approaches, even when they involve the study of human beings as objects “requires only

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<sup>34</sup> Dreyfus quotes Heidegger using the term “deworlde d” in *History of the Concept of Time*, Bloomington, Indiana University Press, 1985.

the circularity of working within a theoretical projection” (Dreyfus, 1991, p. 203).<sup>35</sup> That is why one can make a distinction between the circularity of parts-to-whole and whole-to-parts of lexical meaning or system dynamics for example, which only require deworldeed theoretical projections, on the one hand, and the true hermeneutic circle needed to understand ambiguous, open-ended situations.

### **Examples of analytical processes in design**

There are numerous approaches to design that are based on a “scientific” methodology, and that could be described as analytical or structural in the sense of the term presented above. These approaches which fall under the heading of “design science”, use models of design that exhibit “kinship with the logical-empirical approach and the hypothetical-deductive system of theory construction [...]” (Rowe, 1987, p. 163).

Typical of these approaches are those that model the design process as one of search and optimization, using generate-and-test algorithms. As an indication of how removed such approaches are from human values, practices and areas of shared significance, they do not allow room for the “style” of the individual designer, something most people take as a self-evident characteristic of design as a creative activity. “Style” is viewed simply as a byproduct of bounded rationality and the resulting inability to reach the optimal solution to the design problem (Simon, 1981, p. 150).

Another example of an analytical approach is the use of shape grammars to automate design (Stiny et al., 1978; Mitchell, 1990). In these approaches, design primitives (geometric shapes that play a role equivalent to that of words in language) are specified, along with rules that determine how these primitives can be combined to form coherent structures (the equivalent of the rules of grammar that allow words to be combined into “meaningful” sentences.) These systems make it possible, for example, for a computer to generate Palladian villas (or, more accurately, villas in the style of Palladio) (Stiny et al., 1978; Mitchell, 1990, pp. 152 ff), or various pieces of consumer electronics in the Braun

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<sup>35</sup> The term “projection” is used by Heidegger to refer to the way man’s everyday coping is organized by his *for-the-sake-of-which*, that is, his final point, not in the sense of final goal, but in the sense of the long-term purpose of our being that gives meaning to our lives (e.g., being a teacher or a parent.) (See Dreyfus, 1991, p.186 and pp. 92, 95.)

style (Wallace, 1991a).<sup>36</sup> In these approaches, as in semantics, the primitives are given; how they came to stand for what they stand for is external to the system or the approach itself. For example, the rules for generating Palladian floor plans consist of rules for generating grids, for I-shaped, T-shaped, and cross-shaped central rooms, for generating porticos, and so on. These rules are totally removed from the 16<sup>th</sup> century notions of status, wealth, elegance, style, comfortable living, formal entertaining, and all the other contextual and background factors that must have impacted the architect's work (by virtue of his being situated in and engaged with a world of shared significance with his community), as he interpreted these notions for his clients. Similarly, reducing the Braun style to certain corner treatments and radii and to certain shades of black does not account for the social and political environments, the philosophical beliefs, and technological factors that came together at one point in time to set the tone for the early Braun style (through the work of Hans Gugelot and his students at the Ulm school of design) (Lindinger, 1990), and how that style evolved to its more recent Braun adaptations. More importantly, these approaches cannot inform nor guide the evolution of a design language or grammar over time, as the environmental and contextual factors change. For example, such a system would not be capable of taking the design of Braun coffee makers from their traditional cylindrical forms of the 1970s and 1980s to the newer conical shapes of the 1990s.<sup>37</sup>

### ***Interpretive practices: pragmatic and hermeneutic.***

The other two types of practices are interpretive in nature; they are respectively inspired by the ideas from pragmatics and hermeneutics presented earlier.

The key difference between analytical (structural) and interpretive practices or approaches is in the underlying conception or model of the world in which they are used.

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<sup>36</sup> Stiny and Mitchell were able to use their system to generate designs for villas that Palladio himself had never actually designed, but which were nonetheless thought to be his by experts on the subject (Mitchell, 1996). That is why "villas in the style of Palladio" is a more accurate terminology.

<sup>37</sup> Wallace explains that an important contribution of this thesis is to show how a lot of industrial design work is mechanistic in nature and can indeed be captured by such systems, and that industrial designers should focus their energies on the much more difficult task of developing new shape grammars (Wallace, 1991a, p.30; 1991b). Such a system "uses conventions observed in existing products to design new ones," "by borrowing ideas and visual language from other known and related artifacts." The system has the advantage of "freeing the industrial designer to partake in truly creative design" (ibid., pp. 143-144).

The former apply within a particular theoretical model of the “world” (or system or situation), a necessarily reductionist, fully circumscribed abstraction or simplification of the real world. Interpretive practices, on the other hand, have as their range of relevance the real world of everyday life. It is the world of situated human beings interacting with one another against a background of shared social skills and know-how that cannot be reduced to an explicit set of facts, assumptions, beliefs, and principles, no matter how complex (Dreyfus, 1998, p. 285).

A certain amount of shared background is not the only contextual factor necessary for successful interpretation and communication. Interpretive practices, be they pragmatic or hermeneutic, are dependent on several levels of contextual factors, as discussed earlier. These contextual factors, like the shared background, are all “external” to the communication itself. For that reason, in interpretive practices, what is unsaid, the implicit, can turn out to be just as important as what is said or given explicitly. This is not the case with analytical practices.

As a result of their context-dependence, interpretive approaches tend to be open-ended. Unlike the analytical/structural approaches which are after the one correct, optimal answer, interpretive practices admit that whatever answer is reached at any point in time is tentative and fallible, subject to modification or even radical change as ‘new’ contextual information is revealed. An interlocutor involved in interpretive practices therefore plays an active, reflective role. At every point, he is asking whether the interpretation arrived at so far is to be accepted, or whether an alternative should be considered (and why.) His counterpart involved in analytical practices, on the other hand, who can hardly be referred to as “interlocutor”, is passively receiving information or merely applying mechanical transformations to it.

Although the two types of interpretive processes share these general characteristics, they differ in some important respects on which the typology is based. These are discussed below.

### **The differences between pragmatic and hermeneutic practices**

The two types of interpretive practices or activities differ on several dimensions. Some are primordial, such as the degree to which each conforms to or rejects the subject/object dichotomy. Others, though somewhat less fundamental, may be of greater practical relevance. (These less fundamental ones invariably reflect the more basic ones; for example, the constitutive role of the interpreter in hermeneutic interpretation is connected to the rejection of the primacy of the subject, and of the subject/object dichotomy, and thus of the preexistence of a separate, self-standing meaning “out there”.) The latter include the nature of the role of the interpreter or interlocutor, the role of the subject matter itself, and the breadth of contextual factors.<sup>38</sup>

In both types of interpretive practices, the interpreter plays an active role. In pragmatic interpretation, that role is akin to that of a detective: during the course of the interpretive activity, the interpreter or interlocutor actively gathers contextual information that may be useful and relevant to recovering or getting as close as possible to the speaker’s intentions. In hermeneutic interpretation, on the other hand, the interlocutor’s active role is more creative in nature, as he plays a constitutive role, via his prejudices, in the process of coming to understanding. In this case, there is no such thing as an original speaker’s intention, a preexistent idea or meaning that the speaker is trying to communicate. The contextual factors are not subordinated to the process of recovering the speaker’s intention but they themselves (as interpreter’s prejudice) are part of the creative process itself. These two situations can be considered the extreme points of a continuum which would include those commonly encountered situations where the interpreter detects an idea that is not fully formulated nor clearly articulated by the speaker, and participates in developing it further through the exchange that takes place between them (Dascal, 1979, p. 248).

Since hermeneutic interpretation is not focused on recovering any preexistent speaker’s meaning or intention, the original communicative object—the initial question or statement—“hardly plays a distinctive or focal role” in the interpretation process (Dascal,

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<sup>38</sup> The presentation of these differences draws heavily on Dascal’s discussion of the same topic (Dascal, 1989).

1979, p. 252). It is merely a starting point in the conversation that takes place between the interlocutors and more generally in the interaction between the human agents. It is simply an entry point into the hermeneutic spiral, described previously, of ever increasing consciousness. This is different from pragmatic interpretation in which the interaction between the human agents is seen as a significantly more “purposive and rule-governed activity” (ibid.). Instead of some starting point that is likely to be overshadowed as the interaction proceeds, and some general direction that is as likely to change as the hermeneutic process unfolds, pragmatic processes try to stay focused on the original intention of the interaction. In a pragmatic exchange, although any understanding remains in principle tentative, there is present the notion of an ultimate understanding that is derivable from the initial communicative object, that is, from the starting point of the interaction. And even though that derivation may rely on heuristics, analogy, intuition and other forms of abductive inference, pragmatic practices remains less open-ended than its hermeneutic counterpart. In other words, pragmatic interpretation discriminates carefully between the contributions made by the different factors involved in the interaction to the final understanding: the interlocutors (e.g., speaker and interpreter, or interviewer and interviewee), the initial communicative object (statement or idea or question), and the various elements of context.

The last difference between pragmatic and hermeneutic practices (or at least the last one to be discussed here) involves the range of contextual factors that enter into consideration during interpretation. This may seem surprising since, as we saw, both allow for the most general contextual factors to be considered: general extra-linguistic ‘background’ knowledge in the case of pragmatics; the concept of the ‘question’ and the role of the interpreter’s prejudice in the case of hermeneutics. Since hermeneutic interpretation does not accord any privileged position to what the utterer may initially have in mind, then ‘the question’ that motivates the initial communicative object, and in light of which that object is to be understood, “may legitimately be found well beyond anything the utterer might have in mind” as well (Dascal, 1979, p. 251). Similarly, as the process proceeds through the spiral of coming to understanding, the interpreter “should inquire into his own possibly unconscious motives for, say, being interested in the [communicative object] at all” (ibid.). Therefore, hermeneutic practices do not discriminate between the

roles played by the various factors that enter into the process of coming to understanding, be they subconscious motives, historico-cultural considerations, or the original intentions of the people involved in the interaction. In a sense, this last difference is closely related to the previous one. As the speaker's intention loses importance in the process of coming to understanding, then it is only normal that contextual factors that are not directly related to these immediate intentions end up gaining in relative importance.

In general, it could be said that "each pragmatic principle ha[s], for (philosophical) hermeneutics, an additional metaphysical import..." (Dascal, 1979, p. 251). For example, consider the reflective element that exists in both. In a pragmatic exchange, the "second-order critical or reflective step" involves "asking whether there are reasons *not* to accept a given 'transparent' interpretation," based on the contextual factors available (ibid.). In hermeneutic exchanges, on the other hand, we saw that reflection moves to a higher level, from searching to the question that motivates the initial object that starts the interaction, to probing one's own motives for participating in the exchange.

### **Examples of interpretive practices in design**

In recent years, design researchers have come to see the limitations of the analytical models of the design process of the 1960s, as exemplified by Simon's rational problem solving and optimization theory, which was briefly mentioned earlier (Simon, 1981). The result has been a shift in the research focus, with renewed emphasis on the designers themselves, and what it is that they do as they go about their daily work, as opposed to some abstract methodology. Schön's description of the design process as one of reflection-in-action is a prime example of that shift to an interpretive conception of that process (Schön, 1983). The differences between Simon's and Schön's models are summarized in the following table reproduced from Dorst and Dijkhuis (Dorst et al., 1996, p. 255):

*Table III.3: A comparison of an analytical and an interpretive model of design: Simon's rational problem solving model and Schön's reflection-in-action model (Reproduced from Dorst and Dijkhuis, 1996)*

<b>Item</b>	<b>'Simon'</b>	<b>'Schön'</b>
<b>Designer</b>	= information processor (in an objective reality)	= person constructing his/her reality
<b>Design problem</b>	= ill defined, unstructured	= essentially unique
<b>Design process</b>	= a rational search process	= a reflective conversation
<b>Design knowledge</b>	= knowledge of design procedures and 'scientific' laws	= the artistry of design: when to apply which procedure/piece of knowledge
<b>Example/model</b>	= optimization theory, the natural sciences	= art/the social sciences

Schön's view of the designer as a "person constructing his/her reality" is reminiscent of the hermeneutic notion of the interpreter's ever-expanding understanding and consciousness. Similarly, his description of the design process as one in which the designer is involved in a "reflective conversation" with the design situation is analogous to hermeneutic interpretation, where the interpreter is engaged in a dialogue with the subject matter (the text or his interlocutor's utterance), a dialogue that is reflective because it invites the interpreter to inquire into his initial prejudices and to modify them in the process of raising his 'historical effective consciousness'. Furthermore, Schön's view that every problem is "essentially unique" points to the fact that every situation is highly context-dependent, a key element of interpretive thinking. It is very similar to Gadamer's view that in language use, untranslatability is the rule (Dascal, 1979, p. 242). Finally, in contrast to Simon's focus on knowing procedures and scientific laws, something that can be done equally well by any individual or even machine, Schön focuses on the artistry of design and the related know-how, which highlights again the important role played by the prejudice and judgment of the designer and the particularities of the situation.

In their paper, Dorst and Dijkhuis test the descriptive power of these two models of design, by looking at how closely each of them reflects the actual activities that designers

indicate they are involved in in real-time.<sup>39</sup> The authors conclude that Simon's model "is particularly apt in situations where the problem is fairly clear-cut," and where the designer had well-established strategies and procedures he could follow in solving the problem, as would be typical of the embodiment phase of design (Dorst and Dijkhuis, 1996, p. 269).<sup>40</sup> Schön's model on the other hand "works particularly well in the conceptual stage of the design process, where the designer has no standard strategies to follow and is proposing and trying out problem-solution structures." The author stress, as a critical aspect of Schön's model of design as reflection-in-action, the fact that it does not sever "the close link between the content and process components of design decisions" (ibid.). This is in contrast to the analytical approaches to decision making in which "deworlde" (to use Heidegger's term), value-free methodologies are assumed to apply regardless of the specifics of the situation.

### ***Structural, pragmatic, and hermeneutic practices: a summary***

This section sums up the most important features of the typology presented in the preceding few sections. First, Table III.3 presents the differences between structural approaches and their interpretive counterparts, *grosso modo*, without distinguishing between the pragmatic and the hermeneutic types. Next, Table III.4 focuses on the key aspects that differentiate pragmatic from hermeneutic interpretive practices; where relevant, the corresponding aspects of the analytical practices are also presented.

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<sup>39</sup> The protocol analysis that they encoded was based on 15-second intervals. In protocol analysis, the researcher relies on a verbal account given by the subject, in this case the designer, of the cognitive activities in which he or she is engaged at every time interval.

<sup>40</sup> In one well-accepted model of the design process, embodiment design is the phase that follows the conceptual design phase. In the embodiment phase, the designer gives shape or form to the concept arrived at in the previous phase, thus the term embodiment (Pahl et al., 1984).

Table III.4: Analytical v. interpretive approaches: a summary

<b><u>Analytical (“Structural”)</u></b>	<b><u>Interpretive</u></b>
<p>Abstracted from reality; Theory- / Model-based (assumptions, simplifications); “Deworlded.”</p>	<p>“Real-life”, “actual use”; Description of what actually happens.</p>
<p>Closed, self-contained system; Clearly circumscribed with fully characterized interactions at the boundaries.</p>	<p>“Open” in the sense that any number of factors might have to be considered; Almost no limit to how remote relevant contextual factors may be.</p>
<p>Reductionist; partitioning of whole into parts, as well as ordering and combining of parts to form whole follow strict rules.</p>	<p>Rules not sufficient for partitioning of wholes into parts and for recombining parts into wholes; contextual factors are needed.</p>
<p>Circularity of working within ‘theoretical projection’; Objectivity of the natural sciences.</p>	<p>Circularity of ‘shared significance’; Reflectivity; Prejudice and (pre)judgment play a critical role.</p>
<p>Outcomes are repeatable and predictable; Governing rules based on deduction and induction.</p>	<p>Ambiguous; “untranslatability is the rule;” Context dependent: contingent on multiple factors; Abduction, heuristics.</p>
<p>“Content independent”, non-normative: rules and methodologies apply regardless of the specifics of the situation.</p>	<p>Each situation is (potentially) unique and therefore requires its own treatment and approach.</p>

Table III.5: Analytical, pragmatic and hermeneutic practices: key features

	<b><u>Analytical</u></b> <b><u>("Structural")</u></b>	<b><u>Interpretive</u></b>	
	<b>Syntactico-Semantic</b>	<b>Pragmatic</b>	<b>Hermeneutic</b>
<b>Subject / Object</b>	Cartesian; full separation; Thinking subject free of prejudice and preconceptions acting against preexistent, self-standing objects	Grey area: Some instrumentality: communication is a purposive act; Careful discrimination between the role of the different actors and the contribution of the different factors involved.	Separation between subject and object fully rejected; Ditto for primacy of subject; No actor (interlocutor) occupies any privileged position.
<b>Universals / particulars</b>	Universality; repeatability	Understanding result of <u>possibly</u> unique interplay between the situation and the particular context	"Untranslatability is the rule"; Every situation is unique.
<b>Role and breadth of context</b>	None; Model, process, or methodology is circumscribed, self-contained.	Generally very important; Yet, it is not always necessary to go looking for a meaning beyond the "transparent" one; Quasi-static: changes as the exchange develops, but given at any point in time; Multiple levels (see background section on pragmatics); Subservient to communicative intention of speaker.	Crucial; prejudice constitutive of meaning, not only for disambiguation; Dynamic: prejudice changes as interpreter goes through the hermeneutical spiral, even if the interaction has stopped. Intentions as well as "second-order" motivational, historico-cultural, functional or causal explanations equally relevant.
<b>Role of interlocutor / interpreter</b>	Receive information; "Process" information mechanically, using fixed, deductive / inductive rules.	Disambiguate situation by gathering relevant contextual information.	Constitutive; participates equally in developing an understanding of the situation.

<b>Reflection</b>	Not applicable; Value of any bit of information given by model, not subject to judgment; Information processing is mechanistic; rules, as well as when and how to apply them, given.	Epistemological level; A critical, reflective step is involved in understanding a situation: “Does this understanding make sense, given the context? Or is there a reason to look for an alternate explanation of this situation?”	More ontological; Expanding one’s ‘historical-effective consciousness’ changes one’s prejudices, and therefore one’s being; The consciousness involves itself into its own reflection, through the fusion of horizons.
<b>Role of prejudice (prejudgment)</b>	None: objective scientific (Cartesian) stance; All assumptions explicit.	Assumptions and background knowledge cannot be made entirely explicit.	Positive, enabling; Plays constitutive role in coming to understanding, as the original horizon of the interpreter.
<b>Role of conversational object</b>	Primordial.	Primordial; End point derivable from it.	Starts conversation More open-ended
<b>Focus of interaction, purposiveness</b>	Fully goal oriented.	Interaction purposive; Focused on original issue represented by initial conversational object; Focus on identifying communicative intentions of speaker.	Interaction more open-ended; has general direction, but can go anywhere; Characterized by openness of ‘true questioning’, desire to know; Yet subject to constraints; Interlocutors taken over by the ‘game’.

### ***The typology at work in PD***

In closing this chapter, I will use the typology presented above to analyze a few popular product development methodologies or practices and, in the process, to understand their limitations and their range of applicability. This will be similar to the way in which different design approaches—search/optimization, shape grammars, reflection-in-action—were analyzed and discussed earlier, using this taxonomy. The particular

methodologies discussed below are stage-gate systems and the design structure matrix (DSM).

### **Stage gate systems**

A stage-gate system is a workflow model of the product development process, from the idea stage all the way to product launch and beyond (Cooper, 1990). A stage-gate system divides the development process into a number of phases of activities, the “stages”, each of which is followed by a decision point, called a “gate”. At each gate, a decision must be made on whether to proceed to the next stage, to return to the current stage for more work, or to abandon the idea altogether. That decision is referred to as a “continue/abandon/recycle” or “Go/Kill/Hold/Recycle” decision (“hold” is another possible gate outcome, where the project is put on hold, either to await a change in available technologies or market conditions, for example.) Each organization, upon implementing its stage-gate system, will define for itself the activities that are to be performed during each phase, as well as the inputs, decision criteria, and outputs for each gate (O'Connor, 1994). The inputs are the deliverables from the current stage of activities, and the outputs of the gate are the decisions described earlier, as well as the approval of a plan of action for the next stage. Figure III.2, taken from Cooper (1990), shows a typical stage-gate process that consists of five phases.

Underlying stage-gate systems is a conception of product development as a process analogous to any other, which therefore can be managed using standard process-management methodologies (Cooper, op. cit.. p. 45). In particular, Cooper compares product development to the manufacture of physical products, which can be divided into a number of work stations (analogous to the stages), with quality control checkpoints in between (analogous to the gates.)

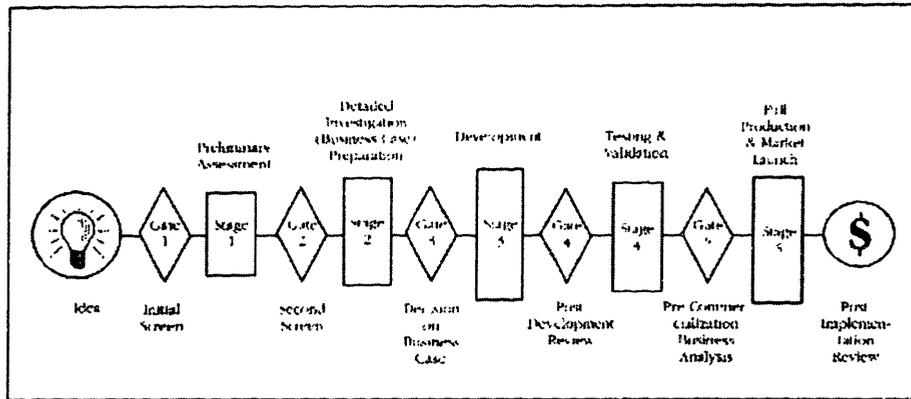


Figure III.2: Stage-gate system model (from Cooper, 1990)

The most important aspect of this analogy can be gleaned from the following statement by Cooper:

*The way to improve the quality of output from the process, of course, is to focus on the process itself—to remove variances in the process (Coopers, op. cit., p. 45).*

The approach to product development embodied by stage-gate systems has many of the hallmarks of a structural method, as explained below.

First, the reductionist nature of the model is already clear from the production system analogy, with the division of the process into fixed sets of tasks at each stage, and rigid “quality control” or inspection requirements at each of the gates. Secondly, the work-flow model is presented by Cooper as a self-contained system, with clearly-defined inputs and outputs, such as the initial idea that starts the process rolling (“The new product process is initiated by a new product idea, which is submitted to Gate 1, Initial Screen” (Cooper, 1990, p. 52).) Thirdly, critical contextual factors are similarly not accounted for by the system itself but are considered to be external to it, given from outside the system, just like inputs. These include the decision criteria that are used at every gate, criteria which are decided à priori. Consider for example Gate 1, the Initial Screen gate. Cooper describes it as follows:

*Gate 1 is a “gentle” screen, and amounts to subjecting the project to a handful of “must meet” and “should meet” criteria. These criteria deal*

*with strategic alignment, project feasibility, magnitude of the opportunity, differential advantage, synergy with the firm's core business and resources, and market attractiveness (Cooper, 1990, p. 52).*

The above description begs all the important and difficult questions in conducting real-life product development: What makes a market attractive enough? How does one assess the magnitude of an opportunity at such an early stage, and how precise does that assessment need to be? Will all the participants agree on the issues of strategic alignment and synergies? Is it OK to deviate from these criteria under certain conditions? When and by how much? Does it depend on the particular project? On the business climate? And so on. Similar issues can be raised regarding the descriptions of the other gates and phases of the system (Cooper, 1990, pp. 52-53).

The fact that there is no room for considering any contextual factors in the stage-gate methodologies described above is not surprising given their aspiration to mimic production systems. Although organizations are expected to customize the stage-gate model to meet their particular needs, the overall direction is still towards the implementation of a universal methodology that would be followed by all projects, with the aim of increasing repeatability and predictability, and of “removing variances in the process” (refer to earlier quotation.) Such a structural system leaves no room for individual reflection and judgment. Even when an allowance is made for the fact that different projects may have different characteristics or requirements, the goal remains one of standardizing the process, through the development of different stage-gate models, each appropriate for a particular, standardized type of development project. Quoting from Cooper:

*Not all projects pass through every stage of the model. [...] Standard definitions of project types are developed and based on project scope and investment required. Appropriate routes are determined for each type of project. The routing for any project at the idea stage is decided in the first gate (Cooper, 1990, p. 53).*

Again, the types and decision criteria are laid out ahead of time and the path to be followed is determined and finalized at the beginning of the process, thus eliminating any context dependent or situational changes within the process.

The push for standardization and repeatability leaves us with a system that is rather generic and devoid of real-world considerations and meanings (we already saw that the meaning of such things as “quality”, “strategic alignment”, “economic viability” and so on are external.) The system can best be compared to the systems of syntax and semantics described in the linguistics background section above.

Perhaps one could even think of the generic model as a syntactic model, and the models that are organization-specific as semantic models. These are not systems that tell us what to do in real use, what actually has to happen; it is akin to saying that a sentence consists of a preposition, an object, a verb, and a subjective clause; that does not tell us how to write literature.

The limitations of stage-gate systems, which are the result of their structural nature, become clear when one confronts the number of non-germane elements that need to be added to them in order to make them more useful in practice and better able to achieve the optimistic results ascribed to them, as in the following claims:

*Stage-gate systems form one solution to what ails many firms' new product programs. Facing increased pressure to reduce the cycle time yet improve their new produc. 'hit rate,' corporations are increasingly looking to stage-gate models [...] (Cooper, 1990, p. 44).*

And:

*One study (Booz, Allen & Hamilton 1982) found that [...] firms that adopted a formal new product process did better [...] (Cooper, 1990, p. 47).*

One of these unrelated supporting elements is the use of project teams to carry out the development process (modeled using a stage-gate process), along with the attendant organizational changes that necessitates:

*The implementation of stage-gate systems requires certain organizational changes within some firms. For example, a project team approach to organizing new product projects is fundamental to stage-gate approaches. No longer can projects be handed from department to department within the firm [...] (Cooper, 1990, p. 46).*

It is not clear that the link between a project team approach and the use of a stage-gate system is as fundamental as indicated in the above quotation. It is not so difficult to imagine a company using project teams without necessarily following a stage-gate system. Conversely, it is not impossible to have a firm organized into functional departments follow a stage-gate process. As a matter of fact, a study that looked at how several companies actually used stage-gate systems in practice found that one firm did not form multifunctional teams until the third stage is reached, in order to control costs (multifunctional teams being expensive to set up):

*This means that stage 1 and 2 activities, typically involving technical and market assessments and business case analysis, are done in functional departments and compiled by a program champion (O'Connor, 1994, p. 189).*

Another important supporting element in stage-gate systems, one that might also require an organizational change, is the involvement of senior managers as gatekeepers. In addition to being “senior enough to have the authority to approve the resources needed by the project,” these managers should form a group that is multifunctional and multidisciplinary (Cooper, 1990, pp. 46-47). Here again, the connection between the use of a stage-gate system and the involvement of such senior managers in the process is not necessarily a natural one. We know from the work of other researchers that having such a strong senior manager with access to resources involved in the development process—Clark’s heavyweight product manager for example—can by itself improve product development performance (Clark et al., 1991). Conversely, deploying a stage-gate system does not automatically include such involvement, judging by the structural description of the system. In his survey, O’Connor found that top management involvement remains “difficult to gain and enormously difficult to sustain over time,” notwithstanding the adoption of stage-gate systems (O’Connor, 1994, p. 188). And in any case, getting the necessary resources allocated to a project in real-life is a much more complex and demanding process than the trivial stage-gate prescription of having a senior manager as a gatekeeper. Other projects undertaken by the firm contemporaneously will presumably also benefit from having an equally senior manager playing a similar role. A more evolved type of stage-gate system, a “third-generation” PD process model, attempts to

deal more pragmatically with this and other limitations of the “second-generation” stage-gate model described in this section (Cooper, 1994). (More on this below.)

The same type of argument can be made about another element that is presented as “an important feature of stage-gate systems” but that does not seem to be necessarily intrinsic nor limited to it, namely, “parallel processing” or the execution of activities in parallel instead of sequential fashion (Cooper, 1990, p. 49). Ditto for other “benefits” of stage-gate systems such as improved quality of execution of important PD activities and increased market orientation (Cooper, 1990, pp. 47-49).

The limitations described above are typical of several approaches to product development that attempt to reduce what is in reality an interpretive situation to an analytical process. Another such approach is Quality Function Deployment, which was briefly discussed in the Introduction (see Chapter I.) As O’Connor’s survey shows, the successful implementation of a stage-gate process is really a process of organizational change, with all the difficulties and pitfalls that such a process, grounded as it is in human interaction and organizational culture, entails. It is not merely a matter of having product development projects follow a particular analytical process model. Rather, it involves “motivating” people, “secur[ing] senior management commitment [...] and involvement,” “guid[ing] and influenc[ing] the organization,” and so on (O’Connor, 1994, p. 197). The fact that the implementation of any PD process is intimately linked to the particular context of the organization involved is captured in one of his conclusions:

*Yet no one suggests, nor does any empirical evidence exist, that supports the notion that one specific NPD process is better in all organizational settings than any other process (O’Connor, 1994, p. 199).*

The “third-generation” NPD processes, briefly touched upon earlier, are intended more closely to reflect actual, real-life product development projects. Specifically, they seek to address the limitations that come from forcing all development projects into a “one-size-fits-all” model, such as the “second-generation” process model on which we have focused so far. These newer models allow for the fact that every project is different and may require a unique treatment, a treatment that depends on the particular situation and context. “Third-generation” process models allow for such context-dependency through a

number of features including “fluidity”, “fuzzy gates”, and “flexibil[ity]” (Cooper, 1994, p. 9). “Fluidity” is meant to reflect the need for the process to be “adaptable”: stages can be overlapped, activities are no longer “married to specific stages”, and so on. “Fuzzy gates” feature “conditional Go decisions (rather than absolute ones), which are dependent on the situation” (ibid.). The process is “flexible” in that “it is not a rigid stage-and-gate system: each project is unique and has its own routing through the process” (ibid.).

The “third-generation” process model described above is fundamentally different from the rigid, mechanistic “second generation” model covered earlier. “Fluidity” and “flexibility” can be viewed as making room for the numerous contextual factors that enter into the assessment of the quality of what has been accomplished at the end of every stage. They also make it possible to account for the conversational aspect of the decision making process at the every gate. Cooper closes his description of the major features of the new process model by cautioning against a “possible negative consequence,” namely, “fallibility”:

*This Third-Generation Process introduces much more freedom and discretion to project leaders, teams, and senior managers (who are the gatekeepers or decision makers.) With freedom and discretion, of course, comes risk: the odds of making mistakes go up (Cooper, 1994, p. 12).*

The introduction of this notion of fallibility is the clearest indication that, in the end, the PD process is an interpretive process that cannot be captured fully using structural models. In the next section, we look at another methodology that has been developed for the purpose of organizing product development projects, the design structure matrix.

### **DSM (Design Structure Matrix)**

This section considers another tool used to organize product development activities, the design structure matrix or DSM. The DSM methodology was initially developed by Steward in 1981 (Steward, 1981). It was later picked up and further developed by researchers at MIT, and has been gaining increased acceptance in industry at companies such as Ford and Boeing, where it has been used in understanding and modifying the structure of complex product development projects (Eppinger, Whitney, Smith, & Gebala, 1990;). As with the stage-gate process, which was the subject of the previous

section, this section attempts to understand the range of applicability and limitations of the DSM methodology using the framework and typology developed earlier in this chapter. In the process, we will look at its evolution as practitioners have started using it in increasingly realistic and more complex situations.

The Design Structure Matrix method was originally developed by Donald Steward as a means of addressing a basic limitation of standard design/project management tools, such as the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Specifically, these tools are limited to representing independent tasks or activities that can be performed in parallel, or dependent tasks that must be performed serially (Steward, 1981, p. 71). They cannot represent interdependent activities, which are related to one another in a circular fashion (what Steward refers to as “circuits”.) Yet, such activities are very common in design and product development, due to the iterative nature of many design tasks and sub-tasks, and to the learning that takes place in design through trial and error. Eppinger (1994) provides a very good summation of the concepts and assumptions that underlie the DSM approach. To paraphrase:

- a) The basic elements of the design process are viewed as tasks of some duration, which require information as input and produce information as output.<sup>41</sup>
- b) The design process can be improved (in terms of speed and efficiency) by re-sequencing these tasks such that available information is put to use as early in the process as possible, and information is made available to tasks that require it as soon as soon as possible (Eppinger, 1994, p. 11).

In Steward’s original work, the focus was on the variables or parameters that define the design, manufacture and behavior of the product, and with the relationship between them (Steward, 1981). In the more recent work, the definition of the unit of analysis in a DSM has been broadened to include design tasks (Eppinger, 1991; Eppinger et al., 1990; Eppinger et al., 1994), product development teams (McCord & Eppinger, 1993), as well as subsystems and system components (Pimmler & Eppinger, 1994).

