



## **THE FRAME NETWORK OF INTERDISCIPLINARY STAKEHOLDER COMPOSITIONS IN THE EARLY PHASES OF NEW PRODUCT DEVELOPMENT**

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### **Abstract**

New Product Development (NPD) projects have continually become more complex over the years and now involve a diverse range of stakeholders, who have different disciplinary backgrounds, values, objectives, and experience. This makes them create different ‘frames’, which may represent conflicting perspectives. This might create challenges or bring the process to a standstill ultimately wasting resources. By analysing case studies from three different Scandinavian product development companies: LEGO, LEO Pharma, and Zenit Design, this paper investigates the characteristics of the framing process in the early phases of NPD projects involving interdisciplinary stakeholders in organisational settings. The study indicates that stakeholders create isolated aspired values and working principles and from these form a ‘network’ of ‘partial frames’ before connecting them into ‘fully defined frames’. The study also identifies core activities and events of the framing process and propose a model describing an iterative cycle of six phases that stakeholders in New Product Development go through, which we in this article call ‘The Interdisciplinary Framing Loop’.

**Keywords:** Framing, Design practice, Early design phases, New product development, Design thinking

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# 1 INTRODUCTION

The complexity of New Product Development necessitates the involvement of a multitude of stakeholders, who draw from a range of disciplines and bring in their individual perspectives on the project; including a set of assumptions, goals, and values, that guide their actions (Hey, Joyce & Beckman, 2007). Some of these are ‘espoused values’ which are based on underlying strategies and philosophies of the organisation that the stakeholder represents (Schein, 1992). The differing perspectives of stakeholders “... interfere with the ability of the group to view issues in similar ways.” (Mohammed, 2001, p.408).

The fact that the experience of individuals influences their point of view on subjects is discussed in psychology, sociology, anthropology, etc. but Donald A. Schön was one of the early researchers to address this in the field of design. Schön identified that the individual’s perspective on problem solving is influenced by what he refers to as an ‘appreciative system’ with its “... likings, preferences, values, norms and meanings.” (Schön, 1984, p.132). This subjective perspective on what to solve and how to solve it is what Schön refers to as a ‘normative frame’. Multiple studies (e.g. Rozenburg & Eekels, 1995; Valkenburg & Dorst, 1998; Dorst & Cross, 2001) have since developed on Schön’s concept of framing, and provided insight into the subjective process that actively constructs an implicit view of the world based on tacit knowledge and mode of reasoning. In 2011, Kees Dorst combined the notion of framing with different modes of reasoning in problem solving and described a frame as “... the general implication that by applying a certain working principle we will create a specific value.” (Dorst, 2011, p.524). A frame can thereby be seen as the meaningful link between a working principle and an aspired value, often communicated through storytelling (Bruner, 1990; Simmons, 2006) and depicted as a theme or metaphor that allows seeing things in a certain perspective (Lakoff & Johnson, 1980; Dorst, 2011). Because stakeholders have differing perspectives, they frame and aspire to different values and working principles for the solution being developed, e.g. based on insights from marketing research or taken from previous projects (Møller & Tollestrup, 2013). These subjective framing processes are likely to complicate the process of ensuring shared understanding.

In 2007, Hey, Joyce & Beckman studied the practical framing process of interdisciplinary teams in the early phases of NPD. They identified that framing takes place in a cycle of four phases, as illustrated in Figure 1.

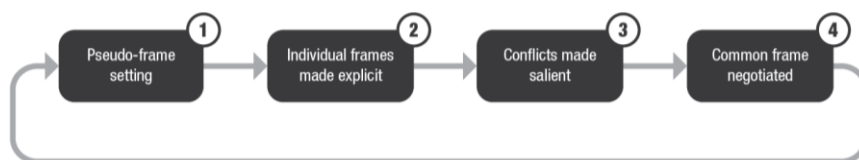


Figure 1. The four phases of the framing cycle based on (Hey, Joyce & Beckman, 2007)

The cycle describes how vague initial problem boundaries and solution domains of a project cause team members to form implicit frames. When making project decisions, the team members are compelled to make their individual frames explicit. This explication makes conflicts between the frames salient, enabling the team to discuss the individual frames and negotiate a common frame. An explicit and shared framing process is therefore necessary for a team to achieve common goals and objectives (Hey, Joyce & Beckman, 2007).

From the above, it is evident that several studies have investigated the framing process on an individual level, whereas studies of framing in teams are limited. ‘The four phases of the framing cycle’ can partly be used to understand framing in teams, but cannot be widely generalised as the research was based in a classroom setting. Therefore, it does not account for professional projects involving compositions of interdisciplinary stakeholders working in parallel, or for how they interact and align frames in an organisational setting.

We will therefore investigate the characteristics of the framing process of interdisciplinary stakeholders in the early design phases of New Product Development projects and propose a model that describes our findings.

## 2 METHODS

We will analyse three cases that describe NPD projects within three Scandinavian product development companies: LEGO (a toy company in Billund, Denmark), LEO Pharma (a pharmaceutical company in Ballerup, Denmark) and Zenit Design (a design consultancy in Malmö, Sweden). In a longitudinal study of 2-3 months, we followed the development processes through observation of and/or participation in the process combined with semi-structured interviews with stakeholders.

To provide an overview of activities, stakeholder involvement, perspectives, and points of view, each of the cases has been mapped in timelines. These timelines are used as an analytical tool to understand development, dependencies, and alignment of stakeholder perspectives and to clarify patterns, similarities and differences between the cases.