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<sup>41</sup> As we will see later in this section, DSM can be used with different units of analysis than tasks.

From an operational perspective, the DSM methodology consists of the following steps (using a task-based DSM as example, without loss of generality.) The first step is to list the component elements or tasks, and to identify the precedence relationships between them. Depending on the information flow between any two tasks, they can be classified as dependent, independent, or interdependent. Figure III.3 below, taken from Eppinger et al. (1994), illustrates these relationships using directed graphs to indicate the informational flow between two tasks A and B.

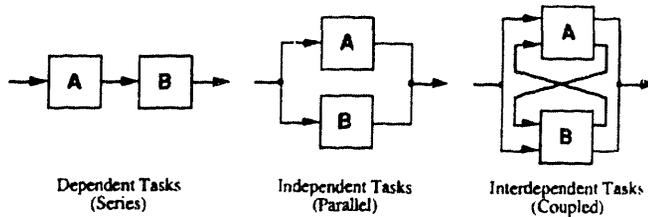


Figure III.3: The relationships between design tasks (from Eppinger et al., 1994)

In the next step, these tasks are arranged along the identically labeled rows and columns of a square matrix, and entries in the body of the matrix are used to indicate the dependence of the row elements on information from the column elements. Figure III.4 (also from Eppinger et al., 1994) shows such a matrix for a project consisting of twelve tasks. The third step involves re-sequencing these tasks, that is, interchanging rows (and their corresponding columns) with the goal of making the matrix lower triangular. In that ideal but rare situation, no task would depend on information generated by a downstream one, and no iteration would be required. The more typical outcome is a block triangular matrix, where interdependent tasks are concentrated in a few, relatively small blocks on the diagonal. Figure III.5 shows one such re-sequenced task matrix for the same project as in Figure III.4.

	A	B	C	D	E	F	G	H	I	J	K	L
A	.	X										
B	.	.										
C	X	.										
D				X	X							X
E					.	X	X			X		
F	X					.						X
G	X						.					X
H	X			X				.	X			X
I			X			X			.	X		
J		X	X			X				.	X	X
K		X	X								.	
L	X								X	X	X	.

Figure III.4: The original design structure matrix (from Eppinger et al., 1994)

	B	C	A	K	L	J	F	I	E	D	H	G
B	.											
C	X	.										
A	X	.	.									
K	X	X	.	.								
L		X	X		X	X						
J	X	X	X	X	X	.	X					
F	X			X	X	.	.					
I	X				X	X	.					
E			X		X	X	.	X		X		
D				X	X	X	X	.	X	.		
H		X	X			X			X	.		
G	X		X								.	

Figure III.5: The DSM after re-sequencing of tasks and partitioning (ibid.)

Interdependencies are now limited to the smaller blocks on the diagonal. Within these blocks, it is relatively easier to start the iteration process; furthermore, certain “tearing” procedures have been proposed for identifying those parameters or task output information, the removal of which (through the use of reasonable initial estimates for example) allows the rest of the block to be made lower triangular (Steward, 1981).

Eppinger et al. (1994) extend the DSM methodology through their introduction of the numerical DSM. The entries in the matrix are no longer limited to marks indicating strict precedence relationships; instead, numerical values are used to represent the strength of the dependency between tasks, or any number of other measures. Along with the

expanded representation, more sophisticated analytical algorithms are used that take into account that information when reorganizing the tasks.

***Early research: DSM as a structural tool***

The rationale behind their DSM work, according to Eppinger et al. (1994), is the argument that the design methodology used in any given design situation should be based on the “underlying structure of the design problem.” The authors trace this argument not only to Steward, but also to Simon (1970) and, before him, to Christopher Alexander’s form synthesis methodology (Alexander, 1964). The authors believe that the structure of the design procedure should depend only on the technical nature of the design problem itself:

*The analysis we will perform considers the relative importance of each design parameter to other parameters, allowing the information requirements to determine the appropriate scheduling of the decisions (Eppinger et al., 1990, p. 40).*

The method proposed by the authors for designing a design procedure is an excellent example of an analytical or structural process, as described in Table III.3 above. First, the proposed method is “deworldeed”, in the sense that it is based on a “mathematical or engineering model of the system to be designed” (ibid.), a model that is abstracted from reality. More importantly, even though the authors include the process of developing the model as one of the steps in their methodology, they make no mention of the assumptions and simplifications inherent to that process, and the attendant judgment calls. In fact, they imply that there is one model for a given system (“Make the mathematical or engineering model of the system to be designed” (ibid., emphasis added.)) This is an obvious reflection of the circularity inherent in working within a theoretical projection.

The method is clearly reductive in that it relies on breaking up the design into its constituent tasks, and the relationships between tasks into one of three clear, crisp categories of information transfer. The method not only operates within a closed system with clearly circumscribed boundaries, given by the model. It is also content independent: the content of the labels attached to the rows and columns of a DSM are unimportant; whether a task is labeled “A” as in the figures above, or whether it is labeled “Check

Geometry Markup” (Figure 5 in Eppinger et al., op. cit.) is immaterial to the procedure itself.

The method as proposed by the authors is effectively devoid of human judgment or prejudice. For example, when designers are interviewed in the early phase of the process of developing the DSM, the objective is to obtain the relationship between design parameters:

*To create a parameter-level description, we document the design process by interviewing engineers only (not their managers). We ask the designers which parameters must be known in order to set another design parameter (Eppinger et al., 1994, p. 7).*

Later in the process, after a new design procedure is developed, its goodness is assessed analytically, not by human designers or managers. A mathematical sensitivity analysis is proposed for assessing the impact of errors or changes in specifications on the progress of the design process, and simulations of the design sequence are used to time it (Eppinger et al., 1990, pp. 42-43).

The purely analytical orientation of this early DSM work is well articulated in the following quote from Eppinger et al., (op. cit., p. 40), which makes it clear that there should be no role for historical contingency nor for the particular organizational context in determining the proper design procedure for a given product:

*The benefit of this work for the second type [of design, the redesign of existing items, such as automobiles,] may be just as great but harder to recognize. This is due to the fact that a “procedure” exists and seems to work well. However, it may have grown up [sic] organically and historically and may never have been subjected to careful analysis. So its internal inefficiencies or irrationalities remain undetected.*

Having established the analytical structural nature of the early DSM research, I turn next to more recent work that takes a more interpretive approach.

### ***The interpretive nature of more recent DSM research***

In some of the more recent work on DSM, the focus has shifted from the mechanics of the methodology and from problems where the technical structure of the artifact alone

determines the DSM, to the process of properly reflecting the knowledge, experience, and judgment of engineering managers and experts. An example of this more recent DSM research is the work of Dong, which is summarized in one section in an MIT DSM tutorial (Dong, 1999; Eppinger, Whitney, & Yassine, 1999). The section in question is entitled “A Proposed Approach for building credible DSMs.”

The first step in the proposed approach is to “Define the System and its Scope.” This critical step, which was taken for granted in the earlier work, is an indication that these researchers are more aware of the fact that they are working with a model of the real world, a model that is clearly circumscribed by its boundaries. As they point out, the output of the DSM analysis depends on how the system is defined and on where its boundaries are drawn (Eppinger, Whitney et al., op. cit.).

Step 3 in the proposed approach involves studying the information flow between the system elements, which were identified in an earlier step. What is notable here is the recognition of the importance of conducting face-to-face interviews with the engineers who hold that knowledge, in addition to reading design documents. This is to be contrasted with the earlier work, where the focus was on deriving these relationships from engineering models of the artifact being designed. More importantly, the author points out that different engineers will often hold different views concerning the relationships between the different elements in the model and their importance. One reason mentioned for these differences between engineers is “the different perspectives on the issues due to the difference of their work.” This is recognition of the role prejudice or prejudgment plays in people’s understanding (see Table III.3 above.)

In Step 5 of the proposed approach, one of the goals of DSM is described as “to aid the design engineers and engineering managers to understand the design process better” and to communicate better. The DSM is presented as playing the role of a boundary object, the purpose of which is to help different people with different prejudices and worldviews come to a shared understanding, giving the DSM a distinctly interpretive role (Carlile, 1997).

In closing this section, it is interesting to note that Steward clearly understood the limitations of the tool he was proposing, the limitations uncovered and discussed in this

section. In his seminal paper, he notes, early on, that the precedence relationships between design parameters “do not have to be based on mathematical equations”, that “[t]hey could represent qualitative judgments by managers or engineers”, based, for example, on their perception of the risk associated with a particular solution (Steward, 1981, p. 71, emphasis added). Even more interesting, and of particular relevance to this discussion, is the linguistic analogy Steward uses to describe the limitations of the DSM as a tool:

*The precedence matrix represents the structure of the system, i.e., what affects what. Semantics is the “how” and “why” of these effects. Choosing a good tearing involves an interplay between an analysis of this structure, which can be done with the help of a computer, and engineering judgment about the semantics, which is done by a person (Steward, 1981, p. 73; emphasis in the original).*

(The selection of a “good tearing”, as mentioned earlier, involves choosing, from among the unknown but needed design parameters, those for which reasonable estimates are easily obtained.) Steward’s use of the term “semantics” does not refer to the structural semantics discussed earlier in this chapter, that is, to a lexical set of meanings and their relationships. Rather, his “semantics” is closer to our pragmatic interpretation, as he is referring to an activity that draws on the judgment and intuition of the engineer, and on his experience with similar design problems or perhaps with different problems within a similar context.

Finally, it is worth noting that in his “Notes on the Synthesis of Form”, which is often described as the seminal work in the area of structural design methodologies, (viz. earlier reference), Alexander was actually concerned with finding a good fit between the designed artifact and its context (Alexander, op. cit.). This concern and his approach concern appear closer to our description of a pragmatic interpretive process than a structural one, especially in view of his expansive notion of context—“anything in the world that makes demands of the form” (ibid., p. 19). His proposed approach revolved around identifying all possible sources of “misfits” between the form and its context, be they functional or economic requirements or constraints, and, in a second step, to cluster these variables in subsets based on the density of the interaction between them. His

description of how these interactions might be identified, which is quoted below, leaves no doubt as to the interpretive nature of his approach.

*The search for causal relations of this sort cannot be mechanically experimental or statistical; it requires interpretation: to practice it, we must adopt the same kind of common sense that we have to make use of all the time in the inductive part of science. [...]*

***We shall say that two variables interact if and only if the designer can find some reason (or conceptual model) which makes sense to him and tells him why they should do so (ibid., p. 109). (Emphasis in original.)***

The notion that a better solution to a design problem could be derived solely from a mathematical model and a set of sensitivity analyses seems at odds with Alexander's thinking.<sup>42</sup>

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<sup>42</sup> In the preface to the paperback edition of his book, Alexander makes clear his concern about design methods that remove or abstract the process from practice (Alexander, 1964).

## **Chapter IV: Case Study I**

### *Chrysler Corporation*

The Chrysler Corporation was selected as a site for a case study because it has been at the forefront in adopting several organizational innovations in the area of product development. Examples are the use of small, dedicated platform teams, and the early involvement of, and increased reliance on, outside suppliers. Both of these organizational approaches are featured prominently in this case study. The study centers on the development of the current Chrysler minivan, which falls in a product category that Chrysler pioneered and in which it has enjoyed unmatched market success starting over a decade and a half ago.<sup>43</sup>

Another important factor in selecting Chrysler as a research site is the company's leading role in design, what used to be referred to in the industry as "styling". Chrysler has either pioneered or capitalized on a number of recent trends in the industry, such as "cab-forward" design and retro or "heritage" design. The company has received critical acclaim and a number of awards from the Industrial Designers Society of America for its designs, one in particular in 1995 for the minivan that is the subject of this case (Woodruff, 1995).

### **The NS Minivan Team**

The Chrysler team tasked with developing the Minivan replacement faced an overwhelming challenge: how to come up with a product that would allow the company

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<sup>43</sup> "Pioneering" here refers to the modern minivan, which is typically based on a front-wheel drive platform. There were other minivans that preceded the Chrysler design of the mid 1980s, such as the Volkswagen Bus.

to maintain its dominant position in the minivan segment, at a time when more and more competitors were entering that market. Chrysler had practically “invented” the modern minivan and, over the years, the minivan had become its most visible mainstream product and one of its most profitable. In the words of one informant, that product was the “heart of the company”; it was “holding the company up...” Achieving continued leadership not only required that the development team correctly identify and preserve those aspects of the original design that made it such a success, but also that they find new features and new minivan characteristics that would make the new model a runaway success. The team also had to be inventive enough to anticipate future market pressures, from a number of motivated competitors. One informant compared the situation to being “the first sailboat in the sailboat race, which means you’re out in front and if you screw up, everybody goes in the right direction except you.”

Beyond the uncertainty about customers’ needs and desires, and the uncertainty about competitors’ future moves, a number of factors contributed to making the development of the next minivan more arduous. One such factor was Chrysler’s intention to increase minivan production volumes beyond what the company had been accustomed to. Another factor was one of the main sources of Chrysler’s success at that time, namely, its innovative styling. The company had recently introduced a number of models that were acclaimed for their styling; styling that was seen as aggressive and daring in the case of the Viper sports car, and clean and elegant in the case of a two-door convertible. Even the functional LH sedans had received significant favorable press coverage for their “cab-forward” styling. Yet, given its utilitarian nature, the minivan is the one vehicle where exterior styling plays a secondary role, and where interior packaging is much more important. “This is the vehicle, more than any other, that gets designed from the inside out.” GM’s Pininfarina-designed minivans, the so-called “dustbusters”, were mentioned as an example of a failed design where too much attention was paid to exterior styling, at the expense of interior space utilization.<sup>44</sup>

In the face of these difficulties, the minivan team responded in two seemingly contradictory, or at least inconsistent, ways. The first response was for the team members

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<sup>44</sup> The Pontiac Transport, introduced in 1989.

to become more customer oriented, “really starting to pay attention to the voice of the customers, so we really became tremendous customer advocates.” This focus on the customer was reflected in the number of market clinics that were held around the country, and in the number of intricate and detailed QFDs or “Houses of Quality” that were developed during the course of the project. At the same time, the team’s second response was to rely on what one informant referred to as “the nontraditional kind of decision making”, what at various points team members described as following their “gut feel”. A significant part of this interview was spent trying to unravel this seeming contradiction, and to understand the interplay between these two responses.

### ***His master’s voice: VoC, QFD, and all that***

This intense focus by the minivan team members on the voice of the customer was not meant to imply that the company had not been pro-customer during previous development projects. Still, it is clear from the informants’ comments that customer input was treated differently on this project. Some of these differences were quantitative, relating to timing for example. A thorough customer study was conducted during the very early phases of the project—it was described as “being in an extremely proactive mode with the minivan”, and “really doing our homework up front”—and this study was of “extreme importance” as the project progressed. Another example is the number of consumer clinics that were held and the number of QFD’s that were used.

Other differences were qualitative in nature. For example, to some of the informants, this level of customer involvement in the design process was clearly a novel experience:

*We did create a lot of questions that were used in the clinics to try and help clarify some of the customer requirements, which was probably, quite frankly, at that point in time, a little bit new. I know we weren’t used to doing that exactly as engineers. [...] We’re used to asking questions, but we weren’t used to asking those kinds of questions.*

Perhaps the most significant qualitative difference was the seriousness accorded to the voice of the customer during this project. Statements such as the following indicate that some of our informants might have been somewhat leery of customer input previously:

*And, the top five of those [issues], if you sat around the table with any given cross group, if you went around those, you basically got head nods around the table. It becomes self-evident that this is... obviously what they're telling us is true. We can all relate to this. It makes sense.*

Chrysler had a significant advantage compared to its competitors when it came to collecting customer input. As a result of its leadership position in the minivan market, it had a large pool of customers to draw upon. For example, the team had a number of unsolicited letters from minivan customers, which were carefully scrutinized early on in the development process. The team also had available to it a relatively large number of press reports.

A particularly important source of information, one that was mentioned during different interviews, was the large number of minivan users within Chrysler itself. In particular, a large percentage of the workers at the minivan plants drove what they built. These customers, who were very motivated to see the next minivan succeed, were surveyed and interviewed in depth on several occasions. More importantly, they were not only asked to answer questions on use patterns or to comment on proposals; rather, the development team actively sought their ideas and suggestions for improving the product, effectively bringing them into the development and innovation process.

### ***“Gut feel” and glory***

Amid all this discussion on the importance of market research and of listening to the customer, the informants would bring up, on several occasion, the importance of following their “gut feel” in certain decisions. The archetypal example centered around the decision to offer a fourth door as an option on the minivan. That is, a second sliding door on the left side of the minivan, something that previous models, whether from Chrysler or from its competitors, had never had. One informant, expanding on the previously mentioned “nontraditional kind of decision making”:

*The fourth door was kind of classic in that regard, I mean, you didn't really have really strong... You had a gut feel that was different than maybe what the market research was telling you, you know, in terms of what you would sell. You ended up making the decision on your gut feel more than on traditional market analysis.*

It was not only formal market analysis that argued against the fourth door. Another informant described his personal experience with friends and neighbors, who reacted negatively when they saw the fourth door on a disguised prototype he was driving.

*... people go, Oh, my God, you can't do that! There's a reaction that says, you don't want that, you don't want your kids jumping out. That's the traffic side! Don't go there! This will never sell kind-of-thing.*

It turned out the decision to go with the fourth door was a good one. Not only were 85% of Chrysler new minivans ordered with that option, but competitors had to scramble to respond, first by offering rebates on their otherwise excellent products (the Ford Windstar, a “credible product”, was made “obsolete”, in the words of one of our informants), then by redesigning their products to retrofit them, at great expense, with a fourth door option.

### ***Innovation and the conflict between VoC and “gut feel”***

The conflict between listening to the voice of the customer and listening to one’s “gut feel” showed up mainly in situations that involved innovations, ideas with which the development team did not have previous experience, and for which market data was not available. Consequently, the conflict was central to the struggle to differentiate the new minivan from its competition. The development team members were very aware that they could not hope to come up with the necessary innovations simply by relying on customer input and data. This point was made perfectly clear by one informant as he explained how decisions driven by QFD and those inspired by “gut feel” played different roles in the development process, and how one complemented the other.

*One [QFD] is based on data from the customer in a unique methodical translation of what we feel the customer wants [...]. The other one [“gut-feel”] is... If you were to do that, everybody would have the same product, because everybody listens to the same voice of the customer. [...] But how you execute that and how far you carry the design, and how innovative you want to be, how anticipative you can be, that's what the difference is; and how [much of a] risk-taker you are.*

(The connection between innovation and risk-taking is discussed in a later section.)

It should be pointed out that this notion that design by market research is incompatible with innovative design is an old one. Critics and the specialized press will often refer to an unimaginative or unexciting product as having been designed by marketers who lack passion for the product. By contrast, our informants mentioned passion several times during this interview, which is remarkable considering that these were mostly engineers, not designers, and the project in question involved a minivan, not some high performance sports car. How were the minivan team members able to combine market research and the voice of the customer on one hand, and their “gut-feel” and self-professed passion for the automobile on the other? The decision concerning the fourth door is instructive here.

### ***The answer to the dilemma: interpretation***

It would be unfair to say that using customer data and relying on “gut feel” were two mutually exclusive decision making modes, each one applied under different conditions. In fact, in all decisions relating to the minivan project, both modes appear to have been involved to varying degrees. This makes sense: it would be difficult for someone to simply turn off one’s intuition or emotions when looking at a set of research results. Furthermore, on most issues it appears that “gut feel” and the customer data were in accord; these were the easier decisions, as explained by one informant:

*And, if the gut supports the QFD, then you're pretty comfortable. When the gut and the QFD are a little ways apart, you don't know which one to believe, you can either believe your gut, and throw a whole bunch of money and take a chance, or you can believe the QFD and be safe. When you got that conflict, you've got to kind of say, something's going on here, we've got to understand this, and then you've got to dive in a little more...*

It is the cases of conflict that are more instructive and that are the focus of this section. What did it mean, in the case of the fourth door, “to dive in a little more”? This question was answered by another informant:

*... that kind of goes back to gut, which you use. You can take it back to these top ten items, what is the vehicle for? And what you find is, utility; and knowing the vehicle and knowing the customer, knowing what you do with it every day, and having a team that's used to using these things, saying, now, if you had a door there and you could just put your stuff in every day, and you can think of ten examples in the last week where you*

*could use that, it all fits back with the QFD, it all fits back with your experience every day, and everybody sees that there's almost no negative. You put a child latch on it, it takes care of the people who don't want people to be able to jump out, and you've got almost at some point [to] say, How could this be wrong? And you've got to go forward...*

In order to resolve the conflict, the team members went back to their own understanding of the basic purpose of the minivan as a vehicle; what they latched onto was utility. Instead of trying to resolve the conflict at the level of the feature itself (whether to have a fourth door or not, whether to use a sliding door or hinged one), they moved the discussion to higher level of abstraction, to the realm of the customer's needs and wants. They then interpreted those needs and wants in their own way, which resulted in the designers including a sliding fourth door as an option.

In doing so, the team members were substituting their own preferences, their notion of what the product should be like, to those of the customer. Effectively, they were saying to the customer, "You don't really know what features you need on this vehicle; just tell us what you want to do with it, how you want to use it; we'll tell you what you need." Such an approach does not accord with the prevailing analytical view of product development, where the customer is assumed to know best, and where the designer's job is to generate a verbatim translation of the customer's wishes.

Such interpretation can only be successful if the interpreter, unlike a mechanical translator, has a thorough understanding of the worldview of the speaker whose utterances he or she is interpreting. In other words, the designer or design team have to thoroughly understand the background, concerns, and interests of the user of the product. From the above quotation, it appears that the Chrysler team members did indeed achieve such a high level of oneness with the customer ("knowing the customer") and, in many cases, effectively lived the life of the typical minivan user.

It is only in this context of sharing the life of the customer that certain of the informants' statements begin to make sense. For example, the following comment about the emotional side of understanding the product and listening to the customer:

*I think we had, as a group, we had a real strong sense of the product, that's hard to put on paper. It just doesn't come out--and that's where the*

*gut comes in--it just doesn't come out in the QFD and all the rest of that stuff. Those are, they're good processes, but they're a little bit mechanical too, in their own way, and there's this emotion side of it that when you listen to what people are saying...*

External integration between the designer and the customer is only one aspect of successful product development. The above statement also points out the importance of the fact that the whole group had a “shared sense of the product”. In the case of a multidisciplinary development team, this internal integration is another key ingredient for successful interpretation. The findings at Chrysler regarding this issue are presented next.

### ***What makes interpretation work in this case? The team***

By definition, acts of interpretation draw on the interpreters' worldview, background knowledge and understanding, and his or her assumptions about how things function and what lies at the root of empirical observations. Interpretation is also intrinsically connected to the interpreter's concerns, interests, and immediate goals. They are therefore highly personal and subjective acts, and one person's interpretation of a given situation will generally differ from another's, to varying degrees.

This subjective aspect of interpretation can be the cause of disagreement and friction when a number of people are brought together to work on a situation involving interpretation; in particular if these individuals have different technical and professional backgrounds and goals (Clausing's “dysfunctional specialization” (Clausing, 1993).) Chrysler's minivan team members appear to have avoided such problems due to the high degree of cohesiveness within the team.

There are two at least two conceptions of how a team functions. In the first, the team is seen as a set of individuals, each with a different set of beliefs and a different perspective on the situation at hand, who come together to perform a given set of tasks. Even though these individuals all have the same goal, they never really develop a common vision of what the solution ought to look like. The team then becomes a forum for them to compromise, each to a varying degree accepting less than what he or she believes the ideal solution should be.

The other conception of the team is one in which the individuals end up developing a shared perspective on the situation and a common vision of the solution. The team then becomes an integrated entity with many of the characteristics one would ascribe to an individual, such as a distinct personality, convictions and passion. In that case, the team members are no longer searching for a compromise solution, the one having to do with less in order that the others can also get some of what they want. Rather, each team member becomes equally concerned with making sure that the needs of the others are met, because each team member understands the importance of the others' contributions to the overall solution, which is also his goal.

When the minivan project first started, Chrysler's reorganization into dedicated platform teams was close to being complete, and by then the company "had worked some of the bugs out" from that organizational model. According to one informant:

*... it was the first time really that all the disciplines came together as a team [...] so when decisions were made, everybody bought into it. There was a great deal of compromise, but there was no arguing later...*

Although the term compromise was mentioned here and in other statements (e.g., "Sometimes, between two competing parties, you have to strike a marriage of convenience..."), other statements make it clear that a higher level of integration was present within the team. In particular, the engineers on the team were not only thinking in terms of the technical aspect of their solutions; but they were equally concerned about the marketability and the financial viability of their solutions, as well as the long term success of the company. The following statement by the Executive Engineer on the team is typical:

*Everything we do is... we're in business to delight customers and make money. I think, we're not in the business to do one or the other, we're in the business to do both because I think you've got to do both to kind of be successful over the long haul. [...] we want to be a nice profitable well-thought of company—for a long time.*

Another statement, concerning his interaction with the finance staff, is also indicative:

*... the few times I had dealings with them [the finance people], it was them trying to figure out how to get me to do something that, you know, I didn't*

*really want to do necessarily. But as we kind of reorganized our thinking as a company in the dedicated platform teams, the thing that became instantaneously clear when they did that was what an ally finance really was, or is. They were the most cooperative, the most knowledgeable, the most helpful group of people that I ever worked with. [...] and it's not like they weren't that way before, but it's just kind of the alignment of the goals, you know, quite frankly made everybody work in the best interest of the product.*

Although the above mentioned goal alignment is often used to explain why teams work, it is not enough to guarantee close integration within a team. It is possible for different team members to share a goal while simultaneously maintaining their particular perspective on what that goal means. The difference in this case is the scope and nature of the goal that the team set for itself. On several occasions, the informants made it clear that their goal was not simply to produce a product that would be desirable in the marketplace, but one that would be a financial success as well. One informant described this as a “critical success factor” that is “really underlooked” and “not well-understood.” This broad definition of the goal—the focus on financial success—must have played a key role in opening up the space necessary for the close working relationship to develop between finance and engineering. By focusing on both market as well as financial success, the finance people on the team had to develop an appreciation for what the market was asking for in terms of features and performance characteristics. They could no longer simply be “the people who said ‘No. It costs too much.’” Similarly, the engineers had to evolve the same concern for cost and profit that previously had been the province of the “bean-counters.”

Within this atmosphere, where every team member was concerned with the other members’ problems, compromise was not a zero-sum game. According to one informant: “Everybody’s needs were supported sufficiently so that we had a good balance of product.” The free flow of information between team members and a focus on communication are prerequisites for this type of open atmosphere. This was described by the Executive Engineer in the following comment:

*Because there was more conversation from more different points of view to basically create, not a consensus necessarily, but to create a nice*

*picture of [the situation.] If you were looking at a feature discussion or a fourth door, so what do you see good about it, what do you totally see bad about it, not just from a technical perspective, but from a marketing perspective, from a design perspective, styling perspective. You can see all of that conversation come together at one time, the manufacturing side of it too. And, quite frankly, it just sort of helped level the playing field of information that everybody that was relevant to making the decision had.*

Another indication that the minivan team was a truly integrated team is that team members were not afraid to admit their failures to each other, and to ask for help, as explained by the engineering manager in charge of noise and vibration (NVH):

*But I think for me personally, the team also provided the environment conducive to self-catharsis. I was no longer afraid to say, I have failed someplace, because I knew somebody was going to help me out. As opposed to before, How am I going to say that? Somebody is going to nail me.*

At this point, it is useful to discuss some of the factors that contributed to the success of the minivan team. A key “enabler”, mentioned by the informants on several occasions, was the “enormously supportive” upper management team that was in place at Chrysler. Equally important, this support came with relatively little meddling in the team’s decision making. Again, the NVH manager:

*Management this time was a partner, as opposed to previous years [... when] we were always afraid. This time they were our friends. They were there, and they supported anything that really made sense and you know, they really turned us loose to do the engineering, to do the development, to do the selling, to do the advertising, to do everything.*

An important factor must have been the deep sense of responsibility that the team members felt towards the rest of the corporation, due to the importance of the minivan to Chrysler. Presumably, the feeling that the “survival” of the corporation was at stake must have played a key role in focusing every member’s attention on the financial success of the product as the ultimate, overarching goal.

The team members were also cognizant that they were “carrying a heavy tradition”, in view of the success of Chrysler’s previous minivans. Accordingly, the team members

were “extremely motivated [and] passionate,” and they “were always charged up, continuously.” Their pride in their accomplishment was clearly apparent throughout the interview.

Achieving such a tightly integrated team was clearly helped by the fact that many team members were also minivan users (see previous comment about “having a team that’s used to using these things.”) This last point suggests that the distinction made here between internal integration (within the team) and external integration (with the customer) is somewhat artificial, that it is more a matter of convenience than reality. The engineer’s attentiveness to the needs of the customer, which was the subject of the previous section, may have been, in the end, the result of engineers and marketers working closely together on the same team.

### ***Conviction, trust, and innovation***

The two previous sections described the minivan team’s ability to innovate as resulting from the team members playing various interpretive roles. Yet, the language used most often by the informants to describe those situations that resulted in innovative ideas was that of risk, and the team’s willingness to take risks. The team members credited the dedicated team structure with making possible those risky decisions that relied more on gut feel than hard market data. This section attempts to bridge these two aspects of innovation, namely, risk-taking and interpretation.

First, let’s look at the interface between the design team and the customer. The lack of customer data relating to the decisions in question made them, by definition, risky decisions. In the analytical language of decision making in uncertain situations, risk is directly proportional to the information gap, that is, the difference between the available information and the information that is needed to eliminate any probability of the wrong decision being made (Suh, 1990). There are several possible responses to such a situation. The first is to obtain additional data to reduce the risk of the decision to an acceptable level. A second answer to a situation marked by incomplete information is to choose a course of action that would be satisfactory, or simply acceptable, under the widest range of possible outcomes. A third response is to forego making a decision at that point, and to diversify the risk by pursuing several parallel courses of action, each relating to a

different likely outcome. These responses generally entail added expenditures of time and resources, whether it is the cost of obtaining additional information, or the cost of simultaneously pursuing more than one track. These added expenditures are often prohibitive (hence the need for a decision in the first place.) In the case of the second response, a very important cost may be compromised performance. By seeking to adequately serve a wide population of potential customers, the product is less likely to delight any of them. How does the interpretive notion of external integration (or customer-designer integration) compare to these analytical responses?

In a sense, external integration is about obtaining more information about the customer in order to make better product decisions. However, the information in question does not necessarily fit the definition of hard analytical data, as envisaged by the analytical model. Rather, the “data” might take the form of tacit elements in a vision of the product that is yet to be fully understood or articulated, let alone coded in precise features and specifications. Interpretive external integration is about reaching a stage in which the designer, by sharing enough of the relevant aspects of the life of the customer, gains a kind of implicit understanding of the needs, wants, and concerns of that customer, to the point where such a vision can begin to take shape in his or her mind. This is quite different from gathering “analytical” data through clinics or test markets.

The analytical thinking about risk management and the interpretive approach differ drastically when it comes to the second possible approach to managing risk, namely, choosing a compromise solution. One obvious compromise answer to the fourth door dilemma would have been for the team to design a normal hinged door. It would have been less expensive to engineer and build, and since an open hinged door is easily visible to drivers approaching from behind, it would have allayed the safety concerns brought up by those who saw the prototypes. The downside of such a design would have been in the areas of convenience and utility. That compromise solution was considered and rejected by the team. Instead of compromise, interpretive thinking is more likely to lead to a sense of conviction emerging within the design team, conviction that stems from their implicit or visceral understanding of who the customer is and what she wants, and that leads them

to see one particular solution is the best one for that customer. That sense of conviction is captured in the following by one of the informants:

*Quite frankly, we trusted our gut because, if you go back right through the number of iterations of different styles of door—we looked at hinged and sliding—and [...] we kept trying to convince ourselves to do a hinged door [because] it would be easy. But [...] you kept circling back around it, and every time you looked at it, you said, if I'm going to do it, I ought to do it as a slider. It was exactly the right thing to do because it had the most utility as a slider. And, ultimately, we made that decision, okay, and I think we, quite frankly, in making that decision we set the standard for the industry again [...]*

A compromise solution or half-measure will generally show up in the product and will be readily apparent to the customers and the critics when they are first exposed to the product, especially since they are not privy to all the trade-offs inherent in the decision. The designers, on the other hand, would have been living with the product for some time before its release to the market, and they would have come to accept the decision, and come to see it as the best answer to the well-circumscribed cost-benefit problem in question. From an analytical point of view, given a certain objective function combining utility, safety and cost, the hinged door solution might have been optimal. How a minivan with a sliding door on one side and a hinged door on the other would have been received by the public is less clear. At best, the lack of symmetry would have raised some questions. The team's conviction in this case not only resulted in a product with a unified design aesthetic and a sense of integrity, but their interpretive approach to the problem allowed them to see beyond the parameters that were germane to the trade-off, and to see possibilities and synergies in areas that are only indirectly connected to the decision itself. This is clear from the following comment:

*And, then an extension of that was the decision to project that we would put more of the captain's chairs in the second [row], instead of a bench seat across the back, and what evolved was, now you've got four people, each with their own door and their own seat [...] So it offers something that a car doesn't in that you've got all this individuality. You've got two teenage kids that hate each other; they don't want to be close to each other. They sit next to each other, but they [...] are separate; separate seats, separate doors, separate everything.*

Finally, as far as the third approach to risk management is concerned, namely, diversifying risk by pursuing different parallel tracks, the story of the minivan team and the fourth door decision does not have much to teach us. Since the fourth door is offered as an option, not as standard equipment on all minivans produced, one could say that it conforms to that model of risk diversification. It is therefore difficult to draw distinctions from that example concerning any differences between the analytical and the interpretive approaches regarding this approach.

Now, let's turn to issues of internal integration among the different team members. From this perspective as well, risky decisions abound: at any point in time during the development process, the team has to rely on information from team members representing the various technical areas, information that is generally incomplete, provisional and equivocal. In addition, the actors may have incentives to conceal and distort information. For example, it may be that preliminary noise and vibration test data do not meet the expectations or the goals set by the development team, and the NVH development engineer may decide not to share that information, in the hope that his group will be able to remedy the situation in the near future. Or, in the case of packaging, the powertrain designers may intentionally ask for more space in the engine bay than they really need, just to be on the safe side, in case cooling problems arise for example, and to make their job easier. Given all this uncertainty, the traditional responses to managing risk are the same ones described above: expend more time and effort to get better information; compromise the design to allow for a range of outcomes; diversify the risk by following several parallel solutions. In all cases, the downside is increased cost, delays, and a loss of integrity in the result. The Chrysler minivan team appears to have avoided these pitfalls, thanks to the tight integration within the team and the resulting high level of trust between the team members.

During the interviews, openness and trust emerged as key aspects of internal integration, playing a role equivalent to that played by conviction in the case of external integration. In a dedicated platform team, the team members are more comfortable making risky decisions, because they perceive the quality of the information available to them as being greater. At a first level, this is due to the increased trust that team members have in each

others' technical competence that results from them working closely together for a significant period of time on a single project. Here is how one informant put it:

*There's a comfort in that you know that the other guy... For instance, if you're the marketing guy and I'm the engineering, I'm not necessarily sure you know what the hell you're doing, right? But if you're working with her every day, you say, the marketing guys don't know a lot about engineering, but it looks like they know a lot about marketing. So I can trust you a little more. So the level of trust goes up and therefore the level of confidence goes up.*

At a higher level, the trust among team members shifts from a trust in the other members' technical abilities, to a belief that all the team members are going to place the common good of the whole team ahead of their personal or parochial interests. The following quote makes it clear that such a level of trust is present within the Minivan team, although, in this case, the informant attributes it to the instrumentality of goal alignment among the team members:

*[In the old days, you probably wouldn't have a meeting with all those people around the same table unless you had a crisis of enormous importance.] Or, if you did, you weren't sure that they were all going to play their hands out the first time. I think that's one of the key differences... And it goes back to being financially successful as a platform. When you're committed to being financially successful as a platform, then nobody has a reason to hide anything or delay saying something [There are] no ambushes.*

This increased level of trust between team members translated into a higher level of comfort with taking risky decisions, as the following quote indicates:

*I think it's comfort with the risk. You can be more comfortable at a higher level of risk because you understand more about it, instead of the classic way of doing it, marketing fires a salvo at engineering, and engineering fires a salvo at manufacturing, and they fire a salvo over at sales, and everybody goes around saying, I don't know if I believe you [...]*

At the next level, trust affects more than the team members' perception of the quality of the information that they are getting from one another. As the level of openness and trust within the team increases, team members feel comfortable taking more chances and

trying more innovative solution to their problems, because the fear of failure (and retribution in case of failure) is reduced, as we saw earlier.

A dedicated team with so much conviction in its own beliefs and so much trust between its members is like a high-gain closed-loop system: it is capable of very high performance, but it could also easily go unstable. What prevented the minivan team members from losing touch with reality by creating a distorted version of their own, and from trusting and supporting each other all the way over the deep end? One form of control came from the team members themselves. The trust between the team members was neither blind nor unconditional. The core team members were experienced in automobile design and carefully scrutinized each other's decisions:

*Everybody was always over cost, and you always had people kind of nipping at you, and challenging what you were doing. All constructively.*

And:

*Being a team doesn't mean that this is a love-in. It's like a family and everybody's got their own little part in it, and so they all challenge each other.*

The other source of control was external to the team, as upper management provided a form of reality check. Generally, all the informants praised upper management a number of times for being supportive of the team, and for trusting the team and allowing it to do the job it was assigned without meddling. Following are two typical comments:

*Management in this time was a partner as opposed to previous years that I was there, and for good reason, that they... we were always afraid. This time they were our friends. They were there, and they supported anything that really made sense and, you know, they really turned us loose to do the engineering, to do the development, to do the selling, to do the advertising, to do everything. And that is really quite different when management is really part of your team and a good partner; you have added confidence in the importance of the project [...]*

And:

*And, in the past we were more driven by [...] what the top guy wanted, on a given Tuesday.*

However, in at least one instance, upper management played an important role in redirecting the efforts of the team. That was in the areas of noise and vibration (NVH), and it happened late in the development process, when it became clear that the prototypes were falling short of the expected performance levels, as described by one informant:

*Let's talk about the total NVH picture. We presented, let's say, a status report to management, through ride-and-drive, and they were not happy with where the NVH was. That was almost late in the program. [...] So, what happened was, we went to work from the technical side, so we put together a property that says here's how we ought to be.*

It should be pointed out however that the team's esprit de corps and the supervisory role of upper management did not translate into an "us versus them" attitude. The interviews indicate that there was mutual respect and trust between the core team and upper management, who were seen by the team members as equally competent and passionate about the product. This is captured in the following comment:

*It was very comforting when you [...] have your high-level management people, and product planners, marketing, and the only thing you could hear, I remember this specific instance, I think, it was, GO FOR IT! To me, the president and the vice-chairman, [when] he gives credence to your gut feel. I mean there's got to be something right. [...] Now you're approaching the area that we're going to talk about, the passion that we have for the automobile.*

Without the strong cohesiveness and trust within the team, and without the strong support of upper management, it is difficult to imagine how the team members would have felt confident enough in their judgment to pursue directions that clearly ran against what the analytical market research findings were telling them.

## **The Design Office**

The dedicated platform team is one of the most significant recent developments in the organization of new product development at Chrysler. Still, the most visible element of the new minivan was the work of the staff of an "old-style", functionally specialized corporate office, the Design Office (DO). In view of the importance of design to the success of several recent Chrysler products, one of two directors in the Design Office was

interviewed at length, and the main findings are presented in this section. To summarize, these are three. The first is a strong connection between innovation and creativity on the one hand, and the relaxation of practical constraints on the other. The second is the responsibility of the designer in leading the customer, a different relationship than the customer-designer relationship that emerged from the NS Minivan team interviews, and the strong fashion aspect of design that is behind this attitude. The third finding relates to the sources of new ideas.

The Design Office is a corporate office responsible for exterior design (previously referred to as “styling”), interior design, fabrics, and colors. It employs about 330 people, and is organized into two groups under two directors. One is responsible for the exterior design of passenger cars, including minivans. The other is in charge of designing jeeps and trucks, and is responsible for interior design, fabrics, and colors on all Chrysler Corp. vehicles. At the time of the development of the NS minivan, the Design Office directorates were further divided into an Advanced Packaging Group and a Production Group. Advanced Packaging works on the styling and general layout (or packaging) of the vehicle in the early design or concept phase. The Production Group gets involved in the next phase of the process, in order to refine the design and make it production ready. The DO also comprises an ancillary group in California called Pacifica Group, whose task is to provide alternative ideas and concepts. Pacifica’s work is limited to advanced packaging, as they have no production design capability.

The corporate Design Office is not part of any platform, but they work with all the platform teams. In the new dedicated platform team organization, the team itself—in particular the DO staff members who are quasi-permanently assigned to the team—would start thinking about the next generation model and developing ideas and proposals for it as soon as their work on the current one is done. In the case of the NS minivan product, the platform organization was still being developed when the project was launched, and the work on the various design proposals therefore came directly from the DO. The details follow.

## ***Creativity v. practical considerations***

The Advanced Packaging Group and Pacifica initially developed a total of four proposals. Their work was described by our informant as “very right brain”, “very creative , not all that analytical”. These proposals were based on general organizing themes, reflected in the names they were given: “Silver Bullet”, “Reach”, “Response”, and “Euro”. In the case of “silver bullet”, the studio was told, “if you had one shot to do the best next-generation minivan, based on everything you know, all the data that you can get, all the experience that you’ve had, and seeing them and driving them and so on, what would that next generation minivan be like?” “Reach” on the other hand was based on the idea that, given that the “silver bullet” design was the next minivan, what would the generation after that look like?

In the case of “reach” designs, the designers are told to be less constrained by practical considerations. They are encouraged to make optimistic assumptions about technological advances that would affect their work. For example, a designer may choose to assume that there is going to be a breakthrough in the cooling system of the engine, allowing a significantly smaller front overhang (the distance between the forward edge of the front bumper and the front axle.) The relaxation of existing practical constraints is seen as an important gateway to creativity, as our informant put it:

*When it's a 'reach' property, it's a little bit further out, things can be far more creative, you can do things that... it might be a crazy idea, but maybe it will work, maybe it will look good, maybe it won't look good. Maybe it will be functional, maybe it won't be.*

“Response”, the third preliminary proposal, was the result of interactions between the DO and the Executive Engineer in charge of body engineering, a core member of the NS team, which was in the process of being assembled at that time. “Response” was basically “silver bullet” modified to allow for more practical engineering considerations and constraints, such as structural members of realistic dimensions.

## ***Pacifica: creativity though isolation***

The fourth proposal was done by Chrysler’s Pacifica group, which was tasked with doing what they thought would be the “ideal European minivan”. From the interview material,

it is not clear why Pacifica was given that particular task, or what the significance of Pacifica's contribution to the overall project was. Still, Pacifica illustrates very well the underlying notion that permeated the whole interview, namely, that creativity can only blossom when practical considerations and constraints are relaxed and even disregarded.

Pacifica group consists of approximately 20 people, located in California. Their task is to provide the corporation with an alternative viewpoint and product ideas. To that end, visits to Pacifica by personnel or management from Detroit are intentionally kept to a minimum. For instance, major corporate visits to Pacifica take place only about once a year. The reasoning is that Pacifica's personnel must be kept away from the daily concerns of their counterparts in Detroit in order for their thinking to remain independent, and their ideas different. As our informant put it:

*Pacifica we generally use to give us alternative points of view that are not constrained by... I mean, we don't go out there that much. We have corporate visits out there, major corporate visits, maybe once a year. But we intentionally keep them away from a lot of the day to day kind of business that we have here, with the intent that they'll come up with something that we aren't thinking about because they're not constrained by the consistent thought process that's running through the offices here.*

Later in the interview, he sharpened the conflict between creativity and day-to-day concerns. From the following comment however, it is not clear whether the Pacifica designers are expected to come up with new and different solutions to given problems because they are removed from the dominant way of thinking of the rest of the corporation, or whether they are simply being asked to develop ideas on the assumption or the wish that these problems do not exist in the first place, or that they are somehow solvable:

*We try to maximize their [Pacifica] creativity, minimize the influences that would tend to homogenize it and bring it down to the level of, 'But don't you know that would be hard to manufacture?' 'Don't you know it would be hard to package it?' Or, 'Don't you know that the cooling problems that we were having with whatever?' [...]*

This notion of helping creativity through isolation from the daily problems and concerns finds its ultimate expression in the “sabbatical room” at Pacifica. The purpose of this room was explained as follows:

*At Pacifica, for example, we have a sabbatical room. You know, the theory behind the sabbatical room is that a designer can schedule a week off like he does vacation, except he doesn't [go on vacation]; he's still at work; he's just in a different room, and he's not involved with any of the projects over here. And what he's expected to do is to do something we haven't seen before. [...] And, the intent, again: Here is the studio that is most removed from Chrysler to begin with, [and we're] saying that even within that environment, designers need to have some time when they're not just working on something that their management says that they should work on. So fine, go out into this room; you've got a week; show me something that I haven't seen before. And from that sort of thing, we would expect to get things that are, whatever's going to come after 'Heritage' [Chrysler's current design trend], and whatever's going to come after Ford's 'Edge' [Ford's latest design theme], or whatever.*

It is noteworthy that Pacifica's immersion in the Southern California car culture was never mentioned in the interview. When US companies set up satellite design offices on the West Coast in the 1980s, one often-mentioned rationale was the need to tap into the California car culture, which is considered a harbinger of the trends that will come later to the rest of the country. It may be that this particular rationale for Pacifica's existence is so entrenched that it was taken for granted and never mentioned. More likely, it seems that Pacifica's significance and importance lays more in its distance away from Detroit than in its location in California.

### ***Design decisions: conviction, responsibility, and what the boss wants***

We now turn to the process of selecting from among the different proposals described above. The focus in this section is on the role of the customer, the role of the designers, and the role of upper management in this selection process.

The four proposals, “Silver bullet”, “Reach”, “Response”, and “Euro”, were developed into full-size fiberglass mockups, complete with representative exteriors, interiors, and seating areas. These mockups were used in customer research clinics, in which

participants were asked about the desirability of certain features, such as the fourth door, and to rate the different proposals using a list of 25 descriptive terms such as “sporty”, “luxurious”, and “efficient”. The data were then sorted based on the informants’ age, sex, income, and so on. From experience, Chrysler knows that certain cohorts are better predictors of future trends in certain product areas than others, and the information was used to “give us [the designers] the best example of what direction we should take the vehicle in.”

It is not clear from the interview how closely these customer data were really used. The informant went on to say that sometimes, such data is ignored, as the designers relied on their own conviction of where the product design should go in the future. The reason given for ignoring customer input is the time gap between the future life of the customer into which the new product is intended to fit, and the current world in which the customer lives.

*... sometimes you have to ignore it all, because you recognize that all of these people are living in that current day; you're planning on something three years away from that day, and sometimes you have to have the courage of your own convictions to say that, I know that three years from now...*

The designers on the other hand, by the nature of the work they do, are analyzing data about the future and studying trends, they are thinking about the future and imagining what it could be like. They are effectively living in the future, and are therefore in a better position to “know” what people will want and need a few years down the line.

The above explanation about the time lag inherent in working on future projects could be taken at face value, and it would make sense from an analytical perspective. If there is a preexisting future reality out there that is coming at some point in time, then it would only make sense that people who are actively involved in tracking trends and analyzing data on demographics would be in a better position to see that future, compared to the average customer who is concentrating on the daily concerns of today. However, there is another dimension to the informant’s explanation that is not captured by analytical thinking. Although it is not articulated during the interview, it is hinted at in a number of the responses and comments, including the one above, in the form of the “courage of [the

designer's] convictions" is mentioned above. This additional dimension also shows up as a responsibility on the part of the designer, which is not merely about getting a pre-existing truth from the customer about the future, but goes beyond to contribute in shaping that future. The example given to illustrate the point was the introduction of the original minivan in the 1980s. The research data on that design was negative, as many informants "thought it was homely, and could not see themselves buying one."

The special responsibility of the designer became clear as the informant went on to describe the next phase in the design process. The four concept proposals are used to get "concept approval", a point at which all the parameters of the package are set, including cost, projected volume, engine choice, suspension design, and so on. At that point, the designers go into "execution mode", and develop a number of "themes" based on that package definition and the now fixed dimensions with which they have to work. Generally, between six and ten themes will be developed in clay, and about four in fiberglass. These are used in the "theme selection" process. Here again, the role of customer input into the decision making process is even less clear, if there is any. Asked if any consumer clinics are used for theme selection, our informant answered "We clinic them after we've chosen them" and laughed. He went on to explain

*It's not fair... It's not fair to ask the customer... To me, it's a real executive cop-out to say, well, the research customer told me this was the best theme, so I guess that must be it. [...] It's not fair to ask them to make the decision. It's not fair to your own corporation to say, you know, I'm only here to run the research clinics. My gosh. You've been hired to be the expert in design; why not be the expert in design?*

Although the informant did not further articulate what it means to be "the expert in design", it is clear that his understanding of that responsibility went beyond mechanically translating the customer's pre-existing preferences. In fact, one can sense a hint of a patrician view of the designer's role, one that puts the designer in a privileged if not all-knowing position. This special role of the designer showed up in a later comment, as the informant was further describing the theme selection process. This is a multi-step process. In the first step, the designers vote on their favorite theme; but it is only the design professionals, people who understand design, who get to vote:

*The process we go through right now is, we'll put the models in our showroom; we'll have everybody from the design office come in and vote on it. From the design office! These are all the designers and the modelers and, you know, people who are sensitive to design, trained in design. We'll have them come in and vote. We've ignored that vote in the past.*

Still, the professional designers are not the ultimate decision makers, and their vote is sometimes ignored by the design executives. Admittedly, this has only happened in rare cases, where the voting was very close. Still, one is left to wonder about who the ultimate decision makers are. Our informant explained that the styling decisions are really made by the top executives of the corporation, with recommendations from the different levels of executives:

*Realistically, the decision is confirmed by the broader group; the decision is made by the design office with our vice president, John Hurlitz, with our executive vice president who is also in charge of product development, Tom Gale; by the president of the company, who is now Bob Eaton, and by our head coach, Bob Lutz. I mean, that's really the group that makes that decision.*

This was later confirmed by another informant, a director in Advanced Manufacturing Engineering, as she commented on how her group might support design and styling decisions:

*Well, that's not how decisions are necessarily made on aesthetics. In our company it's more of a collaboration of the top officers in the company who have a tremendous base of experience in that area, and of the design office bringing forward choices. And what we'll have to work with is to make sure that when a team of people are making decisions about whether a looks better than b-- and much of that is purely subjective rather than objective -- we can help them to understand, you know, that here is a and it costs x, and here is b and it costs y. And they can then make a more informed business decision, so it's not purely an aesthetic decision.*

The fact that the top executives at Chrysler appear to reserve to themselves such a decision making role is at odds with current management thinking, where the push is to move decision making as low as possible within the corporate hierarchy, and to rely as much as possible on customer input in designing new products. It does however explain

an expression that was mentioned several times during the interview, about the “courage of the executive conviction.”

The notion that conviction on the part of upper management is an important element in the way styling decisions are arrived at is closely related to how they see the role of the corporation in the marketplace. Chrysler management often talk about wanting to design cars that people can be passionate about, and they feel that passion in the customer cannot be aroused, and the consumer drawn to the product, by producing designs that appeal to the greatest common denominator of consumer preferences. There are many examples of such designs in Chrysler’s portfolio, such as the Dodge Viper and the Plymouth Prowler, which are low-volume specialized vehicles. But the same thinking is present in high-volume high-margins products, such as the very popular Ram trucks. The story of that design follows:

*[...] when I say we want to build cars and trucks that people are passionate about, it says that we are willing to do things that are more polarizing, we're willing to do things that don't fit the average description. I'll use the Ram truck as an example. When we were doing [...] the packaging on the Ram truck [...] we were trying a lot of different things, and we were researching them, and if it didn't look like a Ford truck or a Chevy truck it was, Pfffft, forget it. It had to look like one of those, or forget it, nobody wanted it. So, if you were to listen to research, you would do a new truck—because this was going to be our first new truck in 20 years or whatever—you would do one that looked just like a Ford or a Chevy, and that would have failed, or we probably would have kept our 7 or 8% of the market. But that would have failed, because it wasn't anything anybody could be passionate about. They already owned Fords and Chevys and why would they buy a Dodge when they could have the real thing? [...] So instead of doing that, we did one that was polarizing, that when we took it out and researched it, there were some people that **loved** it [his emphasis], some people that **hated** it [ditto], and but it wasn't in the middle. And that's the kind of reaction that we want to have to our products. We want to have some people love it, be **passionate** about it; and it doesn't matter if the rest of the people aren't. It comes back to [the fact that] people never buy their second choice vehicle. “It's really nice” but they don't buy their second choice, they buy their first choice; assuming they can afford it, I mean.*

## **Why have a separate DO?**

The answer to this question is twofold. First, the DO is responsible for developing new ideas that would not fit, at least not a priori, within the mission of any particular team. Second, the DO performs an integrative function across teams as it disseminates some of these ideas. The following sections discuss these two roles in detail.

### **1. Developing and exploring new ideas**

Within this role, one can distinguish three classes of activities. In the first category, the activities are product or platform specific. The best example of such activity is the work done by the Design Office for the minivan platform early on, when they developed a range of studies as described earlier. Although platform specific, this work went beyond what would have been done within the platform team itself. The early minivan studies were described by our informant as having “corporate visibility” or “corporate focus”, meaning that the top management at Chrysler was aware of and specifically approved the range of ideas covered by these studies. They felt that the range of ideas was broad enough that these studies would contribute to the future design direction of the minivan and of the corporation as a whole. Our informant explained that, had the Design Office been purely responsible to the minivan team, they would have only developed one of these studies, specifically, the “Response” study. Given the time and profitability constraints under which the team must operate, it would have focused on the readily feasible and immediately relevant, and it would have found it difficult to fund such a wide range of studies. Our informant tied the independence of the DO to its ability to be more creative and less constrained by accepted thinking and market data. This is all captured in the following quote:

*These [the different minivan studies—‘Silver bullet’, ‘Reach’, ‘Response’, and ‘Euro’] were all done about the same time, and these were done about three and a half to four years ahead of launch. So, then we went out and researched those, and we were talking, as far as visibility is concerned, corporate visibility; and the president and so on are all aware of what we’re doing: ‘Yeah, that’s right, that’s a good spread of ways of looking at the vehicle and from this we think we can get a good answer.’ If we had had strictly team responsibility, in other words, if the platform team dictated what we would do, the ‘Response’ may have been the only vehicle we would do, because that was in response to the team. So, by being*

*independent, we have some greater ability to go out of the box in our thinking and try to reach for decisions that are more creative, that don't fit the 'analysis'.*

The cost to the corporation of not having this range of design exploration work performed goes beyond the danger of ending up with a bland, “me-too” minivan in this product cycle. The greater danger lies in losing important elements of conversation within the organization, between engineering and styling for example, relating to future product cycles. By proposing a futuristic “Reach” design that requires some super-efficient not yet developed cooling technology, Pacifica might push the cooling system people within Chrysler or within its family of suppliers to pursue a product development direction that they would not normally have followed, and thus to make such a design feasible at a future point in time.

The second class of activity in which the DO engages, and which is unlikely to be undertaken by the platform teams, is the work of developing corporate or brand design themes. This type of work was touched upon earlier, in the context of describing the sabbatical room at Pacifica, and it was described by our informant as being “a matter of continual experimentation and investigation and, you know, [asking ourselves] What else can we do...” Developing new corporate design trends involves a long lead-time, and a significant amount of trial and error. In addition, these trends change continually:

*[...] heritage design or cab forward are specifics that we're working on now, that fifteen years from now, or ten years from now, we'll probably be working on something else. So they're not the sort of thing that you can say, well here [it] is...*

For example, in the early 1990s Chrysler’s main design trend was the so-called “cab-forward” design, where the passenger compartment was stretched forward as far as possible, resulting in the distinctive look of the full-size LH sedans. Cab-forward, as a design trend, initially began with a design done at Pacifica called the “Navajo”, which was a “reach” study for the LH sedans of the early 1990s, something the LH platform team would probably not have requested. The objective of the study was to reach beyond what was conventional in order to give the passengers of the sedan more interior space. The “Navajo” study was later transformed into a mid-engine sedan called the

“Portofino”, after Chrysler purchased Lamborghini, a small Italian manufacturer of high-performance mid-engine sports cars. The mid-engine configuration of “Portofino” accentuated its cab-forward configuration proportions. As a show car, “Portofino” met with such success that the CEO of Chrysler at the time, Lee Iacocca, became a convert to cab-forward, after initially being against it. The time and resources required to refine a new design theme over several generations of concept cars, and to prepare the different stakeholders within the organization to accept the new theme, are simply not available to a platform team.<sup>45</sup>

More recently, Chrysler has embraced the “heritage” design trend that has been sweeping the industry and that has resulted in such models as the Porsche Boxster and the BMW Z3. Tapping into these industry trends and developing the next ones requires people who are in tune with what is going on in their community of practice outside of the organization for which they work. At the same time, it requires a community of designers of a certain critical mass within the organization working together, exchanging, discussing and interpreting ideas and trends (Seely Brown & Duguid, 1991). That is what the DO provides.

The third category of creative activity that is the exclusive province of the Design Office is the creation of totally new products that do not fit, à priori, within the mission of the existing platform teams. Such products would not simply be extensions of existing models, such as a longer wheelbase or a more luxurious version being added to the minivan lineup, or a stretched cab pickup truck being added to the truck lineup. The best example of such products are the Dodge Viper and the Plymouth Prowler. The Prowler, which was in the process of being launched at the time of this interview, is a modern

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<sup>45</sup> Another good example of the lengthy and complicated gestation of design trends is the current trend at Ford, referred to as “edge design”. Initially, Ford designers started experimenting with basic geometric shapes as the governing theme. This resulted in the current Taurus, with its multiplicity of oval shaped features, from the central console to the rear glass. The oval was a natural shape for Ford whose logo is the blue oval. Following the same basic idea of using one geometric form for as many elements of the car design as possible, Ford developed the GT90 concept car, a mid-engine sports-racing car intended to be the spiritual successor of Ford’s GT-40 Le Mans winner of the 1960s. The GT90 used triangular shapes as the basic design element, resulting in triangular exterior panels, air intakes, and interior design elements. Elements of the two themes found their way to various production cars; the Ford Ka, a mini-size model available only in Europe being an example (ovoid silhouette, headlights with sharp edges.) The combination of the two design trends, ovals and triangles, became Ford’s design theme, and was

interpretation of the hot-rod. It is a two-seat open car, with motorcycle-style front fenders (the front fenders are not part of the bodywork; they are attached to the front suspension and turn with the front wheels.) The story of the gestation of the Prowler, as recounted by our informant, is instructive. The Prowler started with a brainstorming exercise at Pacifica, an idea fair, where everybody, designers, modelers, even the janitor, was invited to come up with an idea for a transportation vehicle, no matter how unusual or off-the-wall, and to present it. One of the designers came up with the idea of doing a hot rod. He was encouraged to do a few sketches of his idea. The design managers liked the sketches and decided that building a few scale models would be worthwhile. This resulted in a total of five dioramas being built. (A diorama is a scale model sitting in front of a blow-up picture of some scene as background, with a few elements in the foreground, intended to show the idea in a somewhat realistic setting.) These scale models were seen by Bob Lutz, Chrysler's president, and Tom Gale, then VP of design. As it happens, Tom Gale is himself very interested in hot-rodding. They found the idea interesting, and gave their approval for a full-scale clay model to be built, which was followed by a show car being approved. The response by the public and the press to the show car was so overwhelming that Chrysler management decided to produce it as a relatively high-priced specialty model, in limited numbers like the Dodge Viper. The decision was buttressed by marketing and engineering considerations. From the marketing viewpoint, the Prowler would give the lackluster Plymouth brand a "shot in the arm". From the technical point of view, the Prowler would be an opportunity to gain valuable design and manufacturing know-how in aluminum-bodied vehicles, with relatively little risk. The important aspect of the story, however, is that Prowler came about by the Design Office providing "an opportunity for a designer just to do something that he felt passionate about, something that [...] turns [him] on, and that's a hot button... [and to] get other people passionate about it..."

## **2. The DO's integrative role**

The corporate Design Office plays a crucial role when it comes to expressing the distinctive identities or character of the various Chrysler brands. In the previous section,

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further refined in a number of studies for the upcoming Ford Escort. The recently introduced Mercury Cougar is the first production model officially referred to as an "edge" design.

the development of corporate design themes by the DO was discussed in the context of the long time horizons involved, and the disadvantageous cost-benefit calculus that would prevent any particular platform team from undertaking that type of design activity. In this section, we delve deeper into the interpretive nature of such work, in order to understand the communication and integration role performed by the DO.

A company needs to have a corporate identity in order to differentiate itself from its competition. In the automobile industry, brand identity and product design or styling have been very closely linked for several decades. At Chrysler, the challenge is to give each of the four brands, Chrysler, Dodge, Plymouth, and Jeep, its own design identity. The executives responsible for the different brands want their product offerings to have a recognizable look that is, at the same time, distinct from that of the other brands. Our informant put it as follows:

*The brand managers, the marketing people, want to have a consistent look. They're concerned with their showroom; when they look at their showroom and see all the Chryslers, that they want them all to look like Chryslers.*

These executives want their products to convey a consistent message. Generally, marketing will develop a descriptive message for the particular brand, based on where they wish to position the brand relative to its competition. That message however will need to be interpreted into a design. Referring to the Dodge brand image, our informant explained:

*If you were to talk to marketing they'd say it's 'affordable performance'; that's the two-word answer. In design we get to figure out what that looks like. And all I can say is, a Dodge wants to look muscular, it wants to look capable, it wants to look strong. [...] And we'll go through these kinds of things with the designers and, in pretty open conversation, back and forth, as we're trying to figure out what a Dodge looks like and how do you make a Neon look like a Dodge [for example].*

Developing a design identity and, more specifically, translating the product positioning message into a design is something that has to be developed “in the metal”, by doing, in practice; and an important aspect of practice is that it is interpretive: the designer reacts to what he is doing and to other people’s reaction to what he is doing. In this case, the other

people would be the other designers in the design office first, the marketing and brand managers second, and the company's upper management third. The process described is not unlike that which takes place between an architect and a client: the architect develops preliminary designs based on his initial understanding of the client's desires; the client reacts to these designs; the architect in turn reacts to the client's reaction and modifies the designs, and so on. That is what "open conversation" and "back and forth" in the above quotation refer to. Even though the designers may be explicitly seeking a design "formula" for a particular brand's identity, the process remains more evolutionary and the designs more emergent than formulaic. In response to a question about how the new front-end look for the Chrysler brand came about, our informant said:

*We evolve our way into it, that is the best way I can put it. As we're designing, we start realizing that we want something different so designers are suggesting other looks and we finally, maybe don't get the look... Because if you look at the Sebring grille, it's a bright color, and it's got a bright bar across the middle. It's not quite the formula. The formula doesn't have that bright bar across the middle. And, if you look at the Sebring coupe it's got the egg crate and it's got the badge, but it doesn't have the bright collar, so it's not quite the formula, but we're getting there.*

The above description implies that it would be impossible for marketing to develop a formula for a brand's design identity on paper and then send it out to the different platform teams for each to interpret and develop to suit their product. Each team's interpretation would be different, and there would be no guarantee that the results from the different teams could be fine-tuned or somehow integrated into one family look to reflect one brand identity. At a minimum, the process would be costly and highly inefficient, as the interaction described in the previous paragraph would have to be repeated several times. Furthermore, other practical considerations combine to make the process even more complex, which casts a greater importance on the central role played by the DO.

One complicating factor is the asymmetry in the contribution of different platforms to the design identity of a given brand. Not every brand offers a full range of models based on all platforms; for example, Chrysler does not offer pickup trucks, nor does it offer a version of the Neon; and specialty models such as Viper and Prowler are specific to the

Dodge brand and the Plymouth brand respectively. Due to this asymmetry, those products that are specific to the brand, the “stand-alone products”, play a disproportionately greater role in establishing the identity of their brand. In the case of the Dodge brand, these are the Ram pickup, the Dakota sport-utility vehicle, and Viper. It is through these stand-alone products that the designers establish the design cues for the Dodge brand. In designing the products that Dodge shares with other brands, the designers will attempt to use as many of these design cues as they can, after modifying them to suit the type of product in question. In the case of the LH sedan, if the process were left to the platform team, the team would have faced the complicated task of interpreting the Dodge brand identity, developed elsewhere, for the Dodge version of the LH sedan while at the same time developing the brand identity for the whole Chrysler range, since the LHS is the closest thing Chrysler has to a stand-alone product.

The need to re-interpret the design cues of a brand across a varied model lineup makes the process even less mechanistic. The brand’s design identity was described as more of a “general framework” than a formula, in order to allow design elements developed for one type of vehicle, say a truck or a sports car, to be re-interpreted for a different type of vehicle such as a large family sedan. Our informant put it as follows:

*But, within that, that look needs to have some flexibility. In the same way that it does with Dodge. I mean, you can't have the front ends of all Dodge's all looking identical. Because what fits on a Ram truck doesn't fit on Avenger, so maybe you say the crosshair is the look but it could be a big bright header with a bright crosshair and honeycomb grille texture up here, or it could be an all body color fascia with a low mouth and a crosshair in the middle of that low mouth on a Viper or Avenger. So, it says that within that general framework there is going to be variety. And, Chrysler's going to be the same way. It's in the general framework of the design that we have. There will be a variety in any given year, and there will be a variety through time.*

Aside from the complication of integrating across non-uniform product lines, there is also the complication of integrating across time. As discussed previously, design themes evolve over time in response to a number of factors including the designers’ tastes and experiences, trends in the industry itself as well as in other industries and, generally, in response to the cultural environment as a whole. Given that fact, and given that different

vehicle models are developed at different points in time, the problem of maintaining the integrity of a brand's design identity in the absence of a central Design Office would be a difficult one. Our informant, again, describing the difficulty of changing the front-end look of Chrysler, from the "waterfall" design of the mid-1990s to the current design:

*The problem we have, over time, is that images change, but you don't change all Chryslers on the same day, and because you don't do that you end up with... Well, I want to move from this -- because we had the waterfall, the vertical bar grille, that was the Chrysler look for quite a while -- and I said, well, I really don't... I want to move away from that; that's not saying what we want to say about Chrysler. Unfortunately, you can't redo all Chrysler grilles on the same day. So, you start doing them a piece at a time, with the intent that finally you'll walk away out of your last waterfall grille into the thing that you want to have for Chrysler.*

To sum up, the Design Office plays several communicative and integrative roles, or rather has an integrative role with several facets: A) it is a bridge, in certain areas of product design, between marketing and individual platform teams; B) it differentiates between the different brands to give them distinct identities (this can be thought of as the opposite of integration, but still a function involving similar skills); C) it integrates across the various models of a given brand and therefore between platform teams; D) it integrates (or differentiates) across time, as it maintains (or changes) a brand's design identity across product generations; E) it integrates across the companies boundaries, by tapping into the overall culture, but more specifically the community of practice of automotive design as a whole. As discussed above, the type of integration that these roles call for is not mechanistic but interpretive in nature.

## **Supplier Relations at Chrysler: Analytical v. Interpretive Integration**

Aside from its daring and innovative styling, Chrysler has also been recognized for its strong relations with its suppliers. Researchers in management and product development have been interested in the company because it started relying on outside suppliers in developing new products earlier than some of its competitors in Detroit. It should be pointed out, however, that that was not entirely a matter of choice: as the company was

rescued from near-bankruptcy in the early 1980s, it was left with reduced in-house resources, and it emerged as a much less vertically-integrated concern than its competitors. As a result, Chrysler has had to give greater engineering and development responsibility to its suppliers, not only for parts but also for increasingly larger assemblies and subsystems.

One problem with relying on suppliers is that significant portions of the knowledge needed to design and build the final product no longer reside within the firm but with its suppliers. This leaves the company potentially vulnerable to a number of dangers: a) the loss of competitive advantage through the loss of proprietary product and process know-how; b) the loss of product distinctiveness as the supplier is able to provide its capabilities to a number of competing firms; c) the transfer of profits from the firm to its suppliers, as the latter come to own a greater portion of the value-added to the product (the extreme case is the PC industry, where the profit margins of system builders have paled compared to those of the firms supplying key components such as Intel and Microsoft.) Some researchers have argued that Chrysler's role is that of systems integrator, and it is a role that suppliers would not be able to perform. A car is a very complex system, and specialized systems knowledge is needed to bring all the subassemblies together and to manage the interfaces between them to make sure they all fit and function together as intended. The ability of companies such as Chrysler to provide that special knowledge and capability, and to maintain it in-house, would guarantee their continued profitability.<sup>46</sup> It was therefore surprising to find that Chrysler had subcontracted the systems integration work for the interior of its future minivan project to one of its suppliers, Lear Seating. This arrangement, which is described in detail below, raises important questions about the division of labor between a firm and its suppliers, and sheds some light on different types of integration tasks.

The supplier in question, Lear, is a \$7-billion company.<sup>47</sup> Lear has a number of divisions dedicated to specific customers; for example, the site of this visit is part of the "Chrysler Division" of the Lear Corporation. This division is a fully self-sustaining business unit,

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<sup>46</sup> For a discussion of the strategic considerations involved in such outsourcing decisions, see (Fine & Whitney, 1996).

with its own management; its yearly business volume with Chrysler exceeds \$500 million. Also present during the visit were staff members from the corporate office of Lear, who work in support of the different divisions of the corporation. The visit to Lear dealt mainly with the RS minivan, the next generation model that is still under development, whereas the focus of the rest of the case study was the current production model or NS. For the NS, Chrysler performed the interior integration work itself and Lear simply supplied seats for the European version. In the case of the RS model, Lear is not doing any work on specific components; it is responsible for the entire task of interior systems integration for the program. For a minivan, interior and seating is a particularly important subsystem. Because the new arrangement between Chrysler and Lear involved a yet-to-be-released model, the interviews were rather limited in scope. Nevertheless, it is possible to briefly but usefully describe the integration and coordination work performed by Lear's Chrysler Division for the future minivan project.

Lear is responsible for managing all aspects of the RS interior program. This is carried out from a 20,000 sq. ft. building, mentioned above, dedicated to the entire interior supply base. At the heart of this operation are two large rooms, the "wall room" and the "integration room". The "wall room" gets its name from one of its walls which is used to display the different iterations and changes over time of the design of every interior component, from its original conceptual sketches to its current status (detail drawings and samples parts.) One informant estimated that the wall had 17,000 items on it. Lear was involved from the beginning of the project: two Lear employees were stationed at the Chrysler Design Office in order to influence the design with their functional and manufacturing concerns. They served as the liaison between the DO and a core "creativity team" at Lear, consisting of 13-15 people from engineering, design, purchasing, manufacturing and service.

The wall is constantly updated by representatives from the various suppliers. Open issues concerning components or systems are posted on the wall, including build issues relating to how different pieces interface with one another and how they are fastened together. The grain, gloss, and color status of each part is tracked and compared to the design

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<sup>47</sup> Since our visit to Lear, the company has grown closer to a \$12b/yr. in sales volume.

objective. Similarly for dimensional tolerances, gaps, and fit conditions. Designer and engineers can place sticky notes on the parts to raise questions or concerns, and those would be answered by the person responsible for the part in question. Only the person who put up the note can take it down when he or she is satisfied with the answer or the resolution of the issue.

As impressive as the “wall room” is, it is but one representation of information stored through a proprietary software program developed by a Lear’s director for the RS program. Woven into that software program are all the Chrysler official milestones and PAPs (Part Approval Points). All the milestones to be met, all the different tooling steps, all tasks that are less than 200 hours are laid out in the program. All tasks are assigned to people by name. These tasks drive the timing and are used in design reviews and in management reviews. The program is also used to track the status of fit and finish, color, grain of the different parts, and all areas of the RS interior program, with the exception of the financial aspects of suppliers’ parts. All this information is available on the network linking Chrysler, Lear, and all the suppliers. The advantage in keeping the information in the wall-room however comes through during the meetings when all suppliers come together to discuss any open issues and any concerns they might have.

Whereas the “wall room” focuses on the product and its various component parts, the “integration room” deals with the manufacturing process and how these parts will come together to produce a minivan interior. Laid along the walls of this room are graphical representations of all the different stations in the assembly plant. Each station in the plant has one corresponding column on the wall. In that column are listed the parts that go in at that station, along with details and sketches. This makes it easy to look at issues of DFA (design for assembly) and to optimize the process as a whole. In general, the push is to increase the density of the modules to get away from having to assemble a large number of individual components at the plant. Here again, Lear is on-line with Chrysler: design reviews can be accessed on-line, and any changes in the manufacturing process or in other assembly processes can be taken into account and reflected in the “integration room” displays.

Remarkably absent from the interview at Lear was any discussion of gut-feel and risk-taking, of developing a shared vision for a yet non-existent product, and other such concepts that were the highlight of the interview with the NS development team. Lear's presentation was much more of a nuts' and bolts' description of project management issues—tracking and communicating design changes and parts status in a timely manner, distributing information to the different project participants, making sure everybody is aware of what the others are doing and how that might affect their own work, and so on. The integration tasks that Chrysler has asked to Lear to undertake can be accurately described as analytical.

The same kind of division of labor, where Chrysler keeps to itself the integration tasks that we have been describing as interpretive, and where it subcontracts out the integration work that is essentially mechanistic in nature, can also be seen at the interface with the customer. For example, both Lear and Chrysler conduct consumer clinics and surveys on minivan interiors. But the questions asked and the information sought by each are different. The research conducted by Lear, mostly by the corporate Customer Satisfaction Group, is intended to understand the ratings achieved by the different vehicles on the market on J.D. Power's customer surveys. The researchers "dig down" and try to find out the reasons for what people are saying. A Lear employee from the corporate office gave the following example:

*For instance, if an armrest is rated 'not comfortable', we try to see why. Is it too short, too long, too hard? Is it the angle? We look at the construction, the foam used, etc. We are interested in continuous improvement; we talk to OEMs so we won't do redundant clinics and to share information.*

Lear's research can best be described as benchmarking. By contrast, Chrysler's clinics are intended to measure the reaction of potential customers to different future exterior and interior designs, different seat packages and trim. A Lear informant described the difference as follows:

*At Lear, our research is much more specific. We look at the whole segment, so we get a snapshot of the whole minivan market, in other words, we look at current products. Chrysler is more concerned about*

*how to delight the customer with future models; so they use fiberglass  
bucks to test new features on future models.*

The terms “delight” and “future” capture the essence of the difference between Chrysler’s interpretive work and Lear’s more analytical, mechanistic activities.

The findings at Lear Corporation point to an important distinction between different kinds of integrative activities, the analytical ones on the one hand, and the interpretive ones on the other. The findings indicate that Chrysler believes that its ability to successfully perform the interpretive functions, both internally (within the organization) and externally (at the interface between the organization and its customers), is the key to its continued competitiveness as an automobile manufacturer. It appears to have no qualms about handing over the analytical systems integration work to outside suppliers.



## **Chapter V: Case Study II**

### *Nissan Design International*

Nissan Design International (NDI), located in La Jolla in southern California, was founded in 1979 as an American satellite studio for the Japanese manufacturer. NDI employs approximately 50 designers, modelers, and engineers. The focus of its work has been the styling of Nissan vehicles sold primarily in the United States. The company has also undertaken a number of industrial design projects for outside, non-automotive client companies. These projects have included designing furniture for children, golf clubs, and a yacht, among others. NDI is best known however for some very successful Nissan models, such as the original Pathfinder sport-utility vehicle, the Nissan Quest minivan, the Infiniti J30, and the Nissan Altima. At the time of the visit to NDI (June 1997), the second generation Altima was about to be introduced to the US market. The Altima project became the focus of some of our interviews at NDI, and at Nissan in Japan as well (see the Nissan Technical Center case study in the next chapter.) A significant part of the visit was spent interviewing the director of NDI, Jerry Hirshberg, who was initially hired by Nissan to set up and run the studio (MacKenzie, 1993). Until he was recently promoted to president, he had been vice-president of NDI, with the president's post being filled by a Nissan executive sent from Japan to La Jolla for that purpose. Over the years, NDI and Jerry Hirshberg have become practically synonymous, as he is often interviewed and quoted directly in industry articles relating to NDI or to new Nissan models; he even starred in some recent TV advertisements for the company (Rechlin, 1999). At the time of the interviews, Jerry Hirshberg was in the process of writing a book about his experiences and his management approach at NDI. That book, entitled "The Creative Priority", has since been published (Hirshberg, 1998). The other interviewees at NDI

were: the studio head and the chief designer who were responsible for the new Altima, one of the key persons in the Design Context Laboratory, and the person in charge of the Color Studio.

## History of NDI

NDI came about as the result of the vision and actions of Nissan's president in the late 1970s, Takashi Ishihara. Mr. Ishihara, who was described by our informant as a "pretty visionary guy", and who went on to become Chairman of the Board of Nissan, had by then come to realize that although the Japanese manufacturer had achieved a very high-level of technological capability, it was still lagging in styling and design compared to the top automakers in the world. Unlike many of his peers at the time, Mr. Ishihara was also cognizant that product design, and in particular the totality of a company's designs over a number of product generations, is a powerful form of communication, a language through which the identity of a company is shaped in the marketplace. With half of Nissan's target audience being non-Japanese and non-oriental, he realized that his company was trying to communicate in a foreign tongue with more than half of its market. He also realized that, unlike technology and science, something as ingrained in the history and culture of a society as design would be very difficult to learn and transfer, and it would have to be dealt with differently.<sup>48</sup> As our informant put it, "You can't get an injection of design." Yet, Nissan's president wanted to go "beyond intriguingly well-put-together products of high quality that were nonetheless quirky and didn't fit the intended market physically, let alone esthetically."

Nissan could have gone to one of the well-known Italian design houses for some of their models, as Isuzu did with the Impulse, a sports coupe designed by Giugiaro, or as Toyota did many years later when it hired Pininfarina to design the original Lexus GS300 sedan. But it would be impractical and too costly to hire these star design firms to do a whole product line, over several generations of these products, not to mention the regular

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<sup>48</sup> Our informant, Jerry Hirshberg, pointed out that while some third world countries have absorbed technological innovations from the leading industrial economies at an amazing pace, they have not been able to come anywhere near the leaders when it comes to design. And those leaders, such as Italy and now increasingly Spain, countries that continue to struggle in other ways (i.e., economically), have such a rich cultural heritage in design that design "is in their bones, and they do it beautifully."

updates and facelifts that would normally be required over the lifecycle of a model. (It should be pointed out that certain low-volume, high-end automakers follow just such a course of action. For example, practically all Ferrari models introduced in the last several decades have been designed by Pininfarina.) In the absence of such a long-term committed relationship with one design house, the company would be left with a disjointed product line-up and with an incoherent message in the marketplace as a result of the dissonant voices represented by the different products. Mr. Ishihara's answer to the dilemma Nissan faced was to propose that the company set up its own design studio in the West.

Five different countries were considered as potential locations for Nissan's new design studio. These were England, Germany, France, Italy, and the United States, all countries with "a rich and successful heritage of automobile design". Nissan's president felt that they could learn about design from any of these countries, and he sent out a team to study which of these countries should be chosen. Although the Japanese had "great respect for German and Italian design," and a "deep awareness of the history of great French and British marques," the US was ultimately chosen because of certain similarities between the Japanese and American markets, something our informant called an "exquisite irony".<sup>49</sup> Some of the common characteristics he mentioned: the two markets' passion for novelty, in contrast to the seriousness of German customers and their focus on tradition and refinement; the fast-paced agility of the Japanese and American markets, as compared to the more slow-moving European markets, the French and British in particular; also, the enthusiasm they share when it comes to technological innovations.

Nissan's decision to set up a design studio outside of Japan, and to tap a non-Japanese to found it and to run it, can be seen as a form of division of labor. This was understood by Mr. Ishihara from the very beginning, as he explained his reasoning to our informant:

*Look, there's a lot of things you guys over in the West are that we aren't, and we don't want to trade who we are to be able to do what you can do.*

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<sup>49</sup> The choice is even more surprising when one considers that in the late 1970s, very few interesting automobile designs were coming from the US, where the Big Three had been struggling and spending most of their resources to meet ever tightening safety and emissions regulations.

*So let's hold hands. You do what you do, we'll do what we do, and let's figure out a way to do it together. (As recounted by Jerry Hirshberg.)*

Jerry Hirshberg also understood the situation on these terms; he recalls Mr. Ishihara saying to him: "We want to change the flavor of our soup; we're going to stay out of your kitchen." And in retrospect, he feels that they have done just that for the last seventeen years. Although, until a few months before our visit, the presidents of NDI had come from Nissan in Japan, they were all told to "stay away from our process, even if it looks weird." Jerry Hirshberg recounts the example when, in the middle of a workday, he decided to take all the NDI personnel to see a movie. It was during the first Altima project, and the design team was way behind; they "weren't hitting it." Both the Japanese and the Americans were worried and the tension at NDI was high. Although the Japanese president initially demurred, citing the status of the project and the timing of the outing, the director ultimately prevailed on him to join the group.

Our informant summed up the decision by Nissan's president to create NDI thus: "He (Mr. Ishihara) wanted an 'Americano', who would be abrasive in the culture, but in a way that they could accommodate." He found him in Jerry Hirshberg. The exposure that NDI and Hirshberg have received over the years, and the tight association of one with the other both in automotive and industrial design circles, appear at odds with the anonymity favored by most Japanese executives; yet that may have what Ishihara intended all along. Hirshberg is invariably mentioned or quoted in virtually any news or magazine article having to do with new Nissan models in the US, and even in articles that only deal with competitors' products.<sup>50</sup> In addition, as mentioned previously, he has recently written a book about his previous experience at General Motors, how he was hired by Nissan to found NDI, and his management philosophy and practices there. These are described in the next section.

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<sup>50</sup> A typical example is an article in AutoWeek, dated August 24, 1998 (Autoweek, 1998). The article mentions a number of companies, including Ford, Audi, BMW, and Cadillac, as well as Nissan. Whereas mention is made of "sources" at some of the other companies, Hirshberg himself is quoted in the case of Nissan. Another example is an article in Automotive News about the new Altima and its pricing and positioning relative to Toyota's Camry (Rechtin, Crate, & Jewett, 1997). In that the article, Hirshberg is mentioned four times, and Nissan's manager for the sedan line only once.

## **NDI as a Creative Entity**

Before Nissan hired him, Jerry Hirshberg (JH) had been working at General Motors, as chief designer for the Buick division. He describes his experience during his last few years at GM as one of deep frustration and of “feeling more and more suffocated as the 70s droned on.” As he sees it, GM, like many corporations, had many “senders” when it came to creative work, but it was lacking in “receivers”. “After a lifetime of having dealt with just throwing ideas against the stone wall of a bureaucracy,” he was determined to organize NDI around the process of creating ideas as the end product. He would tell potential employees “Idea-making is what we care about the most.”

Initially, JH did not know specifically how he would go about creating that new entity; he had an image in mind though, and the image was that of “a sandbox and recess.” He knew that NDI would be built around the creative process, but he also saw limitations in the ideas and prescriptions proposed by the numerous business books that deal with creativity, which he calls “clever ways of manipulating, forcing, somehow opening a way for creativity” within an organization. He resolved that his approach would be different. At NDI, the human thought process, the creative process, would be the centerpiece of the organization. Paradoxically, JH proudly proclaims that he was “smart enough not to try to define what the creative process was, or [what] creativity was.”

The result, according to JH, is an organization that operates differently, and “not just differently than a Japanese company.” “It’s pretty odd amongst American companies too.” Several management researchers appear to agree, as NDI has been mentioned in a number of studies, (Leonard & Rayport, 1997) and (Leonard & Straus, 1997) being two recent examples.

### ***Creativity: a marriage between the rational and the intuitive***

Although he is careful not to give a closed definition of creativity, Jerry Hirshberg has a very clear and strong notion of where creativity comes from. To him, “creativity resides in the intersection of the rational and the intuitive” modes of thinking, “not in the intuitive alone or necessarily the rational.” The major impediments to creativity in most organizations are thus two: one is the low status accorded to intuitive thinking in our

culture; the second is the tendency to divide and compartmentalize the different modes of thinking.

JH believes that intuitive thinking is the most natural way of thinking, and it is the mode of thinking on which we rely most often in our daily life. Unfortunately, these important tools are “educated out” of us and, in the typical work setting where analytical thinking is prized above all else, they are frowned upon as being “everything from ‘sloppythink’ to ‘feminithink’.” To JH, that is a mistake:

*We do some of our best thinking when we sit with our wives and say, Where should we go on vacation? Should we have a dog, or should we have a baby? Then we think well. We come to work and we make charts. We misapply scientific method to things that don't have well-defined bounds; but we have tools available, but they're not allowed.*

NDI then is about “embracing [...] intuitive work.” But as with creativity, JH is careful not to give a simple, closed definition of intuition and intuitive thinking. Again, he relies instead on some of its characteristics:

*Whatever it is, we know what it's not. We know that it's not linear. We know that it's not deductive. We know that it makes leaps that it shouldn't have had the right to do. But so often, it's right.*

The second roadblock to creativity, namely, our tendency to divide and compartmentalize, is also a cultural phenomenon according to JH. It is ingrained in our educational system, and it carries over into organizations where separate “creative departments” are set up and tasked with developing creative and innovative ideas.

*I think the problem is that we tend to divide and subdivide in this country and in this culture. And not just here; in the East as well. A lot of Western education is based on that. For me, all the great discoveries--all the great art, all the great science--is literally the flashpoint where the intuitive and the rational meet, and it's very uncomfortable. So this is not an easy route. Anybody who tries to neatly compartmentalize intuitive over here and rational over here is going to run against the same wall, because that's going to make for 'creative departments', which are a blind alley as far as I'm concerned.*

JH has therefore “developed strategies that attack that division head-on.”

This kind of organizational (and often spatial) segregation of creativity into specialized departments is only one type of mistake that organizations commit. Another is the temporal segregation, when they assume that creative thinking is something that can be summoned when needed, that is, when the organization is facing a challenge and it needs to “break the mold.” As JH put it, “The muscles aren’t there; it’s going to take a long time.” For that reason, NDI is organized so it is constantly immersed in the language, and thus the way of thinking, of the creative organization:

*The language of design, which is the language of intuitive and interpretive thinking, along with rational thinking, has been introduced into the larger methodology of the organization.*

#### **“Creative abrasion”**

Ironically, at the same time that JH sought to eliminate the cultural divisions one typically finds within organizations, between those groups that think and work intuitively and those that operate analytically, he also became aware that cultural differences were a rich source of innovation. This became obvious during NDI’s interaction, on various projects, with personnel from Nissan in Japan.

*Something magical is happening in the struggle to communicate and negotiate with the truly alien culture, that is, between Americans and Japanese. It wasn’t easy. And I realized at some point that the struggle was yielding all kinds of innovation, if the process was handled in a certain way.*

This seeming contradiction disappears when one understands that it is the process through which barriers are removed and conflicts resolved that is the source of innovation. JH refers to this process as “creative abrasion.”

But how are those ideas and concepts operationalized within NDI? Some of JH’s management strategies and methods are the subject of the next section.

### ***Management strategies and leadership at NDI***

Some of the strategies described by our informant are clearly intended to remove the barriers that naturally develop between groups within organizations, while others are clearly meant to encourage and support intuitive thinking. Others, however, do not fit

neatly within that classification scheme, as they appear to support both of JH's goals. Some of the strategies were inspired by the arts, and not only the plastic arts, which have a natural connection with industrial design, but by the performing arts as well. On several occasions, JH reminded us of the emergent and evolving nature of these strategies. These strategies are presented here, and, where applicable, the different type of leadership that they call for is discussed.

### **“Stepping back from the canvas”**

One example of this strategy, the NDI movie outing, has already been described earlier, in the context of the Japanese president's role at NDI. This strategy was inspired by something that one of JH's art school teachers used to ask his students to do. When painting, and after working very closely to the canvas over an extended period of time, one develops a distorted view of his or her work. By occasionally stepping back from the canvas one can see the result of one's work from a more realistic perspective. From time to time, and especially when a project is facing difficulties, NDI shuts down and everybody goes on an outing, to the movies in particular.

This strategy goes against the traditional approach where, when facing difficulties, managers will hold a meeting, remind everyone how important the project is, and call for overtime. Or, as JH put it, “Noses to the grindstone; buckle down, get to work...” He explained:

*What most leaders don't realize is that work in and of itself is intrinsically an inward-turning process. It pulls you into it. It's magnetic. It's a stupid waste of time, and harmful, when leaders and managers push—you know, Get down to work! The trick is to strategically—and you have to know the right time—pull people away from work.*

Usually, people use the weekend or take a vacation to “interrupt the rhythm”, to change their thoughts and to be able to come back to their work with a fresh eye. At NDI, this is done during work, when JH believes it is most effective. And it does not always involve an outing; it could involve one designer taking a break from his or her project and getting involved in another designer's project.

## **“Cheating”**

“Cheating” is a practice intended to break down barriers between people, a “deliberate attempt to encourage interference, intrusion, sticking your nose in other people’s business.” When young employees are hired into NDI, they are told that they are expected to “cheat” from one another. They are expected to rifle through each others’ papers and drawings. They are also told that their colleagues will be rifling through their work. They are invited to do it when the other person is away at lunch, if that makes them feel more comfortable. This is another idea that JH picked up from the arts; in this case, he credits music where many pieces were inspired by other composers’ works, or, as he puts it, “the best ideas are stolen ones.” He admits that he is using “stolen” in a special sense, that “inspiration” would be another good way of describing the process too. He gives another example from music, specifically jazz, where one musician in the ensemble would do a riff on something that another just played, “... like a sax hearing a drummer and doing something with it.” Of course, the person doing the stealing is expected to give credit and to give the idea his or her “own spin.”

JH credits this practice for the idea for the Nissan Pulsar, the first mass-produced car to offer the customer modularity, whereby the customer could convert the car from a mini-truck to a notchback to a hatchback by swapping body modules. It should be pointed out that this is an extreme case of the practice however, as it involved one designer misinterpreting another’s work, not merely reinterpreting it. The idea for a modular car came to JH as he was looking through some of the drawings that another of the NDI designers had been working on. The designer had done a sketch in which he had delineated various body panels with thick black lines. While rifling through those sketches, JH misinterpreted the thick lines to mean that the outlined panels could be removed and replaced with other ones, like a three-dimensional puzzle. Mistakenly thinking that the designer had been working on a modular vehicle, JH did some sketches of his own, and the Pulsar was born.

The practice of allowing and even encouraging this type of “cheating” within an organization that thrives on creativity places some heavy demands on the leadership of that organization, in particular when it comes to fairly apportioning the credit for a given idea or creation. From the interview, it seems that NDI does not rely on some intricate

accounting mechanism to solve this problem; rather, rather, JH has created the kind of closely-knit culture and work environment where such concerns are effectively sidestepped. He explains: “We won’t put up with somebody saying, I did that first, that’s mine.” At NDI at least, this approach seems to work, as he goes on to say: “It’s amazing how that becomes a non-issue.”

### **“Blurring the boundaries”**

This strategy is another “deliberate attempt to encourage interference, intrusion, and sticking your nose in other people’s business.” The idea here is to eliminate the generally accepted division of labor, whereby designers do their thing and engineers do theirs, without either telling the others how to do their job. When engineers are hired at NDI, they are told up front “We [the designers] are going to step on your toes, and we want you to step on ours.” To JH, in any given product, the contributions of the designers and those of the engineers “are so overlapped that we don’t even bother to pull them apart much.”

JH gives the example of the Quest minivan project as a case where that strategy paid off handsomely.<sup>51</sup> Initially, the designers were not very enthused about designing a minivan; to them, doing a minivan seemed “kind of boring.” They responded by trying to make a minivan that would look swoopy. The early sketches depicted one-box designs that JH referred to a “rocket ships”. (A one-box, or one-volume, minivan design is basically a design where the front section of the vehicle, where the hood and engine compartment would normally reside, is not clearly defined or delineated from the rest of the vehicle, as it would be in the more common two-box design. The result is a vehicle where the A-pillars practically form a straight line set at a very shallow angle with the horizontal, resulting in a very large windshield, a windshield base that is very far forward from the passengers, and rather poor visibility for the driver and front passenger. The first GM minivan, the Pontiac Transport of the late 1980s was a one-box design, and it was criticized for being overstyled, for lacking functionality, and for its A-pillars that obstructed the driver’s view. An example of such a design, perhaps a more successful

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<sup>51</sup> The Quest minivan was a joint development between Nissan and Ford. It was marketed in the US by Nissan as the Nissan Quest, and by Ford as the Ford Windstar. The two models differed only in detail, and NDI was responsible for the design of both.

one, is the current Renault Twingo.) Upon seeing these sketches, one of the engineers suggested they try to see what it would feel like to sit inside such a vehicle. So designers and engineers got together and built a plywood skeleton of the one-box van design, complete with wheels and seats. They then sat in the skeleton prototype, and it became clear to everybody that it was not a good design:

*... we sat down in it, and that was the death of the one-box car. We said, 'This is ridiculous. Look where the A-pillars are!'*

JH credits that fortunate outcome to having engineers onboard at NDI, ready to “interfere with the design process, and the designers not saying, ‘What the hell do you have to do with this? Go do engineering work!’”

“Hiring in divergent pairs.” The Quest story above is an example of “creative abrasion”, in the sense that the idea to move away from a one-box design was the result of the engineers, or one engineer, challenging the thinking of the designers and the direction in which they were headed. But for “creative abrasion” to work, the organization needs to bring in people who are different in the first place. This is the role of this hiring strategy. JH describes it this way:

*We always hire in twos, whenever we can. And whenever we do, we will deliberately hire about as oppositional as we can think. Whoever the hell it would make that person uncomfortable to be in a phone booth with for any length of time: different schools, different cultures, different countries, different philosophies, different methodologies.*

Obviously, the benefits of hiring in divergent pairs would be short-lived if the employees’ differences and unique backgrounds are watered down when they start interacting with one another and with the culture and the way of thinking of the organization. JH is aware of the need to prevent such dilution from happening:

*... we spend a professional lifetime encouraging these folks to continue working and thinking the way they came in; and honoring that, and celebrating that.*

And:

*My hope is that other people are operating in their own individual ways in this company.*

JH did not have any simple answer or strategy as to how NDI does that, but his description of how NDI operates makes it clear that conformism is not what NDI expects from its employees. People are encouraged to ask questions, no matter how dumb they might seem (“we encourage people to make fools of themselves, not by being idiots, but by asking dumb questions.”)

The way product critiques are conducted at NDI is a good case in point. In reaction to the way critiques are conducted at Detroit, NDI established some unwritten rules from the very beginning: when a product is about to be shown internally, the event is announced to everyone over the PA system; anybody who is interested is welcome, on the condition that they openly say whatever comes to their mind. “Anybody” includes designers from the other design studios, from the color studio, the design context laboratory (described later), the model shop, engineers, administrative personnel, and, occasionally, even visitors. By contrast, the practice at other car companies is to invite only designers to critique a new design. This point was made clear during the Chrysler visit, in the interview with Chrysler’s Director of Exterior Design (see Chapter IV), who stressed that only “people from the Design Office, the designers and the modelers [...] people who are sensitive to design, trained in design, were allowed to vote on a design.” In fact, according to JH, Chrysler’s would be a relatively progressive design office, as his description of the traditional Detroit approach as follows:

*In the more progressive studios occasionally, some engineers and modelers were invited, but they were not expected to say anything, because this was a design critique. It was only from the studio, and only those people working on that project within the studio, with the exception of the executives, who also came to the viewing patio and viewed these. The rules were very clear: rank spoke; you spoke if you were asked a question; and you only said something negative if you had a better answer.*

To NDI’s way of thinking, that practice seemed “stultifying” and “horrible”. NDI’s approach, on the other hand, does not come easily to designers, and especially to heads of design studios. Traditionally, automobile design chiefs have tended to be individuals with

strong and sometimes colorful personalities. Generally, they wielded a lot of power, acting almost autocratically when it came to design decisions. The archetypal dictatorial design personality was Harley Earl, General Motors first head of styling; more recent examples would probably include Chuck Jordan, GM's former design chief.<sup>52,53</sup>

As an example of the different kind of atmosphere that he has tried to foster at NDI, and of his different style of leadership, he described a meeting during which an unexpected idea was proposed, and he felt that it should be adopted. One of his subordinates interjected that that would be “wrong”, that it would be better not to do anything about it right then, but rather to think of it as one question within the discussion they had had up to that point and to sleep on it.

*...we're in a culture where you can say that to the boss. [...] it's very important in an idea-making culture to accommodate leadership coming from places other than the boss. This is corny, but good leadership in this situation is good following.*

The above example highlights a very important aspect of the environment at NDI, namely, that it supports open-endedness. Autocratic leadership or “strong” leadership in the traditional style is, in a sense, at odds with open-ended thinking. It calls for decisions to be made quickly and without equivocation. The leader is expected to know the answer. The following section describes other practices that support and even encourage open-endedness, a key feature of interpretive management.

### ***Strategies and practices that encourage open-ended thinking***

Some of the strategies already described in the previous section have elements of open-endedness. For example, “creative abrasion” and “hiring in divergent pairs” are strategies the outcome of which is not known a priori. Although it may be obvious that the interactions between an engineer and a designer are likely to yield a more workable product, it is not clear what the details of this outcome are likely to be. The situation is even less clear when the difference between the different people who are being brought

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<sup>52</sup> See (Bayley, 1990).

<sup>53</sup> Wayne Cherry, GM's new head of design, is the antithesis. He is described as being modest and having a “low-key” demeanor. See (Child, 1996a, b).

together relates to their cultural and educational backgrounds. At the time of our visit to NDI, their “most recent hires [were] from Germany, India, England, Canada, and Iran.” Clearly, these people were hired on the expectation that something interesting may come out of bringing them together, but that something is not obvious and it may not even be discernible before the fact. Hiring an Iranian and an Indian do not mean that Nissan intends to bring out a product with Middle-Eastern or Indian styling cues.

Following are some other strategies that favor open-endedness.

“Porous planning.” The idea behind “porous planning” is the realization that, in a creative entity like NDI, one is typically making choices between options that are still ill-defined, and that it is often difficult to separate the decision point from the creative moment. Real life does not always conform to the generally accepted analytical model of design, which consists of a series of “generate/test” cycles, where in the first phase a number of solutions are generated and, in a later phase, these are evaluated against a set of performance criteria and the solution with the highest score selected.

It is not clear from the interview notes how “porous planning” is actually implemented. From the example given by JH, it appears that “porous planning” is more an attitude, a willingness to change directions at a point in the project when the relevant design decisions have been fixed, rather than a specific planning methodology that allows for the fluidity of creating novel designs. The following quote refers to the previously mentioned Pulsar NX project, after JH came up, accidentally, with the idea for a modular vehicle:

*This was mid-product, so it had to do with the unexpected being injected into a well-defined plan. Nobody defines a plan better than the Japanese. But fortunately, we had a wonderful “Shukan,” project director... product planning engineer, who went with the flow, who said, Wow, eureka, let's do this. And we literally shifted directions midstream.*

“Creative questions before creative answers.” In JH’s view, intuitive thinking places a premium on asking questions. At NDI therefore, people are “held up from answers for as long as possible.” At the same time, he recognizes that this is exactly the opposite of what people need in order to move forward with a project and to meet deadlines:

*One of the things about intuitive thinking [...] the stress here is on questioning. We hold people back from answers for as long as possible, which is the exact opposite of what everybody needs to do to finish that. We like to tilt the plane, and leave it tilted, and live with the ambivalence just as long as you can.*

The focus on open-endedness however goes beyond delaying answers until more questions have been asked; it directly affects the nature of the questions being asked. The clearest examples relate to how NDI conducts its customer research. (This topic will be covered in greater detail in a separate section on the Design Context Laboratory.) Very often, consumers, either Nissan customers or people who already own competitors' products, are invited to come to NDI and bring their cars along. These sessions however are unlike the typical focus groups where a list of specific and detailed questions is prepared a priori, and where descriptive words are chosen carefully to gauge the participants' response to different design proposals. (See Chapter IV above; specifically, the interview with Chrysler's Director of Design on how particular descriptive terms are suggested to focus group participants in order to classify different design proposals.)<sup>54</sup> At NDI, there are no prepared questions. JH describes these sessions as follows:

*What we do is, we call people and say, 'Listen, we understand you're an owner. We'd like to meet with you. We'll give you a small amount of money--fifty bucks or something--and we want you to come with your car, and leave it as it is; you come dressed as you are, and we'll just live together for a couple of hours.' We have no questions thought up beforehand, and it's not important to us either--which is another thing to break the rules--that we show results; that, in other words, "This better be good" or "We need to get something tangible out of this." We never know what the hell we're going to get, and sometimes it's nothing. Then you know you're on the right target. So we get together sometimes, and we'll begin observing, and just kind of dancing around issues, maybe talking about the car, and maybe not.*

What is remarkable in the above description is how the process itself seems to be more valued than its outcome. Whether anything tangible comes out of it, the exercise is seen

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<sup>54</sup> The Minivan team at Chrysler did conduct the kind of research described here. The team members talked about looking at what minivan drivers carried around with them and so on. The distinction I'm referring to here relates to the methods used by Chrysler's Design Office (please refer to Chapter IV.)

as valuable because it would have allowed the designers to get to know their customers better, even if that added knowledge couldn't, at the time, be articulated or translated into specific product characteristics. To use an analogy from interpretive thinking, it is as if the designers are trying to discover, or to learn more about, the "horizon" or the worldview of their customers. There are cases, however, where specific ideas do come out of such sessions, as in the following example that was related by JH:

*Another woman had three pillows of different sizes in the car ... One was for driving, one was because she loves to take a nap at noon, and one was because she likes to visit somebody, and the chair is uncomfortable. There were three different pillows, and we started thinking about the possibility of modular removable pillows, and things you could take with you. The opportunities for innovation are just so much richer when you're leaving the discussion open for the unexpected, for the unexplainable, for that which ... In the nature of creativity: the most uncomfortable part of it is precisely the fact that you didn't think to even ask the question that led to it in the first place. If you did, you're there. To our way of thinking, the creative question is the key.*

Obviously, NDI researchers do not go into these sessions with totally blank minds. They are always already involved with a particular project or problem, but they are careful not to have already formulated answers or categories in mind. JH describes it as "going into the field unprepared; deliberately but professionally unprepared." The crucial point is not to go in with "a question that presumes an answer."

Work on remaining amateurs; drinking from diverse wells. This strategy is an excellent example of how JH is careful not to let NDI sink into the hubris that has often characterized the successful design studio and the autocratic studio head. JH sees this as especially important when designers are developing the next generation of a successful product or, more generally, a new product in an area in which they have had success. For example, one of NDI's first successes was the Nissan Pathfinder, which played an important role in creating the current market for sport-utility vehicles (SUVs); at the time of the interview, several NDI designers were working on a Nissan's upcoming entry into the small sport utility vehicle segment (a relatively new segment now occupied by Toyota's RAV4 and Honda's CR-V.) In explaining the reasons for sending some of these

designers on a multiple city tour to conduct focus groups, JH stressed the importance of thinking like an amateur:

*...we always try and strip ourselves bare of any presumptions of expertise, especially when we've been successful in the past. So we work very hard at remaining amateurs here; that's one of the reasons we do diverse products--keep ourselves again tipped, uncertain. It's healthier.*

It is interesting to note that Chrysler's Director of Design was very comfortable with the fact that his designers only work on automobiles, whereas JH sees NDI's non-automotive projects as playing an importance role in maintaining his designers' minds stimulated and open:

*I talk about the value of a company making certain that its employees have opportunities to work on projects outside the realm of their expertise, from time to time. It doesn't have to be continually, but it must be from time to time. So the connection between the projects, also, is the health-giving and is the stimulation that comes from working on a minivan here, and then on another part of the designer's desk you'll see a golf club or, currently, a laptop computer for [Company X]; or a sports car and a 105-foot yacht, or a minivan and a chair for kids. We have found remarkable and unexpected (always) crossovers, but we don't force the issue. So it's kind of acknowledging what everybody knows and says about creative breakthroughs: they inevitably seem to happen from somewhere else, and it's usually unexpected: from a neighboring field. We've brought the neighboring fields home.*

In this section, the focus has been on certain strategies at NDI that encourage open-endedness, a key aspect of interpretive thinking. The next section discusses other practices that are more directly interpretive.

### **Strategies that encourage interpretation or interpretive thinking**

Blurring the boundaries, while keeping people distinct. A hallmark of hermeneutic interpretive thinking is the notion of the 'fusion of horizons' of the interlocutors involved in an exchange, as they 'come into understanding'. Each of the interlocutors comes to the encounter with his prejudgments and background knowledge and beliefs, that is, his 'horizon', and at the end of the successful encounter, each will have had his 'horizon' altered to some extent as understanding is achieved. Understanding does not mean that

one of the interlocutor ended up seeing the situation as the other saw it at the outset; understanding is not achieved by critically eliminating what is foreign, nor by simply uncritically accepting it, but by translating it into one's own terms.

The strategies described previously, "blurring the boundaries" and "hiring in divergent pairs", coupled with the efforts at NDI to prevent its people from falling into conformity and to retain their preferences and values, are key to the interpretive flavor of the NDI environment.

Personalanalysis: providing interlocutors with information about each other's 'horizon'.

Personalanalysis is a tool used to characterize people's personality along a number of different dimensions, such as action-orientation, thinking orientation, people orientation, the importance of history and continuity. The system used at NDI is very visual, relying on colors, red, yellow, green, and blue, respectively, to code for the different orientations. The system is somewhat more complicated, as it attempts to quantify these orientations as the person faces different situations. The result is a graphical map of a person's personality. While admitting to the shallowness of such methods, our informant presented the system as an important tool used at NDI to facilitate communication and interaction between people. Each person has on his or her desk a three-by-five card with that person's 'colors' on it, for everyone to see. This encourages people at NDI to take into account their interlocutors' ways of thinking and values when they interact with them, something that is very important in an environment where people as diverse as color designers and mechanical engineers are brought together. Our informant put it in Heideggerian sounding terms: "... what works is that we're thinking about somebody else's way of being in the world." The other hermeneutic aspect of the Personalanalysis cards is that they are another way to encourage people to keep their particular idiosyncrasies and ways of thinking: "It's another means of retaining each individual's color characteristics, core characteristics, and kind of honoring them."

The designer as "method actor", and "embracing the dragon." Hermeneutic interpretive thinking is also evident in the methods devised by NDI to understand their potential customers. JH describes it as becoming method actors, in the sense that the designer attempts to experience the life of the customer:

*We become method actors, rather than market-savvy. So when we are asked to design a truck, we become truckers. We do that by, (a) we get a bunch of trucks in that are considered interesting; we'll usually get together and say, "Which ones do we want to drive?" We'll get them in here. [...] When we're asked to design a van, we'll all become van drivers, and we'll let our family drive them. We'll use it, and we'll start griping about it, and whining about it, and joining the opposition. We call that "embracing the dragon." But really getting into the process, and suffering the product along with everybody else. And admiring those parts of some of our competitors that are done damn well.*

Clearly, "method acting" and "embracing the dragon" allow the designer, one of the interlocutors in the exchange between designer and customer, to get a glimpse of the other's 'horizon', to experience the other's world, as an important step towards understanding his or her needs.

Analogic and metaphorical thinking. Method acting and interpretive thinking are not limited to the interface between the design organization and the product's customers or potential customers. It is also used internally as the design team tries to imagine what their product might look like. The following quote is a good example:

*... what's a van? It's a mobile, flexible, interior large volume on four wheels. That's what we defined it as. [...] We regard [what we came up with] as a handsome toolbox. It should be like--what's the tool company that does nice design? Black and Decker. There is a company I think that has done some handsome design over the years. We said, If Black and Decker did a van, that's what we'd want to do. That's how we kind of defined it. Or if Porsche did a piece of hand luggage, that's this.*

The quotation reveals complex, multi-level analogies. At the first level, having rejected the idea of a minivan as a swoopy "rocketship", the designers start thinking of a minivan as a toolbox. Then, thinking about the tools of one particular company, the designs of which they like, they try to imagine what a minivan designed by that company might look like. In a way, this is similar to method acting, where one company is trying to experience the life of another, the character, in this case Black & Decker. The second example, involving a piece of luggage and another company whose designs our informant apparently admires, namely, Porsche (or Porsche Design), follows the same idea.

Having looked at the organizing principles and the practices of NDI in general, and the underlying thinking of its president, we next turn to a specific design project and to the people who were responsible for it on a day-to-day basis.

## **The Work of a Design Studio: The Altima Project**

The interviews at NDI were wide ranging and covered a number of general topics including the history of the organization and the management and design philosophies of its president and co-founder (see previous section). Still, the original focus of the visit was the development of the (then soon to be released) Nissan Altima. To that end, the chief of the studio responsible for the Altima design, henceforth referred to as D1, and his assistant during that project, referred to as D2, were interviewed. At the time of the interviews, D2 had herself been promoted to chief designer, managing another of the NDI studios.

### ***The organization of a design studio***

At NDI, a design studio encompasses all the different technical disciplines necessary for automotive design: design, modeling, and engineering. A studio has an engineer, a few modelers, and a group of designers, typically three, including the chief designer who also manages the studio. This arrangement was described as unusual, as many companies do not have a designer acting as a manager too. The fact that the chief designer/manager of the design group is actively involved in the design work was described as significant:

*Yeah, the chief designer-manager of the group is on the [drafting] boards too; he's participating. That's what we wanted to do here; we determined that from the beginning, that there will be no 'hall-walkers' here.  
[Laughter.]*

The informant, D1, went on to compare design to a language and, specifically, to a foreign language. Without regular practice, one's ability to speak the language will decrease over time and ultimately disappear. Similarly, a manager who does not spend any time designing will "lose touch with the working of design, the actual work, the building of a body of knowledge about form and design..." This is especially critical in

an environment like NDI, because drawing and sketching are the language used regularly to communicate and exchange ideas with other people.

The respondents contrasted the organization of their design studio with that of the Nissan design studios in Japan. Compared to NDI, the design operation in Japan is much more structured. The different disciplines are not located under one roof, in one large area. Rather, the designers are housed in a small room off to the side of the studio area proper, and the engineering staff are in a separate engineering building, necessitating frequent trips to the studio to exchange information and data. The studio area itself was described as being the domain of the modelers. Another point of difference between NDI studios and their Japanese counterparts is the environment; Japanese studios were described as being “quiet as a church.” By contrast, the atmosphere at NDI is playful, with music playing, people telling stories and laughing as they work, and even throwing balls of modeling clay around.

#### ***A designer and his creation***

The respondents identified two major phases in the gestation of the new Altima. The initial brief called for a design that would share many components with the larger Nissan Maxima sedan. That phase was carried all the way to a full-size clay model that was taken to Japan for evaluation. That project was ultimately canceled because the manufacturing organization, NMA, concluded that the resulting design would have been too expensive to build, despite the economies achieved through the sharing of parts with the Maxima. In addition, the overall dimensions of the proposed model were too close to those of the Maxima, and Nissan’s marketing organization, NMA, was concerned about a bigger Altima cannibalizing sales from the Maxima, a model that had been very successful for them.

This led to the second phase, in which a replacement was sought, which was closer to the original, first generation Altima. D1’s studio at NDI was contractually required to deliver three quarter-scale clay models, representing three different design directions for the second generation Altima. D2 explained that, as sometimes happens to designers, neither

she nor the third studio designer could come up with a design that “flourished”, so D1 ended up doing all three scale models.<sup>55</sup>

In describing the scale models and the process through which one of them was selected, the informers focused on two of the three. The first was described by D1 as having a “real kind of art-deco thing going” and as being “really, really different”, going beyond the Infinity J30 along the retro dimension. Although D1 referred to it as his favorite design, and D2 characterized it as being a “big favorite” and “a lot of people’s favorite”, they also referred to the design as “bizarre” and D1 admitted that it was so different that “people were kind of afraid of it.” The second scale model, the design that was chosen to be developed into a full-scale model, was described by D1 as “fit[ting]everybody’s image of what the next Altima should be.” The final selection process, as described by D1, seems to have been an unusually straightforward one, at least as far as the executives were concerned. The final show was held in the courtyard at NDI, with all the quarter-scale models set up on display. Executives from NMA and NMC came from Los Angeles to San Diego for the event.<sup>56</sup> D1 presented the different designs and discussed the merits of each of them. That was followed by a vote that was easily carried by the second design. Not only did that design get the most votes, but there was also a consensus among the executives from NMA and NMC, as well as Jerry Hirshberg, that it was the design that should be pursued further. D2 described it as an easy decision, because of the consistency of preference shown towards that model, initially among NDI employees who were polled during earlier shows, and later among the Nissan executives and the NDI director.

But this easy decision belies what could be described as a certain amount of anguish on the part of the studio chief. Although he realized that the “art-deco” design was too risky, that it had little chance of being selected, and that the second design was the less risky way to go, he was still attached to it and he was still hopeful that it would be selected.

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<sup>55</sup> “...sometimes designers are in sync and they totally run with the project and other times, you just don’t have it, you don’t have an idea.”

<sup>56</sup> The courtyard in question is one of the more unusual features at NDI, often singled out when the architectural layout of the NDI building is discussed. It’s an internal court that makes it possible to display models and vehicles in the open, under natural light, while keeping them safe from any prying eyes.

That had been the case from the beginning, before the final show in the courtyard. That model started with something he had observed his wife doing when she got in a car. Being barely five feet tall, she has to move the seat all the way up and forward so she can see the road and reach (barely) the pedals. Once, after she got in, she tried to pull the visor down to check her makeup, and the visor hit her head, which upset her and made her give her husband an earful about how cars are designed. Specifically, she complained that, by the time she gets the seat up, not only can she barely reach the pedals, but the steering wheel is too close to her chest and the sun visor too close to her head. D1 understood that that was the direct result of the never-ending trend in automotive design to make cars sleeker and windshields “faster”, that is, more horizontal. D1’s reaction was to start thinking about the implications of making the windshield more vertical. The resulting design was “like an older statement, from a different era.” D1 developed a model with a more vertical windshield and a teardrop-shaped side glass, resulting in, as he put it, “a whole new, different dynamic in the vehicle.” But from that very beginning, people’s reaction to D1’s favorite model was negative:

*At first, I remember taking that model outside and people were looking at it [and saying], What are you thinking? What have you done?*

The scale model shown to the executives was not that first model but a second iteration in which D1 had “tightened up” the design a little bit and made it “a little more mainstream looking”, while still keeping “that gesture”. Despite the easy win of the second proposal in the final NDI show, D1 was still hopeful that the situation would change and the art-deco proposal would be reconsidered for a full-size model. The NDI show was to be followed by a similar presentation to a committee in Japan. However, D1’s hopes were dashed very early in the meeting:

*I was asked at that meeting by some of the designers there why I brought a car that was so deliberately ugly. You know. So, I knew that that one was not going to fly; that was it, it was all over. Because, I always had hope that maybe I'd get over there and they would say, That's it! Or, you know, You got it! And then I would come back and I'd have some leverage to possibly sell it.*

And so this spelled the end of the art-deco design, which was both D1's and D2's favorite. D1 was philosophical about it:

*Sometimes, you know, you get an idea and the idea is so clear in your own mind, but the vision isn't... everybody can't see it. And that's how it works. Sometimes you have something that everybody kind of gets on board with, and sometimes you're just out there in left field somewhere; you're having fun but, you know...*

### ***A committee car?***

After the winning quarter-scale model was selected, the design studio team faced the task of developing it into a full-scale model. D2 described the scale model as having “the smell of the car” or “the essence of the car”, meaning of the final design, with its “lean surfaces and edges”. Still, a significant amount of work still needed to be done. This phase of the process was described by D2 as one of the elements that make NDI unique, namely, that they “work so well as a team, without the ego dominating.” Although the three designers had not worked together previously—D2 got moved to D1's studio after the Maxima project was completed, and the third designer was practically straight out of school—all three attacked the full size phase together. D2 did the rear quarter of the car, including the quarter panel, the sail panel, and the taillights. According to D1, “that gave it life” because at that point, the car had “movement”, and “the ultimate gesture was back into it, and it had the right stance.” The third designer contributed some ideas to the rear too, and to the bumper area. D2 also worked on the front of the car, at different times moving between the front and the back. D2 went on to describe her experience working as a team in glowing terms:

*It was a wonderful experience as a designer to be involved in the teamwork working on a full size, and the way [D1] was here—it was his original idea and he was so open to the participation of his staff—and how it worked to integrate in the car... It just kept moving ahead which is kind of interesting.*

Given that the final product was the work of three different designers, D2 was sensitive to the fact that the Altima could be called a “committee car”, a harsh descriptive in the individualistic world of automotive design. That negative expression is usually used to describe designs that have been ruined as a result of the interference by powerful

interests, such as a powerful marketing department or executive requesting changes to specific design features. D2 described the situation with the Altima and the three designers working in concert as a wholly different phenomenon:

*It's terrible to say it was a committee car, but in actuality, it really flowed, as far as ideas here... We were really, how would I say, meshing well. It was like we all felt the car, what it needed; we all had a desire to mature the existing Altima...*

Clearly, the three designers had reached a point where they could all work together seamlessly, completing and elaborating, but also extending and modifying each other's ideas. The process they describe has the hallmarks of a hermeneutic exchange. When D1 developed the scale model, it is not that he had a fully evolved design in mind that he communicated incompletely or ambiguously, and it was not just a matter for the other designers to uncover and understand what he tried to say or show. Otherwise, D2's contribution could not have been so important as to "give life" to D1's design, or to change something as basic yet overarching as the "gesture" of the car, to use D1's words. D2, and the third designer too, played an active role not merely in uncovering D1's (pre-existing) idea, but in forming and modifying that idea.

D2 explained that the three designers had a shared desire to "mature the existing Altima, to take a bit of the goop factor out of it, and to make it more expensive looking because these buyers love value for dollar." Also, they all wanted to make the Altima more "appealing from a masculine standpoint, [that is,] stance and posture", as the previous Altima was seen as too feminine by many. These shared objectives may appear to go against the hermeneutic notion of an eventual fusion of initially distinct and differing horizons, since they seem to indicate that the three designers already had a shared 'horizon' to start with (at least as far as it impacted the design of the car.) However, these shared notions were at a more abstract level than the operational level at which the creative exchange described in the previous paragraph took place. The notions of "taking some of the goop factor out" and of giving the car a different "posture" or "stance" are perhaps less abstract to a designer than the concepts of "more expensive-looking" and more masculine, but they do not carry with them one answer or one solution to the design situation, but leave a lot of room for interpretation.

### ***A family or a supermarket? What makes a Nissan?***

The decision to choose the more conservative design proposal at the quarter-scale model stage highlights the tensions that design organizations typically face when developing a replacement for an existing product, especially one that has been successful. Although some of the younger designers at NDI wanted to take the new Altima in a completely new direction, to do something “really wild and very different,” other designers, and the decision makers at Nissan, were swayed by other considerations, all of which reflected their concerns for the identity of the product, of the company, and how they are perceived by the customer.

When the replacement project was started, the original Altima had been on the market for only a few months. It was beginning to sell well, and it was becoming clear, even then, that the unusual design was going to be a success. The design was unusual then because it was unlike other vehicles on the road, and it was a total break with the boxy, angular Stanza which it replaced (“a huge leap” in the words of our informants.) By comparison to the Stanza which had been a poor seller, the Altima had rounded, curvy surfaces, with hints of retro-styling elements, especially in the rear. In talking to those early Altima customers, Nissan had found quite a high level of “commitment” to the car and its unusual design, and several Nissan designers, as well as the Nissan marketing executives, felt that they should not alienate these customers by going in a different direction with the replacement model. D2 explained:

*... we didn't want to alienate them by just going on a different tack, so we definitely wanted to honor what they loved about the car, but improve what was stopping other people from buying it...*

And D1:

*And, we felt that because of that success, [...] making that car so different from the previous car, the Stanza, that now if it had gone in a new direction--and we didn't want to confuse the customer, we wanted to establish a look for the car that would carry something of the old car through, would have some consistency, that the customers could relate to. It wouldn't be seen as another kind of product. It had developed its own look, and now we wanted to mine that a little bit, and use it. And of course, NMC and Sales and Marketing group and Research group really felt that*

*that was a wise way to go, and there was a lot of pressure from them to do that.*

In describing that decision, our informants kept making the point that, as much as they liked the more daring, art-deco proposal, they felt that going with the more conservative proposal was the wise thing to do from a business standpoint, that it was the sensible, rational decision, the “responsible” decision, which was the managerial point of view. Again, D1:

*And then there was the management [at NDI], and they felt that no, it was time to be a little more responsible, to look at the long range business plans, to develop the image of the car ...*

This tendency towards caution that D1 describes is ironic: the success of a daring, unusual design often causes decision makers to become cautious when the time comes to develop a replacement, and to choose a more conservative design, thus destroying the original source of their success. This tyranny of the successful design was mentioned by other informants in other case studies, as we shall see in the next chapter on Nissan’s Technical Center in Japan.

## **The Design Context Laboratory**

The previous section focused on a particular automobile model and the design studio that was charged with developing it. In the next two sections, we focus on two entities within NDI whose work cuts across the projects normally undertaken by the three design studios. These are the Design Context Laboratory, the subject of this section, and the Color Studio in the next section. Both of these fall under the same manager, and they both very consciously rely on highly interpretive approaches to perform their functions.

### ***The history of the DCL***

The DCL was established at a time when NDI’s relationship to the parent company started evolving. Early on, NDI was intentionally kept isolated from the Nissan planning and marketing operations in Los Angeles. The idea behind that decision was to keep the designers free from the pressures of Nissan North America (NNA). NDI communicated directly and exclusively with Japan. In time however, as NNA restructured, and as NDI

was given more responsibility for the design of products, especially those aimed at the US market, the need for NDI to interface with the other parts of the corporation in the US increased. In the course of its interactions with the US parent company in Los Angeles, one individual at NNA was “very receptive and supportive” of the design activity at NDI. He was more forthcoming with information than other managers at NNA and Nissan Motor Company (NMC). Later on, he was invited to join NDI, where a position was created for him. One of the tasks with which he was charged was to set up a colors and materials studio, and another was to create the entity that became the Design Context Laboratory.

According to our informant, everyone who was involved in its creation probably had a different idea of what function they wanted the DCL to perform. The objective was borne of a “nebulous idea” that some kind of a group was needed which would provide research information to the designers in a form that was useable and useful to them, and which would play the role of advocate for the work of the designers within the corporation by speaking the language of business people while being “design sensitive”, that is, able to speak the language of the designers.

In addition to its manager, the DCL consisted of two persons at the time of our visit: our informant, who had been running the day-to-day activities of the DCL for five years, and another individual who had been hired about one year prior to our visit. In view of the unusual role they were intended to play within the organization, it is instructive to mention the backgrounds of these individuals. Our informant started out studying literature and philosophy; he later switched to art history, which he studied in France. After that, he worked in journalism and studied publishing. Before he was hired by NDI, he was the editor of a well-known magazine on industrial design, targeted at professionals in that field. The other member of the DCL is an applied linguist by training, although he is often referred to by some NDI executives as an anthropologist, due to the kind of research he conducts and the methods he uses.

### ***The DCL and internal integration***

Our informant explained one of the main roles of the DCL by contrasting the mindsets or worldviews of the business person and of the designer. Even though designers understand

that they are working within a competitive business environment, they will generally try to explain their work and advocate for what they have done in “designers’ terms”, that is, in a language that is based on art. Their daily language is “the language of form, the language of creation, the language of line,” and the language of color. It would be very difficult for a designer who has been so close to his or her creation, working on it, thinking about it day in and day out in the above terms not to use that art-based language when describing it to someone else. And yet, that language makes most business people “nervous”; they do not understand it, and they do not want to hear about it when their foremost daily concern is to create a product that must compete successfully in the marketplace, that must sell well and earn profits. Our informant finds in that difference of worldviews the reason why most good organizations can recognize the output of the creative process and celebrate their creative people after the fact, while being not at all comfortable with the processes, the systems, and the methodologies that the creative people use.

One of the critical roles of the DCL then is to “mediate between the vocabularies and the worldview and the processes of designers, and the vocabularies, the worldview, the orientation and the processes of the business people.” They play that role of mediator by “lend[ing] a narrative, or creat[ing] a narrative” around the work of the designers so that the non-designers can understand what the designers have done, and why they have done it in that particular way. Our informant explained that a critical element in this mediation process involved explaining the historical progression of the designers’ work, to help the business people in the organization “understand the decision making process that’s gone on throughout the [design] process, so that they can make sense of what [the designers] have created in their [own] terms.” The next section describes a situation where the DCL was called upon to play that role of providing a context for understanding the development of a product.

### **An example of the DCL’s internal translation and mediation roles**

As an example of the DCL’s role in “weaving a narrative” around an NDI design, our informant described the development of a product that had been announced shortly before our interview. The product in question is Nissan’s entry into the small SUV (sport utility

vehicle) market segment, then mostly populated by Toyota's RAV4 and Honda's CR-V. (Nissan's entry has since been introduced to the market as the Exterra, a product that offers some unusual features, such as a first aid kit built into the rear lift gate, and an interior bicycle rack.) Since these competitors had already been on the market for some time, Nissan was playing catch up; its project had to be done under an "exceedingly compressed development time" in order for its entry to be viable. Nissan's design called not only for a "low-priced" SUV but also for an "authentic" one. As our informant explained, most SUVs sold today are not really used for the purposes for which they were designed, namely, off-roading and sports activities; rather, they're used to go shopping and as substitutes for regular cars and minivans. That fact was relied upon by Nissan's competitors in designing their small SUVs: both the RAV4 and CR-V are based on economy car mechanicals (the Honda Civic in the case of the latter), and do not have the ruggedness and handling characteristics needed for off-roading. By contrast, Nissan's "authentic" SUV is intended for people who would actually take it off-road, or use it in their outdoors activities to carry their sports equipment.

Due to the radically shortened development time allotted to this product, it was not possible for NDI, and especially NNA, to "solicit the kind of consumer input that the product planners and marketers normally like to have." Specifically, there was no time to expose the proposed designs to focus groups and consumer clinics along the way, in order to reduce the uncertainty the planners feel about being on the right track. This "system of checks" on which the corporation relies is based on straightforward thinking: if a new product is aimed at a particular segment of the market, then, in order to assess whether the company's proposed offering in that segment is likely to be well received, company researchers go out and ask customers who already own various competitors' products in that segment their opinion about the new design.

There was no time to conduct such research, and yet, "there was a great deal of nervousness within the corporation as a whole" about the direction of the new design. To address that concern, the DCL visited a few local areas where people engage in the kind of activities targeted by the designers. Specifically, they went to mountain-biking trail heads, they went to the local beaches to talk to surfers, and they visited a nearby ski area

to talk to snow-boarders. During these visits, “they concentrated on the people and their activity” without regard to the kind of vehicle they were driving at the time, be it a station-wagon, a sedan, a sports car, or a sport-utility vehicle. They focused on the kind of equipment these people brought with them, and “the issues involved in managing and coping with that equipment.” These visits were conducted at the outset, and they “helped inform the designers.” Seeing their target customers getting into their cars covered with mud and sand and snow led to new ideas and developments such as unique fabric coverings for the seats. The DCL researchers documented their work photographically and created a collage and a narrative that they used in explaining the design decisions to the planning and marketing executives. Our informant describes

*So then when all the marketers and the product planners came down [from Los Angeles, where NNA is based], and there was the vehicle that we created, we could sort of go back to a primary source and say, This is what informed our design effort. We went and we spoke to these people. We talked to them. We observed them. We documented them trying to cope with these kinds of objects. And consequently we have incorporated X, Y and Z features into the vehicle. And so that was enough--that sort of provided the link between the object and the observers. [...] Because they could see, Okay, these are the people; I can see who the people are; I can see what their problems are, and I can see that you've addressed them with these features. So that was enough to get them to go ahead and bless the design.*

Our informant described this approach as simply relying on “common sense”. He complained about the difficulty of dealing with decision makers who seem to “need proof beyond their own existential, experiential proof.” Although the work of the DCL, described above, did not provide the numbers and charts that some decision makers normally associate with that type of proof, it did give present them with a believable narrative that they could understand, accept, and rely on to move forward with the project.

Later on in the development process, when the proposed vehicle was finally exposed to potential customers who engage in the activities around which it was designed, they received it “very favorably.” Of course, it remains to be seen how economically successful it will be over its lifetime.

### **Other examples of internal integration**

The above example not only demonstrated the internal integration function of the DCL but also its role in external integration, where it bridges the distance between the designers at NDI and their target customers. This role will be discussed in greater detail later in this section. Our informant provided other examples of DCL's internal integration role, in which consumer information was not directly involved. One such example is the case of a prototype for an electric vehicle that NDI worked on following the introduction of California's Zero Emissions Vehicle regulations a few years ago (requirements that have since been rescinded.) Our informant described a situation as one where there were "fundamental differences in orientation" between the designers at NDI and the product planners at NNA towards the electric vehicle project. The designers, "being optimistic," saw an opportunity to make a vehicle for the person who is really committed to reducing pollution, while at the same time designing a "really cool and appealing" product. The excitement of the designers was at odds with the planners' attitude, who felt harassed for having to deal with "this damned regulation" Early on, the DCL hosted a conference at NDI to try to build consensus around the project, and they invited representatives of different parts of the corporation. Our informant described that meeting as "very contentious" and "a real dustup." No consensus was reached on that occasion: the product planner in charge kept pushing for a sporty vehicle with a sloping hood, while the designers kept disagreeing with him. The designers went on to pursue their own ideas. Later on, when the planner saw their initial work, a prototype that no one at NDI thought looked remotely like a sports car, he exclaimed "That's what I meant! That's what I meant!" Although the DCL was not particularly successful in carrying out its role in this case, our informant gave this example to underline the nature of its internal integration role. The product planner and the designers basically had the same thing in mind all along, but they talked about it in radically different languages. The product planner was unable to verbally communicate what he could only vaguely envision as an "exciting" and "cool" vehicle without falling back on his familiar vocabulary of "sporty" and "sports car".

The other example offered by our informant also involves the verbal description of a product. In this case, a product planner in the Nissan marketing organization in Los

Angeles sought the help of the DCL. At Nissan, not unlike other organizations, one of the first steps in arriving at a product concept is the “OB stakes document”, where “OB stakes” stands for “out-of-bounds stakes”. That document is intended to stake out an area within which the designers can work, and it will generally answer such questions as what kind of car they’re aiming at, who the typical customer is expected to be, what role will it play in the company’s product line-up, how it might affect the overall product strategy, and so on. Typically, it will also describe what mechanical components such as chassis, engine and transmission, the engineers expect to use in that product. The problem with this process, as with any other design situation, is that in these early stages the planners do not have a well-defined concept in mind; rather, the concept is still evolving. The designers, however, need to start their work; in this case, they started exploring options based on their understanding of the market in general and the particular segment targeted, and on their own interpretation of the requirements. Not surprisingly, conflicts started emerging between them and the product planners as to whether the options were within the (still-evolving) OB stakes or not. It is at that point that our informant was called upon to help the product planner develop some language that would better articulate the concept in the planner’s OB stakes document. Our informant characterized the role of the DCL in this case as crucial in developing a document that would meet the needs of the product planner, while allowing as much room for the designers to explore their various options. He described the language he came up with as a “sort of cute haiku” using the key words “emotion plus intelligence”.

Ultimately however, the role of the DCL as described above is one of interpretation. It cannot translate or interpret what is not there, nor can it through that process close the gaps that were left open by the groups between which mediates. In this case, our informant relayed that later on in the project, the fact that the product planners relied on the DCL proved to be somewhat of a drawback, due to the lack of specificity in the definition that the DCL had helped develop. Since the product planners themselves had not narrowed their own understanding of the concept, they were not fully prepared to give the designers more concrete direction when the latter reached a point in their work where they needed it.

Again, our informant ascribed the dissonance that crops up between designers and product planners to the different orientations of the two groups, the first being visually oriented people by training and disposition, and the latter being more verbally and certainly more quantitatively oriented. As a result of this orientation, the planners have a harder time “reading and understanding objects, especially when they’re in quarter-scale”; “they cannot visualize something that does not exist yet.” Our informant used an analogy to the well-known argument concerning the definition of pornography to describe what he believes to be the dilemma of the product planner who may have in mind an idea that is not well-articulated: “I don’t know what it is but I know it when I see it.”

### ***The DCL and external integration***

The other key function of the DCL is to provide a link between the organization and its customers. Although it is often difficult to separate the two functions of internal and external integration in product development, as we saw in the first example above, this section will focus primarily on the DCL’s particular approach to the problem of external integration, of bridging the gap between the design organization and the people who ultimately will decide whether to purchase its products or not.

In general, our informant was critical of the industry’s generally accepted approaches to customer research, starting with the reductionist practice of segmenting the market into smaller and smaller niches based on product specifications and features.

*The car industry breaks up the market; there’s, what, now 400 and... almost 500 different models of cars for sale in the United States. When car industry people look at the market they break it up into segments. There’s a segment for sporty cars, and midsize sedans, and large cars, and station wagons, and sport utility vehicles, and sports cars, and the whole bit. The average consumer doesn’t think that way. They basically say, “I’ve got a budget of \$15,000 dollars. What can I get? I can get a truck. I can get a coupe. I can get...” you know, whatever. And that’s their starting point.*

Although it may seem like a far stretch for a car buyer to be considering both a pickup truck and a sporty coupe at the same time, that was exactly what the DCL personnel

found when they conducted some preliminary research for a new sports car. That research is described in greater detail later.

According to our informant, the analytical approach to market classification simply does not reflect the complex and non-obvious way in which consumers understand categories and how they use them. More fundamentally, he questions the way in which researchers typically measure consumer preferences for the various product characteristics and features, which are the dimensions used in mapping out the space to be segmented. Again, the objection is based on the significant discrepancy between the consumer's real-life experience and perceptions, and the analytical abstraction intended to represent that experience; more specifically, between the complexity of a real-life car purchase and a consumer focus group:

*And what this [...] system would do would basically say, all right, let's ignore all that. And let's try and make this pseudo-scientific. And let's try and get a pure take on—you know... The consumers can sit around the table and say, "Well, the first thing that matters to me is value and comfort." But they're looking at a photograph. They can't get in the car. They can't sit in it. They don't have Consumer Reports in front of them to tell what the projected reliability is.*

The focus of the DCL then, as the next examples will show, is to better capture, if not understand, the complex real-world interaction of the consumer with the product, be it in the context of the purchase decision or in the context of the day-to-day use of the vehicle; and to communicate, if not explain, that complexity to the designers at NDI and to the rest of the organization. Paradoxically, in so doing, it would seem that the DCL's work has the effect of detracting from the work of the NDI's designers. Our informant talked about the detrimental effect of focusing too much on a vehicle's external appearance, as is commonly done during traditional consumer clinics and focus groups:

*[...] By putting so much emphasis to the exclusion of every other important component in their decision making process, putting all that emphasis on the exterior appearance of the vehicle, you do design a disservice because then the design of the vehicle is carrying all the weight. That the entire rest of the corporation in terms of their communication strategy, their sales strategy, their pricing strategy, the quality of their manufacture, the quality of their engineering, all that stuff, the burden is*

*being carried on what the thing looks like. And it gives the corporation a distorted view of what's important to consumers. And it also subverts progressive design.*

Such a statement may sound strange coming from a group whose purpose is to support the designers' work; however, it is in line with the kind of design in which NDI sees itself involved, namely, industrial design in an automotive context, as opposed to the more traditional "Detroit style" automobile styling. It is worth noting that by helping reduce the undue burden typically carried by the styling of the vehicle, the DCL is not simplifying the work of NDI's designers; to the contrary. By providing the designers with a deeper context about the customer's experience with her automobile, they give them more issues to deal with in the design process, and they are add to the complexity of their task. The following examples of external integration shed additional light on these issues.

#### **DCL's approach to consumer clinics: the case of the Maxima**

The DCL's new approach to obtaining customer input into new product development projects started out as a backlash against the traditional methods that were in general used throughout the corporation, both in Japan and in Los Angeles (at NNA.) These methods were analytical in nature, relying heavily on traditional design clinics and statistical surveys, the results of which were accepted with little criticism and used mechanistically in the development process. Our informant described that approach to the process of soliciting customer input as "incredibly destructive to the output of our corporation in terms of the kinds of cars that we make." He described the old process and contrasted it to the new approach that NDI used for the Nissan Maxima, a model that had been released less than two years prior to our visit.

In the old process, after the most promising design proposals had been developed into quarter-scale models, a focus group consisting of owners of a similar type of car would be assembled. During that focus group, normally run and moderated by an outside firm that specializes in putting together and conducting such meetings, the participants would be shown photographs of the various scale models, and they would be asked which they liked best. Typically, the model that was liked best by the largest number of participants would then be approved by the corporation for further development. The other candidates

would be discarded. And although most managers and executives in the corporation thought that this approach was a “perfectly reasonable” way to obtain customer reaction to a proposed model, our informant criticized it as “being utterly divorced from: a) the way people think about cars, b) the way people experience cars, and c) the way people shop for cars; plus, it does not make sense.” One of the shortcomings of the traditional approach, as he described it, is a direct result of the time delay between when the models are shown to the focus group and when the actual product is scheduled to hit the market, a gap of up to several years. He explained that it is “unreasonable to ask consumers what their taste will be in four years” given that people’s taste is so rooted in the present. Typically, the same people who initially complain about all cars looking the same today, when shown the photographs of designs intended to be “appropriately distinctive four years from now” would find them inappropriate. During an earlier interview with the designers of the new Altima, D1 talked about some of the problems with the conventional approach from the perspective of the designer:

*...when we used to just work with their [NMC in Los Angeles] research, you know, they would take our quarter scale models and clinic them, and they would come back with, you know: “Headlight was rated 20%; unacceptable. Taillight, and this line, [the] door cut here, nobody [liked it]... it rated badly...” And the whole car would be broken up into these little analytic bits, and it just drove us crazy because we didn't know how to relate to that. If you take a customer, somebody who's not associated with the design community, and put him on the spot and say, Do you like that headlight? And he's looking at the whole thing, and all of a sudden, he's got to focus on the headlight and he's got to make an evaluation of it. Well most people just don't look at cars like that; they look at the totality of it.*

He also talked about the personal cost to the designer, of being subjected to such a critique while observing one of these focus groups:

*[The designer would] sit behind a one way mirror and watch this, and you're just like, Oh, boy! And you can see the executive group, they're eating this up, and you're watching your car, this design that you worked half a year on, go down the tube.*

In the case of the Maxima, the DCL decided to conduct their own consumer research, and to design it in a way to improve on the shortcomings of the traditional approach. Instead of holding the focus group in the typical small room with the usual one-way mirror and a hired moderator, they rented a converted power station for the occasion, a large hall that was closer to a studio environment. Next, in an important break with the traditional approach, the participants were told that they would be evaluating designs for Nissan. Normally, the identity of the client firm is kept hidden from the participants (through the use of the facilitating entity, for example) in order not to bias the responses. To the DCL personnel, that consideration was outweighed by the fact that a consumer's reaction to a new design cannot be divorced from the history of the product and the perception of the brand. What may be seen as appropriate for a BMW may be viewed differently if the brand concerned is Mitsubishi, for example. With that in mind, the DCL set up a "context zone" where the evolution of the Maxima, through its three successive generations, was displayed for the benefit of the focus group participants. Another significant departure from the old practice is that the participants invited were owners of the different generations of Maximas, not simply recent buyers of similar models. In addition, they were screened carefully to ensure that they had owned their Maximas long enough, in order to avoid the tendency among recent automobile buyers, who may still be rationalizing their purchase, to react negatively to a newer design.

The focus group participants were shown the context zone, and the Nissan personnel shared with them the history of the model. This was followed by a lengthy conversation about the identity of the Maxima, what it communicates to them, how it differs from competing models such as the Toyota Camry, and so on. Next came a phase during which the participants were educated on the difference between looking at a real vehicle and looking at a quarter-scale model of it. They were shown a quarter-scale version of the then current Maxima, as well as the real car itself, and they were invited to go back and forth between the two and to discuss the similarities and differences between the two experiences. This prepared the participants for the final phase of the meeting, in which they were shown the actual scale models of the different proposals on which the designers had been working, as opposed to the standard photographic shots of these

models. This was an important factor in reaching the DCL's goal of getting more constructive information for their designers:

*... there was a dynamic that was set up in the previous methodology where, by the way that the interaction was structured and by the types of questions that were asked, almost by default you were inviting people to critique the car. First of all they were shown three views: front three-quarters, side, and rear three-quarters in photographs. And since the car was represented in two dimensions those elements of the car that came forward were the graphic elements. So people would critique the wheels and they would critique the door handles. They couldn't get a real sense of the flavor of the car.*

More generally, the DCL researchers made it clear to the participants that they were not asking them to play the role of a jury passing judgment on, or grading and critiquing the work of the designers. They explained to them that they wanted to “invite them into the design process” and “to solicit their input” into that process:

*We'd like you to collaborate with us in helping us to understand what it is that we've done. So that was a way of—we didn't want them to feel compelled to criticize. We wanted to invite their input.*

A critical first step in inviting the focus group participants into the design process, and making them able to contribute meaningfully, is taking the time to educate them about that process. To that end, the participants were told where the designers were in the process; for example, they were told that there would be another set of quarter-scale models, followed by a full-size model. Most importantly, they were told who the target customer was, and the NDI personnel shared with them their thinking on the new model and the company's intentions, information that is normally guarded very carefully by any product development organization.

The following is an illustration of the kind of interaction the DCL researchers were seeking to start with the participants:

*We had four versions, four different models, four different articulations of Maxima. And we shared with them what each designer's intent was. So by doing so what we were trying to get at was not whether you liked that particular car but do you understand it as a Maxima? Does it communicate Maxima to you?*

In trying to engage the participants in the design process at this deeper level, the DCL's personnel were aware that they were placing greater demands and responsibility on the participants than in the traditional focus groups. In fact, they had been warned by other groups within the corporation that they would not be able to conduct such a discussion with consumers because "they're not trained professionals." Our informant's answer to this criticism was that if one were of the opinion that it is not possible to get "good" information out of consumers because they are not trained in design, then why would one bother to ask them in the first place. In fact, our informant described the responses that the DCL got from their modified focus group as "incredibly insightful [and] articulate." He gave the following example loose quotation from one of the participants who was able to identify the particular mix of sportiness and luxury that is the hallmark of the Maxima:

*Well, I understand that one and I really like the way it looks, but that one is not a Maxima because it looks too luxurious. And the other one, Well, that one looks too sporty, and I don't like it anyway. But that one in the middle, I don't know, there's something about it; it's got the right balance of luxury and performance attributes that is Maxima to me.*

Our informant also described a typical reaction from one of the designers to the feedback from the focus group:

*'Wow, people understood what we did. This is how they saw what we did. And, Yeah, I guess I never thought about that model that way, but now that I look at it, I can see why that would signal luxury to someone whereas this one signals performance.'*

The above quotes highlight the open-ended nature of the exchange in which the participants and the designers (even those not present at the focus group) were engaged. During this conversation, the designers took the opportunity to explain themselves, their thinking, and the resulting designs (sometimes indirectly, through the context zone and the description of the target customer.) As a result, the feedback that they got from the participants was more constructive compared to the criticism to which they had become accustomed. They were getting intelligent descriptions of how the consumer understood what they had done and why, and they even were getting some praise for their effort. That kind of feedback helped to boost the designers' confidence in their work and the

overall project. That boost in confidence was described as being important to the work of the designers at NDI, and it seemed at odds with the often-held view of designers as being aloof, of working in a world of their own, and of being unconcerned about the opinion of non-designers:

*[...] our designers are not megalomaniacs and they often are... They have their convictions, but they often are unsure: Did I do the right thing? Did I go too far? Did I not go far enough? [...] in the old model what came back was critique and criticism, never praise: 'This is what's wrong with it. This is what's wrong with it.' And that wears on you if you hear it year in and year out. So what it served to do within the building and within the corporation at large is boost everybody's confidence around the project.*

The open-ended quality that characterized NDI's non-traditional focus group was not limited to the way it was conducted and to the conversation between the NDI personnel and the focus-group participants; it also carried over to the way in which the information that was obtained from the session was later used internally at NDI. Unlike in the past, the results were not treated as a go/no-go decisions on specific design features or elements. Our informant:

*When we got the information out of that research effort, there was no winner or loser.*

What the information provided was a better understanding of the direction in which each of the prototypes was likely to move the Maxima if that prototype were developed further. That deeper understanding started a new set of internal conversations between the different groups within the corporation, about the direction in which to take the next generation Maxima, whether to evolve and refine the then current Maxima, or whether to take the new car in a different direction.

Ironically, at the same time that more work and greater involvement was being asked from the participating consumers, the responsibility for making the tough design decisions was being brought back inside the organization. Our informant described that change as follows:

*So, in a way, what had happened in the past was that the corporation as a whole was using the consumers and the consumer clinic really as proxies*

*for their decision making responsibilities. 'Wow! No matter what I think, we can't go with that model because the consumers didn't like it.' So what we did in this instance was, we got output that really returned the responsibility to its rightful place, which is the management structure that's supposed to be making the decisions. There was no winner. This one means Maxima this. This one does this to Maxima. And this one does that to Maxima. So then the discussions around the decision making process were not about which one won the clinic, but about what is the proper direction to take Maxima? And as a result I think we made a better decision than we would have otherwise.*

This change was not merely a zero-sum shift in the locus of decision making, from the voice of the customer (through the proxy of the focus group participants) back to the design organization. The two parties were engaged in a joint process of developing a deeper understanding of the issues and tradeoffs involved in these design decisions.

#### **A second example of open-ended consumer interaction: the Altima**

Our informant offered other examples of consumer research conducted by NDI which was intended to be open-ended, in the sense that the consumer was not asked about his or her preference regarding specific design features, but where the researchers engaged the consumers in a free-flowing conversation around a very general topic. One case in point involved research undertaken early on during the Altima project. The general aim of the research was to inform the designers about different ways to think about car interiors. The research was prompted by the observation that many people were using the cup holders in their vehicles as “cell-phone holders”, and by the observation that people were spending more and more time inside their cars (something that is especially noticeable in Southern California, with its hour-long bumper-to-bumper commutes.) Here is how our informant described the stance of NDI’s researchers as they prepared for this research:

*... we brought in some Altima owners just to speak with them about their car and talk with them informally. We didn't have a list of questions. And what's interesting about doing that—see, traditionally they would have a list of questions. 'I want to know this and this; here are 10 things that I want to know, that I have to get out of this group.' Well, we want to know what's important to the consumers, not what's important to us. What's important to them.*

This approach led the DCL researchers and their respondents to engage in a “very rich discussion about the notion of the car interior as a personal refuge.” During this conversation, while generally discussing the ways people use their cars, one participant, an emergency room nurse, described one particularly bad day when, upon returning home and finding her baby crying and her dog barking, decided to return to the garage and to take a nap in her car. This led other participants to describe how they too often took naps in their cars. Although this free-flowing conversation is interesting in itself as a method for eliciting information, equally interesting and challenging is the way in which the designers ultimately use this information. The designers are not expected necessarily to act on it directly, by mechanistically translating it into specific product features. Instead, this information is intended to contribute to their general background knowledge about their customers and how they interact with their products. Our informant made that point clear; referring again to the use of the car interior as a personal refuge:

*Maybe that doesn't necessarily mean the designer is going to put a pillow on the seat back, but psychologically, it informs them. 'Well, really, I thought this was a machine for driving, but the consumer is thinking about it as a refuge.' So that leads you down a different avenue of exploration than you might otherwise go.*

### ***A summary of the DCL's philosophy and approaches***

A hallmark of the DCL is their flexibility, both in the range of tasks with which they are called upon to help, and in the variety of approaches they use to carry out their work. The DCL do not follow a given, fixed methodology, nor is their domain of action clearly defined and circumscribed. For example, helping out the product planner in LA in wording and refining his product brief—one of the examples presented earlier—is not one of the DCL's ‘official’ tasks. Furthermore, in many if not all of the DCL's activities, their internal and external integration roles are intertwined, as in the case, for example, where they used an anthropological study of potential customer groups to explain the designers' decisions to the marketing personnel. The DCL personnel do have a set of principles or understandings that guide the way in which they approach any situation, and these are the principles of interpretive thinking. One of these is an awareness of the role that people's background knowledge plays in structuring their understanding and coloring

their thinking. That is the reason why, for example, the DCL held the conference described above to kick-off the Maxima project, the conference that brought together the product planners, marketers, designers, and other concerned parties, to answer the question, “Well, do we know what a Maxima is?” In that conference, every participant was asked to go off and write his or her answer to that question, based on his or her beliefs and understandings. By doing so, the DCL personnel were making sure to start the process of developing a shared understanding that would serve as “the building block” or the starting point for the designers.

Another aspect of the DCL’s interpretive thinking is the notion that additional information or knowledge need not necessarily foreclose options or limit the designers’ range of exploration, as is the case in analytical definitions of information. Rather, the additional knowledge has the potential of opening up new avenues and new spaces for interpretation. In the case of the Maxima for example, the purpose of the meeting described in the previous paragraph was not to capture the shared meaning of the Maxima in order to hand it over to the designers and ask them to develop a new embodiment of that concept. Our informant made it clear that although that was an option, the designers were encouraged to interpret freely and to explore different directions:

*Well, do we know what a Maxima is? And everyone went off and wrote it down and, sure enough, yes, this was our shared understanding of what Maxima is. And that was really the building block. And so the designers' task was to take this shared understanding of whatever it means to be a Maxima and create another one; or create different variations of that.*

Yet another element of the interpretive thinking at the DCL is the reliance on open-ended questions and the avoidance of ready answers, and of questions that would lead to such answers. That was covered in some detail in several of the previous examples, in particular the general conversations undertaken early on for the design of the Altima interior, and the more recent ones carried out in the context of the new sports car project. As a related matter, the use by the DCL of research methods usually associated with ethnography is another example of its interpretive bent (Geertz, 1973; Van Maanen,

1988).<sup>57</sup> Such methods were described earlier, in the context of the research conducted among surfers and mountain bikers.

An important element of interpretive thinking at the DCL, also discussed earlier, is its rejection of rigid, well-defined categories that are based on analytical mappings from sets of features, and its preference for more natural classifications that better reflect the real-life experience of consumers. This approach to categories follows the thinking of such researchers as Rosch, and Lakoff and Johnson (Rosch & Lloyd, 1978; Lakoff et al., 1980; Lakoff, 1987).

A clear expression of the DCL's interpretive character is its reliance on different approaches to their work, as the context and the circumstances suggest or require. That is clear from the range of examples presented above. The members of the DCL do not believe in following one single approach or a fixed research technique all the time. This however turns out to be a source of difficulty for the DCL in its work with the rest of the organization, where people tend to prefer a given system or methodology that they can apply universally and repeatedly, and tend to be uncomfortable with the ambiguity that is inherent in such context-dependent approaches. Our informant's description:

*So what we've been doing in activities like this as well is trying to sort of inoculate the host corporation, if you will, with more progressive methodologies. And we're always quick to say, Well look, just because we did it this way under these circumstances does not necessarily mean that the next time we have a different kind of product that we're going to do it the same way. We're going to try and develop methodologies that are appropriate to the task and appropriate to the product. Which drives people crazy because they want a system and they want to be able to just implement something at the drop of a hat. Whereas we try to be much more sensitive to the particularities of a given product and a given program.*

This openness to the particularities of the given situation and its context, and the readiness to develop new approaches as needed are hallmarks of the interpretive approach of the DCL

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<sup>57</sup> Clearly, this does not refer to the now obsolete notion of ethnographic fieldwork as scientific observation, but to the more modern view of fieldwork as an interpretive process (Van Maanen, 1988,

The DCL is an example of an openly interpretive entity within NDI. Its members are trained in disciplines—linguistics and art history and criticism—that give them facility with the language of interpretative thinking, something that was obvious during the interview with our DCL informant. Furthermore, one aspect of their job is to evangelize, to spread that type of thinking throughout the organization; as a result, they are explicit when they talk about interpretive issues and about the differences between interpretive and non-interpretive approaches. In contrast, the next section deals with a group within NDI that relies on interpretive approaches in a more implicit way, almost by default, due to the nature of their work.

## **The Color Studio**

NDI's approach to design, which NDI's president referred to on many occasions during our visit as an "intuitive" approach, is typified by the work carried out at the Color Studio. The Color Studio consists of four designers who are not only responsible for the exterior colors on specific Nissan models, but for developing interior colors and fabrics as well. NDI's color studio was set up relatively recently; at the time of our visit, it was only seven years old. Initially, the studio supported the other NDI designers in their work such as developing colors for the all-important quarter-scale models used in design decision making, as described earlier. The color studio also undertook "minor change programs", that is, fine-tuning the color offerings of existing U.S. models. The Altima project was the first one for which the color studio was charged with developing an entire color palette for a new model. That work started four years before the introduction date of the car (as mentioned earlier, this introduction coincided with our visit.) Before the Altima program, the major color design work for all of Nissan's products was carried out in Japan, with input from the marketing organizations of the various markets.

The four color studio designers are all young women with academic training in the fine arts. One of them has a background in fabric design; another in product design. They interact most often with the designers from the other NDI studios. They also interact with

their counterparts in Europe and Japan, as well as the assembly plants in the U.S., where the colors they design are ultimately applied to the product.

The color studio is a particularly interesting study site because of the highly intuitive nature of the work carried out there. We interviewed the chief designer in charge of that studio, whom we will refer to here as B, at length. She characterized the work of her studio as follows:

*... we work in really abstract sort of levels because color is so difficult to communicate; and we deal in, I think, in a much different level than the [other] people here. I don't know if it's higher or lower, but it is definitely a different level.*

The very nature of working with colors, fabrics and textures, and the difficulty faced by color and fabric designers in discussing and explaining their ideas and concepts to outsiders, have resulted in B and her team developing certain unusual approaches to communication and integration. These approaches are intertwined with B's and her team's particular philosophy and beliefs concerning the way in which designers select colors, and how these in turn become accepted by the public. Their philosophy is generally at odds with the approach that is more typical in the industry. She underlined one aspect of that difference in rather strong terms:

*I think color designers and color design studios attempt to act like they know what [colors will be popular in the future]... like they have a crystal ball and they know exactly... And we, I think, decided to say, You know, we're not going to pretend that we do.*

Later, another aspect of that philosophy came through as she was commenting on the use of surveys and statistics in data-driven design:

*I can't get a piece of 8½ by 11 paper with a chart on it and expect that to inspire me in any way and/or make me think beyond... Pfffit! I can't do it.*

Not only does she reject the idea that new colors simply jump out of the mind of the individual color designer, as well as the notion that they can be arrived at by looking at statistics of what people are buying. She also rejects the commonly held belief that automobile colors follow, or are interpolations or extrapolations of, trends in fashion apparel or other such “identifiers”:

*... we're not going to say that there's an identifier. And the biggest thing that we feel pretty strongly about is [that] fashion isn't [it]. You don't open a magazine and say, Ooh, there's a purple, therefore it's going to work on a car. It just isn't... if it were that linear, anyone can do it; and we don't believe anyone can just, like, put a color on a car.*

Rather, automobile colors are the result of a complex interaction between, among others, the designer's intent, the forms and shapes that they developed or had to accept as a result of some constraint, and the possibilities afforded by the available paint technology:

*It has much more to do with the communication of what the designer on that exterior [intended], and the forms, and the paint technologies... It's a lot more than just a hue to us. Too many people look at it as, it's kind of fashion oriented; it's not quite that direct.*

The picture that emerges from this series of statements is that the role of the color designers involves complex and intensive interactions and communication with the form designers, the consumers with whom the former are trying to communicate, the paint technologists, and so on.

This section will focus on the communication and integration approaches and mechanisms that the color studio designers use in the course of conducting their work, which requires them to exchange highly abstract and intuitive information. As in previous sections, a distinction is made between mechanisms of internal integration and those of external integration. As explained before, however, that distinction is sometimes an artificial one, as internal discussions often relate to the different team members' perceptions or understandings of the customers' wants, needs, and desires, without the customers being directly involved in these discussions. Still, the distinction is a useful one for the purposes of organizing the presentation.

## ***Examples of internal integration***

### **The Nissan global color meeting**

The 1998 Nissan global color meeting provides a number of examples of the color designers approach to internal integration. Once a year, a meeting is held in Japan to decide on the colors offered on Nissan cars for the coming year. That meeting brings together Nissan color designers from the US, Europe, and Japan. The reason why colors

offered around the world need to be coordinated is the limited capacity in Nissan's plants for the number of colors that can be applied to cars, combined with the differing regional tastes and preferences.<sup>58</sup> Our informant explained:

*They [the plants] just can't deal with twenty colors for America, twenty colors for Europe and twenty colors for Japan, so there's a lot of arm wrestling, you'd call it, and just--This is what our market needs...*

Going into that meeting, the NDI color designers took with them a set of "questions" that they believed would set the theme for that year's meeting, and raise a set of issues with which they had been contending. Each question was embodied in a display that was intended to pose the question and suggest ways of thinking about it and discussing it. According to our informant, she and the other color designers at NDI "knew that we had to make a statement in Japan," so they decided to focus on the "biggest questions" that relate to their work and to that of the other color designers at Nissan.

The first question was referred to as "Redefinition", and it dealt with the public's perception of colors, and the color designers' attempt to understand and redefine how that perception works. Unfortunately, our informant could not tell us more about that question or the display, for reasons of confidentiality.

The second display was entitled "Acceptance". The question that the designers were attempting to address here was the public's perception of softness in seat cloth, a situation that was described as a "continual problem" by our informant. Consumers in the U.S. tend to prefer the softness of velour-like fabrics, a type of construction that is very uncharacteristic of Europe, where people favor a flat, very structured, "modernist" type of construction. The problem is that "most designers despise this very American, very fluffy, pile-like stuff." The display was intended to help the designers better understand the acceptance factors that come into play in the mind of the customer. To that end, the display they assembled brought together samples that convey not only different levels of softness and hardness, such as samples representing different types of fabric as described

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<sup>58</sup> Our informant indicated that Japanese and US consumers tend to be much closer in their color preferences, compared to the European ones. The latter favor colors with high levels of "chroma", that is, bright vivid colors. The former prefer colors that are more subdued. Our informant could not decide whether the US and Japanese were "a little more refined" when it came to colors, or whether the Europeans were ahead.

above, but also disparate items that inform such notions as “hard” and “soft”, or that inspire in people such ideas. For example, the display contained a marshmallow on a stick and a piece of stone. Like the previous question, this exercise was also one of redefinition in a sense, a redefinition of what is a soft and what is a hard fabric. The discussions and conversations that were prompted by the question and the display that went with it resulted in some new ideas for a fabric that “mixes, that blurs the boundaries of what it is, but that allows us to move, maybe as a segue, to the direction we’d like to see things going.”

In this example, as in many others, it is notable that the new design or the new idea was not the result of researching and mapping the customers’ perceptions and preferences, and then targeting the median or some other location in the taste or preference profile. Clearly, the whole exercise was prompted by the state of customers’ preferences; however, the statement quoted above points more to a “quasi-activist” designer, who is attempting to steer the consuming public in a direction that she likes, that she believes people would find interesting and appealing and therefore ought to turn to. But she is doing it in a graduated fashion, in a creative way that smoothes the transition she foresees the customer will have to go through.

Not all the questions and displays related to highly subjective customers’ perceptions. The third question, for example, dealt with the technical issue of paint quality.<sup>59</sup> The problem in this case was the result of differing environmental regulations in the US and Japan, resulting in different paint quality when the identical paint stock is applied in different plants. Again, this issue was not the result of customer complaints or complaints from the plant, but rather by the designers themselves being unhappy with the results they were seeing: “We as designers were frustrated by it.” The problem was very noticeable to them when different models, manufactured at different plants, but both painted with the same color code, were viewed side by side. This display consisted of ideas for different surface treatments, with objects that had polished surfaces and sandblasted surfaces, or

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<sup>59</sup> US plants are required to use high-solids paints, that is, paints containing a lower proportion of thinners or solvents that will ultimately evaporate into the atmosphere. As a result, the micas or aluminium chips in metallic paints lay at a different angle, resulting in different levels of reflectivity and giving the painted surface a different look. One solution to this problem would be to use a water-based paint process, but that would involve large capital investments.

that alternated between the two on different sides. Here again, the question resulted in new ideas for finishes that would bypass the problem. Our informant could not reveal the details of the new finishes, which are expected to appear on the market in the next few years, but she explained the approach as follows:

*We're saying, Ok, fine, if we can't do what we want, how can we do what we don't want well; meaning, maybe solid colors, things that outsmart the system in a sense.*

The final one of the seven displays looked like Batman's cape. It was called "Tension", and it consisted of a piece of rubber that was mounted in the middle of the frame of the display, stretched in many directions by strings attached to the periphery of the frame. This display was intended as a "visual metaphor of how it felt" to the NDI color designers working on so many different things. Our informant explained:

*... as a color designer, you're switching gears so often and it's so frustrating that we said, you know, we just want to [...] to admit to it and tell everyone that we are under an extreme amount of tension; we are running too many programs, too many things all at once, and it feels this way.*

Our informant also explained that this was "purely an emotional thing," that they, as a studio, were dealing with this issue at an "emotional and personal level." One could imagine a more analytical way in which they could have approached that problem; for example, they could have listed the projects and tasks for which they were responsible, estimated the resulting workload on their studio, and made their case for more resources or a reduced workload. Instead, they were thinking in terms of indirectly asking for help, by talking about their workload openly and accepting that designers need not always "act like the Rock of Gibraltar."

*... we thought, by just ignoring these really big questions we're not getting anywhere with it. Let's acknowledge that there are questions and we can't answer them, unless we try to take this huge thing, as a group and deal with it and admit that we don't have--you can do words all you want, you know, Oh yeah, well, this is... But we said, let's come up with--we're not sure how we're going to answer this. We don't know how to screw the perception of the public. We don't know how to get quality. We weren't sure. These were just questions that kept floating around us, and then*

*when we started working on the progress, we said, Wait a minute, the quality, when we can't get it, what can we do? And then the answers came. And, it's the same up here. Okay, but what can we do? What, [inaudible] different with the yarn over here...*

### **Applying colors and textures to forms that don't exist**

The previous section on Nissan's global color meeting provided examples of interpretive practices of internal integration between geographically dispersed yet functionally similar groups (namely, color and fabric designers from the US, Japan, and Europe.) In this section, we look at the internal integration role that the Color Studio members play within NDI itself, in the course of their interactions with the exterior and interior designers.

When NDI is tasked with developing a new model, the work of the Color Studio begins immediately. Our informant, B, and her team have to start developing a color palette for the exterior, and fabrics and colors for the interior, from the start of the project, before any exterior shapes or interior forms have been sketched. This early start is necessary due to the long lead-time required to develop colors and fabrics. In order to insure the durability and fade resistance of every exterior paint color and every interior fabric, extensive and lengthy wear and exposure testing must be carried out. In effect, as our informant put it, "The color happens before the form; in most cases." At this early point in the project, the Color Studio, just like the studios responsible for the exterior shape and for the interior design, is working from the brief given to them by the marketing organization (the "outer bounds" document described earlier in the DCL section.)

During the interview, it became clear that our informant found this situation problematic for two related reasons. First, as discussed at the beginning of the Color Studio section, she is a highly visual thinker who needs more than a "just a piece of paper" to "inspire" her. She describes the typical product brief as follows:

*It's really weak, I can tell you. It's one of these things that [makes you say], So what? I know that they're 24 years old and mostly skewed male and graduated from college. That doesn't really tell me a lot.*

Second, she believes in a holistic approach to form, color, and texture. In the case of exterior color for example, this was clear from her criticism of a show car displayed by a

competitor at the Detroit automobile show the previous year. That car was painted with a novel type of paint that changed color from green to red depending on the incidence of the light on its surface:

*It looks like the car was being done over here, and the color design was over there, and they didn't have the same plan in front of them of what it was going to be. [...] I don't think they ever looked at that color, any of those colors on that car, and made sure and said, Yes, this is where we want to launch it because it's appropriate on this car.*

And in the case of the interior:

*It's really hard for me to just slap a material onto a form, and bring it... make it work. Which is basically, I think, how too often cars are designed; as opposed to saying, Okay, I want this—maybe it's the crash pad, the IP [instrument panel]—but could we do something different than just slap vinyl on it? And you have to design that from the beginning. I can't do that at the end. It's very difficult. [...] The shape and the materials are the same.*

Designing the interior fabrics and colors is even more difficult and complex than the exterior color palette because the exterior shape affects the whole interior environment. In particular, the shape and size of the greenhouse (the glass area) and the disposition of the roof pillars can change the feel of the interior, and therefore how particular colors and textures will look in it.

In effect, the tasks of the three design groups—exterior, interior, and color—are highly dependent on one another. Furthermore, the interdependencies are difficult to articulate or to describe in analytical terms.<sup>60</sup> For example, when pushed to explain what she did not like about the competitor's show car mentioned above, our informant answered: “It was too much. It did not have to go from red to green.” Clearly, she was basing her assessment on an overall impression, not on a specific analysis. In fact, when one somewhat technical explanation was suggested, that perhaps the ever changing color

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<sup>60</sup> Referring back to the section on the Design Structure Matrix in Chapter III, it is interesting to note that the interdependencies described here are, to a great extent, idiosyncratic. A color designer other than our informant, one who may be comfortable developing a color palette in the abstract, without working directly with the specific shape the color is being applied to, or using a generic form instead, would not encounter the same interdependency.

made it difficult to accurately perceive the angles and curvatures of the body shape, our informant did not comment on or pursue that line of reasoning.

One way in which B and her team deal with the circularity of this situation is through extensive communication and “a lot of discussions with the designers” in the other studios at NDI. Most often, these discussions center around highly visual elements and concepts, and B and her colleagues rely on displays boxes that contain assemblages of objects, similar to the displays they used for the global color meeting in Japan. These boxes are assembled ad-hoc, to address particular issues or to make particular points. Our informant uses these assemblages in a number of dialogic exchanges: a personal dialogue where she is trying to clarify and organize her own thinking on the issue, and to explore different dimensions and new directions relating to it; a dialogue within the Color Studio, where she discusses these issues with her colleagues; and, of course, in the dialogues with the other NDI designers.

One such box, the “potato display”, was developed by B to explore different “levels of thinking [on] how we deal with materials as humans.” The display box contained models of a potato in its natural state, of mashed potatoes, and of French fries. It also contained some of the implements used to process the potato from one state to the other, such as a potato peeler and a cutter. B described the display and her personal thinking and motivation for putting it together as follows:

*We start with this very natural thing, and then we start manipulating it; and then we manipulate it more; and then we overmanipulate it; and then we... It circulates almost back to this, to me. And perceptions; I was dealing with perceptions. These are like real and fake; and we do this real-fake thing that isn't necessarily... I think that's where we are in terms of automobiles right now: we do this fake animal grain and we do this fake wood. We throw in real leather. There's this mixture of weird things to me. And I thought, okay, after that, we go to this level, where we take...*

This particular approach, using the different forms of potato as a model, “was not panning out” for our informant. She admits that although that particular display could help her make her point, She felt that she needed to make her point using colors and materials “that would matter to the designers.” Perhaps the potato display was too

abstract, even in the NDI environment. In any case, it played an interim role in the overall conversation about material naturalness.

The display B developed next contained several different materials—plastics, rubber—in their raw or natural state, whatever that “natural” state was. In some cases, it was the state of the material as it occurred naturally, but in several cases of man-made materials, the state was one of minimal processing. For example, a few items in the display looked like blocks of latex similar to that used in medical gloves and similar devices. The display contained some colored materials as well. Again, in the process of choosing the materials for this display, our informant was going through an interpretive process with herself:

*I was doing it because it was something that I had to get out of my head. It was something that I had to make dimensional to remind myself... When you have too many things floating around, it's so easy to think, Natural, organic, pop, colorful, or lack of color, clear. Or, you know... When you start, sometimes you start dealing that way, very machine like... I kept feeling confined by that, and saying, Okay, how can I get out of this spiral I was in. [...] I decided I didn't want to do anything unnatural. I just eliminated that fake animal grain and this and that and, maybe, there's other opportunities. So then I said, OK, the next one might be actually where we take this very raw materials; they're not designs. These are things you would get... you know, it's the inherent color of the material I guess is what I'm saying; without designs.*

Clearly, B had a certain goal she was trying to achieve through this interaction, and she had certain ideas in mind, which she was trying to develop and to communicate. She describes her objective as follows:

*I was trying to influence the designers to think differently about, when and how they choose a form, to think about how, eventually, what material it might be*

Referring back to the typology developed in Chapter III, this would tend to place this interaction close to the pragmatic interpretation type. The instrumentality of pragmatic interpretation is clear in that she wanted to influence the thinking of the designers. She wanted to get them to move away from what she saw as a strange mixture of materials and textures. She also had a sense that there was some type of cyclical evolution that materials underwent, and that it may be possible to move on to the next phase in that

evolution. Yet, her ideas were ambiguous, not fully formed nor clearly articulated, as is clear from her descriptions above. By presenting and explaining the displays to the interior designers, she was not proposing that they use specific designs or textures. Going from different forms of potato to a material for an automobile interior would obviously involve more than a trivial mechanistic transformation; similarly for the various forms of raw plastic and latex. She was presenting her abstract ideas, along with the contextual material contained in the displays, to start an interpretive process, a set of conversations between her and the interior designers, but also between the interior designers and their own work, with the purpose that this directed interpretive process would then potentially lead to novel materials for car interiors.

During the visit to the Color Studio, several similar examples of highly interpretive but directed interactions between B and her colleagues on the one hand, and the designers in the other studios on the other, were discussed. One of these revolved around the design of steering column control stalks and their texture. Through chance, our informant had come across some interesting woodworking tools that had what she thought was an interesting knurled handle. As a result, she became interested in “things that were knurled or milled”, and she started thinking about ways in which one could come up with “more interesting stalks” as opposed to reusing the same carry-over stalks in all their cars. She decided to communicate her ideas to the designers, and to try to move them to think differently about control stalks and, more specifically, to think in terms of knurled designs. To that end, she put together an assemblage of different tools and objects with differently knurled surfaces, one of which was an exquisitely machined miniature hammer with a knurled metal handle (the very object she had discovered earlier.

A similar example involved another member of the Color Studio, herein referred to as J. In that case, J was thinking about the evolution of masses in shapes and forms, and she was trying to develop a vocabulary for discussing hard forms and soft forms with the interior designers, and use it to suggest materials and patterns to them. She developed a display using different materials in different phases—solid, liquid, and gaseous. The display included pieces of rock with sharply defined edges and angles, to rocks with softer forms. Also included in the display were small containers of liquid, some with

objects moving in them, as J had become fascinated with fish and things in motion in water. (At that point, she also started looking into fishing and fishing gear.) The display included images of liquids beginning to boil, with different stages of bubble formation, as an intermediate phase between liquids and gases, again looking for ways to convey different, novel ideas about textures.

All these examples are characterized by a known direction, a certain goal, but one where the ultimate embodiment of that goal is unclear and yet to be articulated. Neither J nor our respondent was trying to suggest a specific design or shape or texture to the designers. In fact, the open-endedness of the concepts and ideas that were presented in the displays was such that our informant had a rather difficult time repeating, or explaining in her own words, how her colleague presented the contents of her display to the interior designers. Clearly, the contents of the displays by itself, and whatever ideas attach to these objects at any one point in time, were much less important than the role they played as a starter used to initiate an exchange of ideas.

### ***Examples of external integration***

The Color Studio at NDI provided some of the most compelling examples of highly interpretive approaches to external integration. Our informant described several situations that illustrate the Color Studio's unusual approach to understanding their potential customers. Three of these are reported below. The first example, briefly mentioned in the Introduction (Chapter I), deals with understanding the buyers of sporty cars. The other situations were not directly connected to a specific car project.

#### **“Market segmentation” by bag of “chips”: Understanding sports car buyers**

A short time prior to our visit, NDI had been asked to start working on a new sports car design program. The purpose of the program was to develop a new Nissan Z car, a successor to a line of highly regarded and successful sports coupes stretching back to the original 240Z model of the early 1970s. The last Z model, the 300ZX introduced in the late 1980s, met with much success. A few years later, however, it had fallen victim to the unexpected collapse of that segment in the sports car market, along with its competitors in that segment—the Mazda RX-7, the Toyota Supra, and even the Porsche 944/968. As a

result of poor sales, all these models were ultimately discontinued, at least in the US market, even though replacement models had not been developed. A number of factors had been advanced as contributing to that unexpected change in the market, including demographic shifts and a change in people's behavior from the conspicuous consumption of the late 1980s to the more sober early 1990s. One of the explanations held that people who in the past had opted for sports cars had in recent years replaced them with sport utility vehicles and pick-up trucks, for a variety of reasons.<sup>61</sup> On the other hand some data from the marketing organization also suggested that the converse was also true, that in one survey, half of the customers who ended up buying sports cars were initially considering trucks and SUVs as well. Jerry Hirshberg, NDI's president, explained:

*Hey, guys, let's check our own intuitions here. Do we really know what a sports car is? Is there any new language? Are there any new references? Who are these people? I'm already intrigued that people went in to buy a truck and they're getting sports cars. What's that all about? Half these people wanted to buy trucks and walked out with a sports car. Now no marketing group is going to discover that. That's not a question you think to ask before. "What truck were you interested in?" We may be aiming for the entire wrong market.*

The Color Studio was involved in the research project aimed at developing a better understanding of who these sports car buyers were, and what their interests were. Our informant in the Color Studio used different language to convey the same reasoning:

*We decided... We said... We're working on this program, and [we] said, Who are these people? We really couldn't decide who they were and why they would want to buy this product. And yet, it's always easy to put them in a market segment that... we think that it's changing, and that people might pull from a different segment...*

To help them shed some light on this question, our informant in the Color Studio and her colleagues devised an unusual approach to consumer research. The normal approach for this type of research would have been to hold a focus group. This involves inviting a group of people from the relevant demographic group, sitting them around a table, and

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<sup>61</sup> It should be pointed out that knowing the real reasons for the change in question is not essential for the description of the practices in this section.

having a professionally trained facilitator conduct a conversation with them about who they are and what they do. B described the alternative approach as a way “to let people have fun with research.” She and her colleagues assembled a collection of forty small images, each picturing some item that they deemed “interesting”. The images or photographs were on “chips” measuring approximately one by two inches. They covered a wide range of topics, from food—a picture of a hamburger and fries, a chicken, an Aunt Jemima pancake syrup bottle—to clothing or fashion accessories—watches, sunglasses—to pieces of furniture—a Louis XIV armoire to a modern chair. Our informant explained:

*So I was trying to have some design classics, some sort of more modern things, vintage...*

The above description and statement might suggest that the selection process for the images in question was methodical, perhaps even following some experiment design principles. That would be misleading. One of the images our informant included is an image of a baby duck; she described her reason for including it as follows:

*You know what, when we did it, we didn't like over-strategize or think about the images. Like, I insisted this be here, and everyone said, “Why?” And I said, “I don't know, I just have a feeling. Don't ask me why.” [...] It's a chicken, it's a duck, yeah, it's a duck. It's cute. [...] It's a baby duck.*

It is notable that out of the forty images in the set, only two or three represented cars, even though the purpose of the whole exercise was to understand car buyers.

Furthermore, the car images they picked included a model that is not sold in the US, the Renault Twingo (a one-box mini or city car, noted for its unusual interior design.)

Having decided on the set of images, our informant and her colleagues put together identical packages that consisted of the chips, a few sheets of paper on which to glue them, each sheet corresponding to one of three categories—“Like”, “Don't Care”, and “Dislike”. They included a set of instructions, along with a return envelope. Those recipients who chose to complete and return this unusual questionnaire to include contact information, and to indicate whether they would be interested in participating in a “roundtable” discussion (in case our informant and her colleagues found them “interesting”).

The process by which potential participants were selected is no less unusual than the design of the research instrument itself. Our informant, still in apparent disbelief herself, described the process thus:

*We went around and had a little envelope... We drove around... What we did is, we put these on... We drove around... Can you believe this? We're nuts... We put these on people's cars that were competition [sports] cars, in a sense... It's cool, huh?*

The questionnaires were dropped off in shopping mall parking lots in several locations around the country, including such disparate locations as San Diego, where NDI is located, and South Carolina. Every car that received a questionnaire was also photographed, so that the Color Studio personnel would have a record of what that participant's car looked like when they selected it.

Finally, every participant who mailed back a response was eligible to receive a gift certificate for a store of his or her choice, the available choices including a record store, a bookstore, a home furnishings store, and store that sells fashion accessories. The participant's choice was used by the NDI researchers as another indicator or "data point" about the participant, albeit in a highly scientific way (as we discussed below.)

At the time of our visit, our informant and her colleagues at the Color Studio were in the process of organizing the responses they had received, and it was clear that their approach to sorting through the responses and extracting any knowledge from them would be as non-analytical, as "intuitive" and interpretive as the process through which the grab bag of image chips was assembled. The images were divided among the four members of the Color Studio, with each responsible for sorting and organizing the responses corresponding to ten of the forty chips, and for interpreting the results. Our informant, for example, was tracking the baby duck mentioned earlier. As it turned out, all the participants expressed a liking for that image. In discussing the implications or meaning of that outcome, it was clear that she had not decided, a priori, what a positive response to the duck would indicate about the participant. Rather, she was in the process of developing an interpretation for that response after the fact:

*Everyone likes the baby duck, so I don't really know what that means; I'm still working on that.*

And:

*There's a vulnerability, I think, or a cuteness or babylike... or awkwardness, or... I'm not sure. These are all questions that I have that I'm going to just pose to other people. Why do you think the duck's here [in that category]? And it opens, maybe, communication?*

Clearly, she was not following some algorithm or set of rules to translate a participant's responses and demographic information into specific design preferences, such as, "If the participant likes the baby duck, and if the participant is a male, and if his or her current car is not black, then that respondent prefers bright colors such as yellow or green." In that sense she was not following a straightforward pragmatic scheme, in which a particular response, combined with certain contextual elements, result in a particular understanding.

The above description points to a process that is more open-ended, more ill-defined a priori, one that is best described as one of hermeneutic interpretation. By including the baby duck (and several of the other images as well), our informant was starting a set of open-ended conversations, between her team and the people whose cars were selected, but also between herself and her colleagues (as the last sentence of the above quote makes clear.) Other than the loose direction of generally leading to a better understanding of sports car buyers, these conversations did not appear intended to provide direct answers to clearly formulated, well-planned questions. At the beginning of the conversation, the question posed by the baby duck picture was not clear in our informant's mind: she thought the image was interesting, but she did not have a clearly articulated reason for including the duck. Consequently, the responses received could not be expected to have a clear and unambiguous meaning within them. The quote above indicates that whatever meaning these responses will ultimately carry will emerge from the conversations and interpretive processes in which our informant and her colleagues were entering into.

It should be noted that our informant's statement does not seem to point to a carefully planned set of conversations. Her last comment, "It opens, maybe, communication", suggests that she did not look at the conversations that would result from this research exercise in an instrumental way. She does not state that her objective is to have a set of conversations, and that this research is the means for initiating them. Such a stance would be at odds with the highly interpretive mindset that imbues the thinking and most of the activities of the Color Studio.

It is remarkable that our informant and her colleagues seemed at ease living with the ambiguity and lack of precise definitions that are inherent in their approach. In that respect, they are different from many design teams who feel the need to fully define what they expect to learn from any research exercise as they are designing it, and to crisply categorize and quantify the data they obtain from the field. When asked whether she was concerned that her research design might have been biased, and probably did not come close to meeting accepted standards for sampling or design of experiments (for the selection of the chips, for instance), our informant answered: "We don't care." And later, when it was pointed out to her that some of the responses were not understandable, her answer was that the point of the exercise was not to make sense of all the responses. That exchange is transcribed below:

*Interviewer: This is something I don't understand...*

*Informant: I think. It doesn't matter. You don't have to. Maybe that's... I think our biggest thing is, if we could figure out why the thing was there for every object, then you lost it...*

*Interviewer: Because ...*

*Informant: I don't know why.*

This would indicate again that our informant understood that she and her colleagues were not seeking answers to specific questions, but something that could not, or rather, should not be easily articulated and captured through an analytical framework. What they were looking for is an interpretation, and specifically their interpretation, of the consumer's mindset, an interpretation that would then illuminate their work in a non-obvious or

straightforward way. The picture that emerges here is one where the Color Studio designers, or our informant at least, accept as a premise that people, their thinking and their preferences are very complex and difficult to capture in words and numbers; at least that part of their thinking and preferences that have to do with colors, shapes, and textures. And that the best way to understand them is to accept them as a black box, and to train one's own "black box" through exercises such as the one described in this section. An apt metaphor for this situation is that of a neural network that is being trained to give an appropriate output (in the form of a design) for a set of inputs (a set of observations about potential customers and the world at large) (McClelland et al., 1988). The exercise can be thought of as a training data set, with the "neural net" parameters in the mind of the designer being modified and adjusted through the observations and conversations described above. This metaphor can be glimpsed in the following statement by our informant:

*You know, it opens up your mind of maybe how people might be thinking. And what was interesting too, how I started even looking at the information, is taking, like these sunglasses, and saying, okay, looking at the name and the age, and say, okay, where do I think that person would have put them, and seeing if you're right outguessing yourself on how well they think. Look at their car, look at this, and, Hey, I was right!*

The key to this metaphor is that even after the mind of the designer is "trained", it remains very difficult to figure out and articulate the highly nonlinear relationships and rules embodied in that black box; thus the statement above about not being able to figure out the reason behind every response, for example.

As befits the highly open-ended and interpretive nature of the exercise they were conducting, the members of the Color Studio, and our informant in particular, did not have any qualms taking a piece of information—an observation or a response from a participant—and reading into it a meaning or a conclusion (an admittedly provisional one) that would not be supported from an analytical perspective. A typical example is the way in which our informant was using the data from the gift certificate arrangement described earlier. She explained that depending on which of the gift certificates a

participant requested, she and her colleagues could infer certain facts about that participant:

*We can track, either fashion, records, books, home, or, like, organizational, Target, general... So then we can also kind of see, where is their... Are they homeowners, are they...? I don't know, we got a lot of Tower Records.*<sup>62,63</sup>

Needless to say, it would not be unheard of for someone who regularly spends an important part of his or her income on home furnishings to decide to use a free gift certificate to buy a music CD or a book, something they may not do often. To infer much about a participant's interests based on which gift certificate they select seems tenuous. Again, our informant was not concerned about this; she understood that she was not conducting a statistical study, but simply using the different pieces of information available as contextual elements for the interpretive process in which she was engaged. The following quote reflects the questions she was struggling with:

*I'm going through just asking questions: Do they like this or did they respond to the image? Do they hate it? Do they eat on the run? Do they have a casual lifestyle? Do they not? You know. Some people like it, some people hate it; maybe... Oh, this was actually quite interesting; young women loved these things, these... loved them, every one of them. Older people didn't care, and men hated it, but I'm not sure if they responded to the packaging, the gap, or like this indulgent kind of... I'm not sure. But anyway, it leads me to think that they're very literal thinkers, this group: what it is is what it is, in a weird way; that they're really responding to it.*

Finally, another aspect of the research exercise was described by our informant, which highlights its interpretive nature. She explained that, after they were done sorting through the responses and discussing them, she and her colleagues anticipated re-dividing the chips among the four of them and re-organizing them using different classification schemes, or different categories. One possibility she discussed: instead of using the objects depicted in the images, they might define categories that reflect certain styles and organize the chips that way.

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<sup>62</sup> Target is a chain of department stores that sell a broad range of products, including house wares, sporting goods, clothes, and so on. (See [www.target.com](http://www.target.com).)

*Yeah, but then I think we'll break it apart again into like products. I was thinking about doing things that... like maybe classic images or modern things that... Define it that way and maybe do it the way we think, and see if they group into the same areas or if they fall apart.*

Our informant suggested a slew of questions and interpretations that would come out of this process of taking a different look at the responses. Again, it was difficult to see how these would be supported by the data and the research design, if one were to take an analytical stance.

### **Drive-by shooting: A photo essay of random cars and their drivers**

The exercise described in the previous section was conducted in the context of a specific development project, aiming at developing a modern replacement for the Nissan Z car. However, our informant described similar open-ended, interpretive research activities within her studio, which were not connected to a specific project.

In this particular example, the Color Studio hired a professional photographer simply to take pictures of people driving their cars. The photographer was asked to do that in two different cities in the US. Following is our informant's description of this project:

*... we worked with a photographer by the name of Andrew [B.] that basically just photographed people driving. He's an art photographer, he's just fascinated by culture and population and changes and... We sent him to a couple of different cities, and he drove around with his car, with his camera mounted on the side basically, and he was very selective of what he [shot.] It was everything and anything. And there is no science to this; we didn't say, Go shoot BMW's, Go shoot this. He just shot everything. And we have binders and binders of proof sheets that came back. And I put up all the proof sheets on the wall and we just stood back and--this is really how really generalized--we stood back and said, Wow, that's a lot of red! I mean... That's a lot of teal! We see a lot of... I mean, the colors popped off the page, and they were done like this; and then we said, Wow! There's something just really honest about stopping sort of what you see every day, and looking at it in a different way.*

As was the case with the previous research exercise, our informant did not have specific questions in mind that she was trying to answer by commissioning this project. She had a

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<sup>63</sup> Tower Records is a chain of stores that sell music recordings and videos. (See [www.towerrecords.com](http://www.towerrecords.com).)

general idea of photographing people driving their cars (she uses the term “generalized”.) And even though she describes her and her colleagues’ surprise at the high incidence of certain colors, this is an observation that emerged during the process. Clearly, their objective could not have been to learn about the color distribution in the car fleets in the two cities in question; such information is already tracked by a number of market research companies, and NNA (the Nissan marketing organization at the time of the interviews) in all likelihood already had that information. Furthermore, our informant was unconcerned about any biases introduced by the photographer’s selection process, or by the method used to look at the pictures (for example, while looking at a large number of photographs placed side by side, one’s attention is more likely to be attracted to the brighter colored ones; ones depicting red cars for instance.) As she pointed out in the above quote, “there is no science to this.” Also, when pressed again on this issue:

*Yes, there's no--that's what I'm saying--there's absolutely no science to this. He didn't purposely sort of go to sedans, or BMW's, or this or that; or clean cars or dirty cars; or interesting people. I think the selection process obviously happened there...*

Although it may seem from the above that the focus was on the cars in the photographs, the idea was to take pictures of people driving. The Color Studio designers selected some of the pictures for enlargement; in those, it was easy to see the drivers of the cars, what they looked like, and what they were wearing. Again, the different designers took turns sorting the pictures using different classification schemes. And in this case too, our informant stressed the importance of the conversations that were taking place within the Studio throughout this project, and the thoughts and ideas engendered by that process:

*You know, maybe if we worked in this direction, as we are, that's inspiring to us and allows us to talk to each other and allows us to think more about the product. And then if someone else wants to come in and say, You're full of [expletive]! And, It doesn't mean anything! That's okay to me, because that isn't why we did it.*

### **Watching Oprah to stay in touch with the public**

The discussion concerning mechanisms of external integration soon turned to questions about ways in which our informant keeps in touch with trends and with what people are

doing. It should not be surprising by now that, here too, her approach is unusual. Her description follows:

*Exactly why I'm stuttering on this question, I'm not sure what it is. And I think that each one of us is very, very different as designers. I know what I do personally, and I think once you define it, maybe you come up with a different way, you know... Take a sick day. I know it sounds really ridiculous; I'm kind of answering this as I'm talking. On a sick day, I will watch the shittiest TV you can possibly—Maury Povich, Sally Jesse... I will just go from one to the other, one to the other... I love those shows. I really feel out of touch when I don't watch all that crap. And, maybe that isn't an identifier; maybe that doesn't necessarily draw it. I don't know what it does, but somehow I like it. I like it. I like that. I like going to places, public places where there's this mass of people, of all different cultures and many areas. Something that isn't an identifier, not like a museum or something that says you're this type of person. Something that's so generic that it's—a parade or something—that there's no... I like just watching people, in general, masses of people. I think it's great. I love people.*

As expected, she does not describe a situation where she relies on research reports and consumer trends data. Rather, she engages in a set of activities which do not appear to have, a priori, a defined set of well articulated deliverables. She does not suggest that the purpose for watching a particular show is to identify popular apparel color combinations in one specific demographic group. She does not even indicate that she observes what people are wearing, for example, or what colors are used in the set or floats in the case of the parade. Again, her focus is on observing people and what they are doing, not on objects or things.

Another activity that was discussed in the same context is travel. Here too, her approach is different from what other designers might do. Instead of visiting the large metropolitan areas and the acknowledged of design such as Milan or Barcelona, she is more interested in going to rather non-descript areas of the US, and to smaller, less touristy towns in Italy, for example. More specifically, our informant described a trip she took with two of her colleagues the previous year; she answered a question concerning any specific things that she noticed, or ideas she got during that trip:

*We ended up in Positano, a very small seaside community. [...] I can't think of anything right now. No, I can't, and maybe that's why I enjoyed it so much, I'm not sure. I usually remember where ideas and things start from. And I don't think that I used that trip in that way. Maybe there's certain times that... I think I never not think about work; I don't think I ever not think. But I don't remember looking for that to be the solution to something that I was... Maybe it was more like, a generalized thing as opposed to a specific thing I wanted to answer.*

Also:

*Yes, I think we need more travel. I don't think we travel enough in the U.S. I don't think we travel enough to enough shitty parts of the country. I want to spend... It's a hard one to define because I haven't come up with a strategy yet of what the company would get after I go through this process. [...] Unless I come up with a plan, sometimes it's hard to get it.*

This underscores the constraints that crop up in a business environment, when highly interpretive, open-ended activities of the type discussed above come up against traditional budgeting considerations, which are designed to deal with instrumental, means-ends approaches. This was somewhat surprising considering the support afforded to the Color Studio and the Design Context Lab by NDI's president, and his strong belief in, and enthusiasm for, their approaches and methods.

## **Chapter VI: Case Study III**

### ***Nissan Technical Center***

The Nissan Technical Center, or NTC, is Nissan's main design and engineering facility in Japan. It is located in Atsugi, in Kanagawa Prefecture, about one hour outside of Tokyo by train. As with the case at NDI, this study started out by focusing on the development of the second generation Altima, but quickly evolved into a wide-ranging investigation of product development practice at NTC. This report is divided into three sections. The first covers the function of the Product Planning Department and the integrative role of the "Shukan" or product development manager. The second section covers the area of design (or styling.) Finally, the last section describes the "marketability" function, which falls under the Product Experiment Department (a test and development department.)

### **Product Planning Department #2**

The Product Planning Department (PPD) was described as the "center" that coordinates and controls all product development activities. PPD personnel are in charge of all decision-making as it relates to all proposed new Nissan models. This includes decisions concerning vehicle size, performance, features, engine size and configuration, transmission choices, and all other specifications. PPD personnel are also responsible for deciding on the investment level and profitability targets for these new models. The PPD is organized into two directorates, #1 or "Luxury" and #2 or "Global", each of which has its own design and development groups, such as body design, testing, and so on. The Altima falls under the "Global" directorate, along with other models that are popular in different world markets, and which therefore need to be developed "on a worldwide basis." These include the Maxima and Sentra sedans, in addition to the Altima.

Generally speaking, there is a Shukan, or product manager, for every vehicle model, reporting to one of the two PPD directors. Our two informants in this part of the study were the previous Altima Shukan, who had recently been promoted to Deputy Manager of the Product Design Administration (discussed later in this section), and his successor. The Shukan is typically an engineer promoted from one of the development groups, such as testing, body engineering, powertrain, etc. A few have come from the sales department, and one came from exterior design. The senior informant indicated that in the future, Shukans would most likely come from engineering because, as he put it, “the characteristics of a new vehicle model are mostly influenced by the design engineering circle” (referring to one of several functional circles he had sketched.)

In addition to the PPD, there is a separate office, the Product and Marketing Strategy Office, or PMSO, which is in charge of deciding the positioning of each Nissan model. The PMSO gives the PPD a specification range for each model, and the PPD then decides on a particular point within that range.

Our informants focused on describing the development process, in particular the process through which the Shukan determines the vehicle features and specification targets mentioned above. At the launch of a new project, a “role-studying” committee is assembled to decide on the role of the proposed new model. A Shukan is nominated for that model, if one is not already in place. This committee is multidisciplinary, with participants from the PPD, PMSO, engineers who are in charge of vehicle packaging (platform and body engineering), and representatives from sales, who are in charge of putting together the business case for that model. The outcome of this first phase is a brief with high-level specifications for product position, price, size, engine, cost, and so on.

In a second phase, a development study request is issued to the various engineering groups—design engineering, production engineering, manufacturing—to conduct preliminary studies based on the initial development brief. The results of this study are fed back to the PPD, which then generates a first draft of the product specifications.

The draft product specifications are used as the basis for the start of the development process proper. In this third phase, each department undertakes more refined engineering

studies. A significant difference at this stage is that now, for the first time, a styling study is also undertaken as part of the development work. The information that results from these studies is again fed back to the PPD (this time including a design proposal), and the draft product specifications are refined. This last phase may involve a few iterations in order to refine the design proposal.

For the purposes of this dissertation, the details of the process itself are not critical. Of greater interest is the fact that our informants chose to focus on the process itself, not its content or particulars as they played out in the case of the Altima project. The rigidly structured, pre-planned information feedback and decision points received particular emphasis.

Equally interesting are the sources and types of market information that our informants stressed. In the case of the Altima, they described a set of traditional approaches to obtaining customer information, including the use of sales and demographic data, visits to US Nissan dealers, and user group interviews. Unlike NDI's approach to research where the Design Context Lab personnel and the designers themselves were directly involved in conversations with customers, the Shukan described a particular focus group where he stood behind a one-way mirror as Altima owners were interviewed by professional facilitators.

Our informants reported that PPD does not conduct any activities aimed at learning about trends in the marketplace, outside of projects tied to the development of specific vehicle models. That is not the case with the PMSO, which conducts regular market surveys. However, here too, the approach used is an analytical one, and the PMSO's role appears to a rather mechanistic one: one of the two leading market research firms in Japan are usually retained for the job; the focus is on collecting demographic data—age, gender, income level, among others—as well as data on customer satisfaction for the various Nissan models (and possibly their direct competitors;) the resulting reports from the research firms are then circulated among the relevant PPD personnel.

Although not related to product planning, the new role of the outgoing Altima Shukan was also discussed. He described his new position of Deputy Manager of the Product Development Administration (PDA) as a “conventional position”. He is engaged in

identifying commonalities between the various groups involved in product development. This includes those that fall under the two directorates described above, with their design and testing groups, as well as other development related groups within Nissan. The purpose of this work is to reduce overlap and redundancy between these groups, and to rationalize and shorten their processes. In other words, the task of the Product Development Administration is an analytical one, aimed at streamlining the development process and making it more efficient.

The PDA also serves as the contact point for the control and dissemination of product development information. Again, this appears to be a largely mechanistic activity. All design and engineering releases go through the PDA, and these typically follow pre-agreed schedules. For example, product engineering may be required to make certain decisions or to turn in a certain set of specifications to the Design Administration by a given date. If this is not done on time, the PDA intervenes to try to identify the problem and its cause, and issues a warning to the Shukan to “hurry up.” Although the PDA oversees the schedules of all development projects and tracks their progress, it does not decide the schedules themselves. Its task is a structural one that involves information gathering, dissemination and control, but that is not concerned much with the content or meaning of that information. From the PDA’s perspective, the schedules and rules are pre-agreed or pre-arranged externally.

## **Exterior Design Department #2**

A second part of this study dealt with the development process from the point of view of exterior (and interior) design. Our informant was the “Design Producer” for the Altima project. He is a senior manager in Exterior Design Dept. #2, which is responsible for the “Global” cars. In that position, he works with the Shukan to “negotiate the appearance, specifications, and features of the car,” and he oversees all the design teams working on it, including the exterior, interior, and color teams at NTC in Japan, and, indirectly, the exterior design and the color teams at NDI. (NDI did not have a team available to participate in the Altima’s interior design.)

Work on a new model starts informally before the official Design Declaration point, with the “advanced stage models.” These are sketches intended to serve as an “evaluation of the current product,” and to provide a hypothesis or hypotheses that “the designers want to check with the market.” When the PPD officially announces the start of the development project, the Design Proposal stage begins. This stage typically involves between twelve to fifteen sketches, followed by two to three quarter-scale models. One or two of these are then selected by the Design Strategy Committee to be developed into full-scale models. This leads to the Model Direction Selection decision point, which our informant described as “the biggest event” as far as exterior design is concerned. The full-scale model that is chosen is then developed into a detailed production clay model. It is refined until the Model Freeze point is reached.

The various decision points in going from sketches to quarter-scale clay models to a full-scale clay, and the positions of the decision makers involved at each step, are very similar to those found at Chrysler (please refer to Chapter IV) and the rest of the industry. Sketch and quarter-scale model selection are mainly done by NTC designers along with key executives in charge product development—mostly personnel from PPD. Model Direction Selection involves executives at the Vice President level, specifically the VP of Sales and the VP of Engineering, as well as personnel from the relevant marketing and manufacturing subsidiaries, Nissan North America and Nissan Motor Company (both in the US) in the case of the Altima. One significant difference from Chrysler is the importance Nissan attaches to the voice of the customer. Findings from consumer surveys and consumer clinics play an important role in these decisions. Our informant had an interesting perspective on this aspect and its causes:

*Nissan relies on clinics for model decision. Because of the late 80s successes, the company became less diverse, more stiff. My personal opinion is that this is due to the fact that the company did not have enough experience with success. It was our first success, and as a result we became cautious; we did not want to lose that success. So we told each other, “We can’t fail now.” So we started relying on more market analysis.*

Not only is this cautious attitude in sharp contrast with Chrysler's risk taking mentality; its "stiffness" is also at odds with NDI's creative, unorthodox, even playful approaches to learning about the customer.

Our informant also blamed this cautious, analytical approach, and the over-reliance on customer input in the design process for the difficulty his company was facing in defining itself and the character and look of its products, a problem that several Japanese manufacturers share:

*If you look at the total information that goes into producing a product, [...] the current pattern of Japanese companies is 20% creation and 80% market information, which is the same to everybody—Nissan, Toyota. Maybe Honda is different. So the differentiation is only in that 20%. We need to go to 60-40 in order to get our own identity.*

He traced the problem to the recent history of Japan's automobile companies. According to our informants, starting in 1945, Japanese companies have targeted the US and European markets. Their goal therefore was to catch up to American and European designs. Although he admitted that in certain areas they were still somewhat behind, he felt that, in general, Japanese designers had caught up. However, he believes that they had done so at a high price:

*For more than 50 years, we have been chasing and copying their way of doing, so it has become our nature [to follow and copy.] Even now, when we are told that we can go anywhere [with a design], we can't. So we're having a very tough time deciding where we, as Nissan, want to go.*

Aside from copying foreign designs, our informant related another approach to product positioning, based on a metaphor from golf, which he believes has been commonly used by Japanese companies. His description reveals an analytical process of averaging or interpolation. And again, he blames the resulting thinking for his company's difficulty in defining itself:

*It's the "OB" strategy, from golf terminology. This has been Japan's strategy in PD since 1945. If you don't know where to go, you look at your competitors and see where they are, and you aim in between them. There is one here, and the other is there, etc. I will hit the middle. The question is how to define myself? Up to now, it has been like this: first, define the*

*competitors; second, define ourselves. But now, we need to define ourselves first!*

Throughout the discussion, attempts were made to surface non-analytical practices at NTC. Unlike the case at NDI, the studio designers at NTC do not undertake any non-automotive design projects. Furthermore, most of their work is tied to regular production models. Our informant reported one set of exceptions, dating back to the late 1980's and early 1990's. These are the so-called "Pike" cars, the BE-1, Escargot, and Figaro. The latter two are a micro car and micro van inspired by the original Citroen 2CV. They were the result of some work that a few young designers did after hours, on their own time. The Be-1, a playful mini car combining retro and modern elements, came about after a few designers spent some time with outside consultants, discussing trends and lifestyles, and doing a lot of "town watching." These young designers then translated the ideas they had following these activities into design proposals and show cars, which led to the Be-1 going into limited production.

These activities appear to have been limited to that particular time period, and they were probably connected to the company's economic success in the late 1980s. There is no evidence that similar activities were ongoing at the time of this study.

Our informant stressed the importance of helping designers stay in touch with popular trends, in general as well as in the automotive field specifically. He acknowledged that NTC's location, which he described as "quite remote from downtown Tokyo," is not particularly conducive to that. One answer is to "pick certain young people and middle managers and send them to refresh or recharge their good designs." This is done when there is a lull in the workload, outside of project peak times. There is no official rule for who gets chosen, but "the more senior managers are always watching to see who is exhausted and who needs refreshing."

Another solution relayed by our informant is what he called "mini Detroit" or "mini Paris shows", referring to two of the more important industry shows, which are held in these cities. He described these events as follows:

*Recently, we have been doing what we call mini-Detroit or mini-Paris shows. What we do is, we get ten cars from Europe or from Detroit, and*

*we display them in the hall, so even the young designers and engineers get to see all these models that are not available in Japan. If I had enough money, I would send all the designers to Italy and Europe, to the market in question. Of course, to see them in their environment would be ideal, but still, this is better than looking at pictures.*

Finally, our informant described an interesting system, the Senior Designer system, which he referred to as “unique”. Senior designers, of whom there are ten at Nissan, are different in that their activities are not confined to Atsugi. They have an expense allowance, something that the regular studio designers do not have. One senior designer uses his allowance to keep a studio in Tokyo; others have used their allowance to go to Italy to work on particular projects, either to do sketch work or quarter-scale model work (a senior designer can select a modeler to accompany him on such trips.)

In general, our informant gave the impression of wanting to create space for more interpretive activities to take place at NTC, and wanting to encourage more activities that would immerse his designers in the environments in which their customers live. This is apparent in his comments concerning NTC’s distance from Tokyo, for example, and concerning the suboptimal quality of the mini auto shows. But this desire appeared hampered by a rigid, analytical, cautious corporate culture, which results in a set of half-measures. Studio designers are (temporarily) given more freedom in order to solve a burnout problem, not to get them immersed in a different environment proactively in the hope of stimulating their interpretive thinking. The Senior Designer program is another telling example: a designer has to reach a certain level of seniority and accomplishment before he is allowed the freedom that may very well contribute to that high level of achievement in the first place.

## **Product Experiment Department #2**

The third part of the study dealt with what Nissan calls “Marketability Testing”, a competitive testing and evaluation function. This function falls under the Product Experiment Department, another name for product testing and development. Our informant was the person in charge of the marketability testing area within Product Experiment Department #2, the department responsible for the Altima.

Our informant characterized Marketability Testing as the interface between the Product Planning Department and the Product Experiment Department. Whereas the PPD and the Marketing Department interact directly to determine the positioning and features of the proposed product, when it comes to vehicle performance, the Marketability Testing group plays a crucial role.

Marketability Testing (MT) as described by our informant is a data driven activity, similar in many ways to quantitative market research. The MT group develops questionnaires and conducts surveys about different aspects of performance, targeting both current Nissan customers as well as owners of competitors' cars. Occasionally, market research companies are hired to conduct the research. Based on the data collected, they set certain performance targets and they propose them to the Shukan. Later on, after goals are set and prototype vehicles are built, MT gets involved in testing them and confirming to the Shukan whether the original goals have been met.

Our informant explained his role in decision making thus:

*When a decision is made, there are many considerations that enter into it: there is time, cost, and quality considerations. But sometimes, the decisions are company oriented instead of being customer oriented. In that case, I give the viewpoint of the customer. I use competitor [product] data, or use data from our own research, to try and attach more importance to the customer's side in that decision.*

Sometimes, playing that role involves setting up and coordinating specific tests to resolve conflicts. As an example, our informant gave a case where different members of the development team were in disagreement concerning the noise level of a model under development. The MT group set up a test and invited a group of customers to try out and comment on the different setups. The findings were then presented to the Shukan who made the final decision.

Although the voice of the customer is generally used as the basis for resolving design conflicts, our informant explained that this is not always the case. On many occasions, decisions are made that run counter to the customer's preference. But even then, the reasoning is analytical, with the decision based on a straightforward cost-benefit calculation: following the voice of the customer would simply be cost prohibitive. There

was no indication that such a decision might result from a different interpretation of what the customer really wants; nor, unlike the case of Chrysler, that it might result from the designers taking a risk based on their belief that they have a better understanding of what the customer will want in the future than the customer himself.

In general, our informant described an approach to decision making that was very structured and highly planned, where goals and targets were set at the very beginning of the project, mainly based on survey data. Goals are organized by importance, distinguishing between “must haves” and “wants”, for example. Analytical criteria are developed early on in the process, for making the allowable tradeoffs or concessions as conflicts emerge.

Certain aspects of the approach used by the MT group to analyze the voice of the customer do appear to have an interpretive dimension. The results of the surveys described earlier are organized using a tabulation scheme similar to the House of Quality (Hauser et al., 1988). For each product attribute on which the customer is surveyed, a numerical value is entered in the table, reflecting the score of the current product. If data is available for competing products, those are entered in the table as well. Values are also entered for the importance the customer attaches to that attribute, and for his or her level of satisfaction with that aspect of the product. An interesting interpretive aspect of this table is that it is divided into different segments, corresponding to what our informant called different “scenes.” These represent different contexts of use, such as highway driving, driving on a winding road, around a parking lot, and even washing the car. The table also includes information about the frequency of occurrence of these different scenes under normal conditions of use. Furthermore, the table includes a set of entries that indicate how the customer’s voice should be “interpreted”. Our informant explained that different customers might mean different things even when they use the same terms. For example, to certain drivers “sporty” means crisp handling on winding roads, whereas to others it means good straight-line acceleration. Similarly, a sedan driver expects a lower level of interior noise before he or she would call that car “quiet”, compared to a sports car driver. In order to account for such differences, the table provides for entries about “how to interpret” the findings regarding certain attributes. In both cases, however,

the interpretive elements are reduced to numerical scaling factors, which are used to adjust the numerical scores entered in the table for the various attributes. Clearly, this is very different from the open-ended interpretive practices found at NDI, such as the approach used by the Design Context Lab to understand the context of use of their future mini SUV (please refer to Chapter V.) The concrete examples selected by our informant to illustrate the use of these data in differentiating the Altima from one of its competitors confirm the basically analytical nature of this approach. He focused on purely technical aspects of the product, namely, the size of the cup holder and the size and output of the motor. His description follows:

*Concrete example? The Accord is very strong; that is difficult. For instance, just before the 96 model year, the Accord could not accept a mug[-size] cup, so that's why we added a cup holder to the new Altima that could hold a mug. Unfortunately, they made a minor change and revised their cup holder size. [...] They have a 2.2L displacement engine, we have a 2.4L; the advantage is really good [response at] freeway speed. They have good engine technology, and really good pickup; we don't unfortunately. But on the other hand, we have a 200cc advantage, and this is also pretty good at freeway speed.*



## **Chapter VII: Summary and Conclusions**

This chapter summarizes the findings of this dissertation, both theoretical and empirical. It includes recommendations for product development researchers and practitioners, and suggests several directions for future research.

### **Findings**

The findings from this research are presented in two sections. In the first one, I summarize the theoretical developments that emerged from the empirical evidence, and in the second, I summarize the empirical findings themselves.

### ***Theory development***

The theoretical framework developed in this work takes the form of a typology, or taxonomy, which attempts to go beyond the generally accepted dichotomy between positivist and interpretivist views of product development. The taxonomy draws upon concepts and ideas from linguistics and from the philosophy of language. In a first step, the distinction within the field of linguistics between the structural sub fields (specifically syntax and semantics) and the functional sub field of Pragmatics is used to sharpen the difference between analytical/structural practices on the one hand, and interpretive practices on the other. In a second step, two views of interpretation, one grounded in linguistics, and specifically Pragmatics, the other grounded in the philosophical hermeneutics of Heidegger and Gadamer, are used to expand the interpretive category into two, which I refer to as pragmatic interpretation and hermeneutic interpretation respectively, after Dascal (1989).

The use of the different aspects of linguistics and language as a model for structuring the theoretical framework is felicitous, given the importance of communication and

interpretation in design and product development (Katz, 1982; Krippendorff, 1989; Dougherty, 1990; Griffin & Hauser, 1990; Moenaert et al., 1990; Dougherty, 1992a; Brown et al., 1995). This particular use of language in the area of design is very different from the atomic language models of design, as developed by Stiny, Mitchell and Wallace, where structural linguistics models of our natural language were used as a pattern for developing shape and style grammars, that is, formal, logic based models of particular design worlds (Stiny et al., 1978; Stiny, 1980; Mitchell, 1990; Wallace, 1991a). This work is closer to the concept of product semantics advanced by Krippendorff (1989).

Although reasonably parsimonious, the taxonomy presented in this research is widely applicable and can be deployed in a number of areas. I used it in describing a designer's thinking process—the internal conversations she was having with herself and her work input and product—as she reflected on what she and her colleagues were doing (Schön, 1983). I also used the taxonomy in describing the interactions between the different members of a design team, specifically those from different functional areas, in order to discuss various approaches to internal integration. In the context of external integration, I used it to discuss the relationship between a company and one of its suppliers. I also used it extensively in analyzing the approaches used by the various product development practitioners to learn about and develop a better understanding of their customers. Generally speaking, the typology should be applicable in most situations that involve people communicating, whether they are exchanging well-defined bits of information, or whether they are engaged in a more open-ended process of coming to understanding.

The taxonomy was used briefly to analyze the evolution of two methods that have been proposed in the last few years for improving the organization of product development projects, namely, the stage-gate system (Cooper, 1990; O'Connor, 1994), and the design structure matrix or DSM (Eppinger, 1991; Eppinger et al., 1994). An interesting finding from that exercise was an evolutionary path shared by both methods, which comes across clearly in the respective literatures. Both methods were initially presented as analytical, structural models of the product development process, with the content of the models treated as external inputs to the model and assumed to be unambiguous. In the case of the stage-gate system, objectives and other inputs were assumed known at the beginning of

the process, and decision criteria were assumed clearly and unequivocally defined at the beginning of each stage. In the case of the DSM, the tasks and their informational relationships were assumed fully defined, for example from a physical model of the product. Later on, as more experience was gained with applying these methods in practice, they evolved into approaches that have important pragmatic interpretive dimensions. An updated version of the stage-gate system made room for overlapping stages and for fuzzy and conditional decision points with emergent decision criteria (Cooper, 1994). In the case of the DSM, one focus of research became the interview process for obtaining meaningful or “credible” information about the relationship between activities, in other words, the interpretive modeling process used to develop the DSM (Dong, 1999).

From a pedagogical point of view, one of the goals of this work was to enable practitioners and students of design and product development to understand the advantages and disadvantages, as well as the limitations and range of applicability of the countless tools and methods proposed to them. In particular, I wanted to make this work accessible to engineering students of various backgrounds. To that end, the theoretical framework was presented as a self-contained (albeit lengthy) chapter. It does not assume much (if any) prior knowledge or familiarity with the concepts used to develop the taxonomy, neither linguistics nor hermeneutics.

### ***Empirical findings***

In considering the empirical findings presented here, the reader is invited to keep in mind the theory building nature of this research. These findings should therefore be considered as hypotheses to be tested in future research, as opposed to generalized findings supported by statistical replication (Eisenhardt, 1989).

The first notable observation is that each of the three organizations studied in this dissertation has a propensity towards relying on one of the three classes of product development approaches developed in this thesis. Chrysler is essentially a pragmatic interpretative organization. It is not likely to take customer data at face value and accept it without questioning it or without putting its own twist on it; but it does so in a rather directed, focused fashion. At the same time, it does not come across as a company likely

to indulge in open-ended pursuits. Nissan's NDI, on the other hand, represents the consummate hermeneutic interpretive environment, where designers are given the freedom to engage in highly open-ended projects, the outcome of which is difficult to predict or explain beforehand. Finally, Nissan's Technical Center in Japan has the hallmarks of a mostly analytical organization, at least judging from the relatively limited case study reported in Chapter VI. The focus there is on obtaining very specific survey data from consumers, and following the data to the extent possible, given cost constraints.

The next finding is that practices utilizing hermeneutic interpretation were more common in situations involving styling and color, viz., the NDI Color Studio. One explanation points to the nature of shape and color, and the difficulty of describing them verbally in a precise and objective manner, with one person's description often unlikely to match another's. This difficulty in quickly achieving intersubjectivity on matters involving form, color, and texture makes a hermeneutic interpretive approach better suited for carrying out a conversation about them, as it naturally allows the vocabulary and categories to emerge during the conversation. Another explanation is that these are areas where the designer enjoys the greatest degree of freedom, and where there is the most room for creativity, which makes open-ended, hermeneutic approaches particularly applicable. Designing a new automotive shape or a new color palette are activities that feel least like traditional engineering problem solving. Even if one were to cast these activities in terms of problems to be solved, one would be hard pressed to provide criteria for determining when the problem would be considered solved, that is, what would constitute an acceptable solution.

A third observation is the predominance of hermeneutic interpretation in those situations that involve external integration, such as the unusual approach used by NDI's Color Studio and Design Context Lab to understand the customer. As with the previous finding, two explanations, similar to the ones discussed above, present themselves. One explanation is the language barrier: if designers and developers already have difficulties discussing shape and color among themselves, the situation would be worse if the customer, who is removed from their world and unfamiliar with their specialized language, were invited to join in such a discussion. This would explain why, at Chrysler

for example, only trained designers are invited to comment on proposed designs (please refer to Chapter IV.) Another explanation is the open-ended mandate that the developers were pursuing in these particular cases (the future Nissan mini SUV and sports car), and the wide ranging exploration they were conducting in the hope of understanding new consumer trends, and of discovering previously unknown or unarticulated customer needs and wants. In particular, they were consciously questioning their preexisting understandings (“Let’s check our own intuitions”) around these product categories, in view of the then recent breakdown in the sports car market.

Conversely, situations of internal integration were more likely to call for pragmatic interpretation, as they were closer to situations involving relatively directed problem solving. One example is the work done by NDI’s Design Context Lab in developing the “outer bounds” document for an environmentally friendly vehicle, as described in Chapter V. In that case, a product description was needed, that would bridge the gap between the marketing organization and the designers at NDI. Here too, the crux of the problem was a gap in language between the two groups; however, the situation involved a well-defined problem, resulting in an activity that was targeted, with a clear objective and an ex-ante understanding of what a successful outcome would entail. Another example is Chrysler’s decision to include a 4<sup>th</sup> door in its Minivan design. In that example, the interpretive challenge was less one of understanding the voice of the customers, who were clearly and unambiguously opposed to the idea, as one of bringing the team to a consensus regarding their decision to go against the customers’ wishes.

The fourth observation is the important role of trust in enabling the use of interpretive approaches in design and product development. This is not surprising given the speculative nature of interpretive activities. Trust among team members, as well as between the development team and upper management, was mentioned on several occasions by our informants at Chrysler. At NDI, although the issue of trust did not come up much, it was obvious from the interview with NDI’s president that he had managed to create a non-politicized, open, even collegial culture within the organization. Recall for example that he encouraged the designers regularly to rummage through each other’s desks. It is also clear that he was able to shield the designers from the influences of the

parent company, as well as create a culture that encouraged and supported their highly interpretive activities.

## **Limitations**

As with most research, this work suffers from several limitations. One set of limitations stems from the research approach used. Eisenhardt ascribes two potential pitfalls to theory building. The first is that the outcome might be an overly complex theory due to the intensive reliance on empirical evidence. The second is that the resulting theory may be “narrow and idiosyncratic”, tied to specific phenomena due to the bottom-up nature of theory building (Eisenhardt, 1989, p. 547). I have attempted to avoid these pitfalls by limiting the theory to a relatively simple typology, one more likely to be broadly applicable. I have used this typology to organize, explain, and discuss the findings, without extracting specific organizational guidelines or recommendations. For instance, the findings at NDI are presented solely as examples of interpretive practices, without the suggestion that the way NDI is organized, or the particular practices used there, are the only appropriate ones, or that they ought to be duplicated by companies facing similar situations. Similarly, although I propose that a company ought to consider separating its analytical activities from its interpretive ones as it structures its supplier relations, I do not suggest that the model to follow is necessarily the one observed at Chrysler and Lear.

To the contrary, it may be that a limitation of this work is that it leans too far towards generality, because what is proposed is a descriptive typology, rather than a set of directly actionable prescriptions or methodologies. Practitioners can learn from the theory how to distinguish the different types of situations they may face, and to be aware of the limitations of the tools and approaches presented to them. They can also learn from studying the rich examples presented in the case studies, about how certain organizations dealt with different design and development situations. However, modifying the approaches presented here or developing different ones to suit their particular needs still involves a creative leap, an extra step that is context dependent. I would argue that this creative step may be more challenging than mechanistically applying an analytical methodology such as the house of quality or the design structure matrix.

Finally, certain limitations can be traced to the particular industry chosen for the case studies, namely the automobile industry, and to the significant focus on the industrial design (or styling) aspect of automobile design. In Chapter II, I argued, following Clark and Fujimoto (1991), that the internal and external complexity of the automobile makes it a good choice for studying design and product development in general. Still, automobile design is principally evolutionary in nature. Although recent years have seen the emergence of new popular product categories such as sport-utility vehicles and new hybrid designs such as the Audi Allroad (Knoll, 2001) and the Volvo V70 Cross Country (Passell, 1998), the basic architecture of the product has not changed in decades. Similarly, the basic technology, namely, the internal combustion engine and the welded steel structure, have remained static. As a result, there is a greater level of specialization and compartmentalization within the automobile industry between industrial design (styling) and the engineering design activities (Tovey, 1992). Case in point, Nissan's NDI and Chrysler's Design Office are separate corporate entities. The situation is very different in the typical industrial design firm, such as IDEO or Design Continuum. There, engineers and industrial designers typically work closely side by side (Rosenberg, 1997). Still, this limitation is mitigated by the fact that the industry had already started moving to closer functional integration by the time the empirical research was conducted, as we saw in the case of Chrysler's reliance on multidisciplinary platform team.

## **Implications**

### ***For researchers***

This dissertation represents an example of a multiparadigmatic approach to the study of product design and development. The findings, both theoretical and empirical, underline the power of such an approach, and the many ways in which using a single paradigm would be limiting. The comparisons between the different sites and their different approaches to product development would have been impossible to capture and contrast without the breadth of perspective provided by this theoretical framework.

The approach used here is not the mode-switching or multiple-lenses approach suggested by some researchers. In that approach, the situation of interest is studied first from one

self-contained perspective or paradigm and, in a subsequent step, studied from another paradigm. Later, the findings and conclusions obtained from each sub studies are compared (Gioia et al., 1990; Dorst et al., 1996). By definition, paradigms are incommensurate; each provides its own proprietary concepts and vocabulary, which do not accept any intermingling. However, in the real world, successful product design and development involves different types of approaches, each of which has an affinity to a particular research paradigm. This thesis suggests a framework for bridging the gaps between the concepts that the different paradigms make available to the researcher.

The framework presented in this dissertation could be useful to researchers engaged in developing tools, methodologies and process models for design and product development. It provides the vocabulary and categories that would help in understanding the range of applicability and the limitations of such methodologies, following the examples of the stage-gate process model and the Design Structure Matrix presented at the end of Chapter III. It also suggests ways in which these models could be extended. For example, the framework would give a more solid theoretical grounding to models such as Coopers “third-generation” stage gate process model, in which he proposes the use of “fuzzy” gates and overlapping stages in order to deal with some of the open-endedness inherent in product development practice (Cooper, 1994).

### ***For PD managers and practitioners***

The case studies in this dissertation show that it is possible to find, within the same industry, the entire spectrum of design and development practices represented by the typology developed here. This is the case even in an industry as well established or mature as the automobile industry, where new products entail little innovation or novelty. In fact, the two organizations that provided the examples reflecting the extremes of that typology, the Nissan Technical Center and Nissan Design International, are part of the same corporate entity.

However, the findings also suggest that using one or another type of approach to product development is not simply a matter of making a simple choice at the appropriate time. Different organization are simply better attuned to, and adept at, one of the different types of practices. This reflects a number of factors, from the background and experience of the

employees, to the organization's approach to budgeting, to the value system instilled by its senior managers. The impression given by Chrysler and NDI is that these organizations are coherent and internally consistent. The attitudes of the informants, their approach to their work, and the character of the products they produce are consistent with each other and with the image of the organization and its senior executives. Similarly, the research approaches used at the NDI Color Studio were not only supported by NDI's president; they also reflected his views on the nature of design as an activity and those of the people he had hired over the years. It is difficult to imagine the Chrysler informants operating comfortably in an environment like NDI. It is even more difficult to imagine the NDI designers working happily in the highly structured, analytical environment of the Nissan Technical Center in Japan, with which, ironically, they interact regularly.

This research highlights several challenges to managers of product development organizations. The first one is the need to understand the source of the organization's current or future comparative advantage, using the typology developed here. Does the organization derive its market advantage primarily from its analytical activities, or from interpretive ones? And does it see this changing in the future? Clearly, in certain product areas, the automobile with its complex interfaces being one example, the top tier producers may not have the luxury of focusing on one type or the other. This drove Nissan to found NDI in the first place, even though the president of Nissan at the time may not have seen the distinction between Nissan's work in Japan and the work to be done at NDI in terms of analytical versus interpretive design work. The fact that several companies in the industry have followed suit by setting up design organizations in California and in Europe (Barron, 1998) underlies the realization by these companies that interpretive design and development activities are an important source of market advantage in the current environment.

Other companies, lacking the ability or experience to carry out interpretive design and development activities in-house, often choose to contract that type of work to specialist houses (Tagliabue, 2001). This is especially true of certain automotive companies that had previously focused on being low-cost producers (a mostly analytical challenge), and later chose to compete more directly with the top-tier manufacturers. One such example

is Isuzu, a second tier Japanese company, which relied on Giorgetto Giugiaro's Italdesign for design (interior and exterior styling), and on Lotus Engineering in England for chassis tuning for its cars of the late 1980s and early 1990s.<sup>64, 65</sup> (In 1995, Isuzu decided to stop producing sedans and to focus on trucks and SUVs.) A more recent example is Korea's Daewoo with its Leganza sedan, introduced to the US market in 1998. Here again, Italdesign was retained to help with the styling (Siano, 1998).

In a sense, the typology of product design and development presented in this dissertation provides managers with another perspective on the core competence and sources of comparative advantage of their organization. As we saw in the case of Chrysler and its relationship to its interior suppliers, this perspective can be more insightful than the traditional views where core competence is tied to a specific technology, subsystem, or to generic integration capability (Prahalad & Hamel, 1990; Stalk, Evans, & Shulman, 1992). In the Chrysler case, the insight came from drawing a distinction between an analytical or structural integration role, which Chrysler was comfortable turning over to its supplier, and a more interpretive integration function that it viewed as a source of market advantage and chose to keep in-house.

The typology presented here also provides managers with a useful framework for considering how to locate the different groups involved in product development. Several studies have highlighted the importance of collocated teams as a success factor in product development projects. This dissertation suggests that collocation may be particularly important for interpretive design and development activities. And as companies increasingly undertake product development projects that involve geographically dispersed groups, decisions concerning the division of labor among these groups and the choice of IT collaboration tools may benefit from an understanding of the analytical and interpretive dimensions of the work in question.<sup>66</sup>

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<sup>64</sup> For example, the Isuzu Impulse, which was based on Giugiaro's Asso di Fiori prototype, shown at the 1979 Geneva Auto Show.

<sup>65</sup> As explained in an earlier chapter, chassis tuning is considered more art than science, and generally requires experienced vehicle test and development specialists. It is closer to an interpretive activity than it is to solving a mathematical optimization problem.

<sup>66</sup> Large multinationals, such as Ford and General Motors, are trying to maximize the utilization of their development resources that are dispersed around the globe. These efforts have gained momentum for a

Regardless of how labor is divided and workgroups are organized, the challenge of integrating those involved in interpretive activities and those doing analytical work remains. The case studies in this dissertation provide a different perspective on what has been traditionally seen as the source of many integration difficulties, namely, the usual schism between analytical engineering thinking and the more “intuitive” or “non rational” thinking of designers and stylists. They show engineers, marketers and designers all relying on a range of approaches, from the highly analytical to the highly interpretive, depending on the situation and the environment, with some favoring one type over another. The Design Context Lab at Nissan Design International provided some interesting examples of how one company approached the issue of integrating between the interpretive thinkers at NDI, and the more analytical marketers at Nissan North America. An important insight that comes from these examples is that the integration task itself is an interpretive activity, one that is best entrusted to people comfortable with that approach.

At a more practical level, this research highlights another challenge that product development managers must address when the organization undertakes both analytical and interpretive activities. The issue in question is how to budget for highly open-ended (or hermeneutic) interpretive work, when the outcome of that work is not clear even to the people undertaking it. As our informant at the NDI Color Studio indicated towards the end of the interview, the very nature of hermeneutic work makes it difficult to explain and justify, especially in comparison to more analytical activities with their well-defined tasks and goals.

## **Suggestions for Future Research**

One set of future research projects immediately suggests itself by virtue of the research design used in this dissertation. The obvious next step would be to take the typology and concepts developed in this theory building exercise, and use them in a larger sample of companies to test the observations and hypotheses advanced in this dissertation. Some of the findings worth studying include: the degree of reliance of various companies on the

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variety of reasons, including advances in information technology, and a reduction in certain types of product differences across geographical markets (partly due to more uniform regulations.)

different types of design practices; the role of upper management and the corporate culture in enabling or hindering the reliance particular types of practices; the preponderance of hermeneutic interpretation in areas of aesthetic design or styling; the relationship between the type of product being designed and the type of approach used (for example, comparing a utilitarian van versus a sports car intended to evoke an emotional response in the customer.)

One of those areas of research that is worth singling out is the relationship between interpretive practices and creativity and the development of innovative designs and solutions. How do the concepts advanced here relate to the rich body of research on creativity, from the highly analytical (Navinchandra, 1991; Finke, Ward, & Smith, 1992; Boden, 1994) to the less so (Gardner, 1994; Csikszentmihalyi, 1996)?

A second avenue of research would be to study the applicability and relevance of the theoretical framework and its typology in industries other than the automotive. Although the larger project within which this research was conducted studied a broad range of industries, from apparel to medical devices (Piore et al., 1995, 1997b, a), that work was conducted using an earlier version of the framework that did not distinguish between different interpretive approaches (Piore et al., 1994). It may be fruitful to revisit the empirical findings in those studies again.

A third research question relates to the effect of corporate profitability or free cash flow and the degree of reliance on interpretive practices. (This is related to the issue of how to fund or account for hermeneutic interpretive practices, briefly discussed earlier.) This question arises as a result of the open-ended nature of the more hermeneutic interpretive practices, and the parallel that can be drawn between these practices and advanced scientific research. As we saw in the case of NDI's Color Studio, it is often difficult to explain what the outcome of such activities will be, or even what a priori specific questions are being addressed. In that sense, hermeneutic interpretive practices and advanced scientific research are both activities that have a significant speculative aspect. In the early 1990s, facing reduced profits due to the economic slowdown of the period, and as a result of the reengineering movement that was at the height of its popularity then, several highly regarded corporate research labs saw their funding reduced. More

importantly, the scope of their activities was drastically changed, in an effort to make their work more directly relevant to the mainstream products and services of the parent companies. Examples include the changes at General Motors Research Laboratory, IBM Research, Bell Labs, and XEROX PARC.<sup>67</sup> In a similar vein, are interpretive practices viewed as a luxury in which companies indulge when they are flush with profits? The case of NTC points to a connection between a cautious corporate stance and the dominance of analytical practices. Although the cautious attitude in that case was blamed on the fear of frittering an initial early success, it could as easily have been the result of poor corporate performance.<sup>68</sup>

Finally, one of the more important questions that fell outside the scope of the present study is the converse of the one raised in the previous paragraph. Namely, how does a company's reliance on one or another of the different types of design approaches presented in this dissertation ultimately affect corporate profitability? Are products designed using a predominantly interpretive approach likely to be more or less successful in the marketplace? What about critical success? And overall project profitability? These "bottom line" questions are probably the ones of most interest to practitioners and managers, but they are also the most difficult to answer. This is especially true in the case of corporate profits, due to the countless confounding factors that may have little or nothing to do with the design of the product, such as manufacturing overcapacity, longstanding labor agreements, financial issues and so on.

Referring back to Clark and Fujimoto's work, one could use their metrics to assess the effect of different practices on product development performance (Clark et al., 1991). The metrics in question are development lead-time (or time to market), development efficiency (the level of resources needed to develop a new product), and product integrity (specifically, external integrity, i.e., how closely product function and aesthetics meet the

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<sup>67</sup> More recently, this trend has seen a partial reversal, as corporate profits have risen in the late 1990s.

<sup>68</sup> It should be noted that when the empirical studies presented in this dissertation were conducted, Nissan, the parent company of NDI, was already losing money (\$1.3 billion in 1995 (Thornton et al., 1997).) Yet, among the three case studies presented in this dissertation, NDI is the site that relied most heavily on hermeneutic interpretation (please refer to Chapter V.) This would seem to argue against the point of this paragraph. That is not the case: it is clear from the case study that NDI has held a privileged position within the Nissan Corporation from its inception, and that it has benefited from a hands-off attitude from the parent company.

needs, wants, values, self-image, and lifestyle of the target customer.) One may very well find that different practices or approaches to product development involve different tradeoffs between development efficiency and product integrity. The problem with these metrics however is that they work best when applied to development projects that can be identified with a clear beginning and end, and a well-defined set of inputs and outputs. Interpretive activities, by their nature, tend to transcend project boundaries. As we saw in the case of NDI for example, and the Color Studio specifically, several of their activities were not connected to particular projects but were ongoing processes that likely impacted more than one project. Furthermore, an improved ability to interpret a situation and to understand customer needs and wants are qualitatively different from a new manufacturing process or a new technical feature. Unlike the latter, the costs and benefits of the former are more difficult to measure and apportion among projects and product lines. Developing the means for addressing these challenges is left for future research.

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