## 3 CASES

The following section describes the case studies alongside a simplified visualisation of the timelines exemplified through dives showing key aspects: The timelines depict the overall ‘themes’ in the development process, whereas the ‘events’ represent specific activities stakeholders perform. The ‘perspectives’ represent a stakeholder’s perspective on an aspect of the project, where the ‘point of view’ represents what type of perspective it is, e.g. a commercial, aesthetic, strategic or technical point of view (Figure 2, 3 and 4).

### 3.1 LEGO Case

This case study was conducted at LEGO, a Danish toy company with approximately 14,000 employees worldwide. The study focuses on the development process of a LEGO dragon within Ninjago®, which is an Oriental fantasy inspired universe with an extensive portfolio of dragon models aimed at children aged 5-14.

The study focused on three central stakeholders: A designer, a design manager and a marketing lead. The design manager and the marketing lead were part of the core decision-making team that managed the strategic decisions, whereas the designer was responsible for model building and development. The case study depicts the development process over a period of 2.5 months including prior activities that influenced the process, as illustrated in Figure 2 below. The study was concentrated on the early design phases of the dragon, where multiple design explorations were performed and presented at regular meetings. The main challenge was to create an acceptable alignment between the stakeholders’ different perspectives.

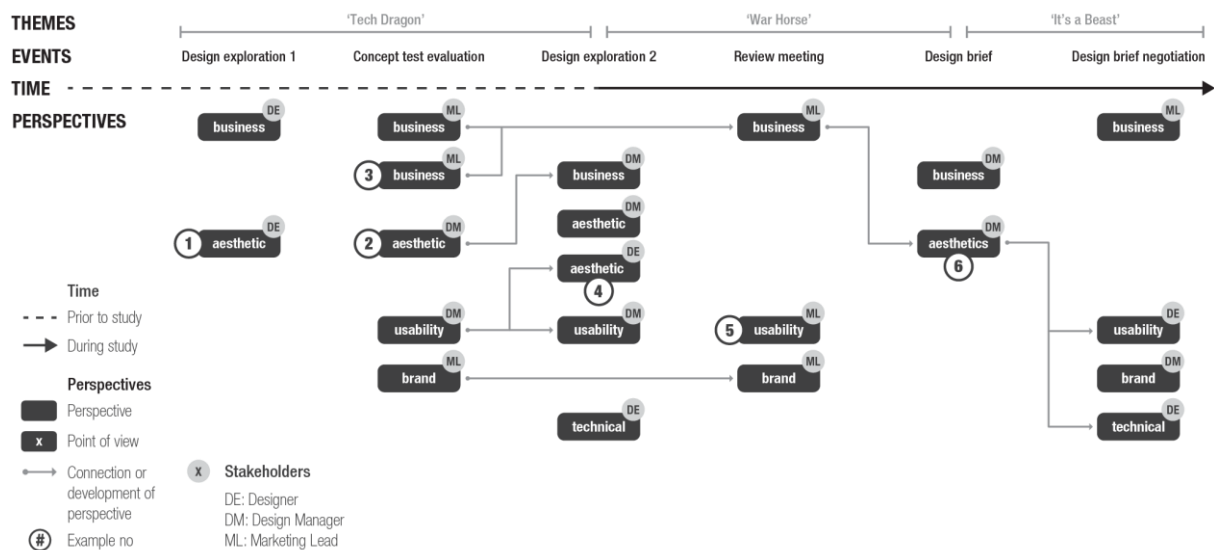


Figure 2. Simplified timeline mapping the perspectives of the LEGO case

1. Based on past experience with building dragon models, the designer took inspiration from other

dragons in the Ninjago® portfolio and combined this with the robotic aesthetic of one of the ninjas, thereby creating a ‘Tech Dragon’ metaphor: A futuristic, technological and empowered dragon.

2. Testing showed that users perceived the dragon as a ‘battle machine’ rather than a creature. Based on these insights, the design manager suggested reintroducing a realistic aesthetic, inspired by previous dragons, with organic shapes and fewer technological looking elements. This eliminated the concept of a robotic dragon, making it easier for newcomers to the get into the Ninjago® universe.
3. Based on market research and test insights, the marketing lead aimed to avoid customer rejection by making it easier for the user to decode the dragon through a more traditional and recognisable aesthetic. This coincided well with the suggestions of the design manager (2) and the stakeholders therefore agreed on developing a realistic and easily decodable dragon.
4. Inspired by an Oriental ‘War Horse’ metaphor, the designer and design manager agreed on developing a ‘naked’ dragon and armouring it up through sub-builds to achieve the traditional iconic realism.
5. During a review meeting, a conflict emerged when the marketing lead could not see the ‘War Horse’ design proposal accommodating the realism he was looking for. He argued that the armour cluttered the realism, which made it difficult for the kids to decode the dragon. He suggested to remove the technological ornamentation and instead make the dragon more realistic by introducing natural features like claws, mouth, and wings inspired by popular fantasy.
6. The stakeholders then agreed decided to go for a whole new design direction revolving around a metaphor of ‘It’s a Beast’, escaping the stakeholders’ preconceptions of how to design the dragon.
7. The design manager converted this into a design brief with the objective of exploring the decodability of the dragon inspired by reptile anatomy with strong references to popular fantasy to achieve a novel kind of realism.

### **3.2 LEO Pharma case**

The following section presents the observations from a project at LEO Pharma, a Danish pharmaceutical company of 4800 employees worldwide developing high-end solutions for skin diseases. The project was based in the department of Device & Packaging, part of R&D in Ballerup, which consists of around 40 employees working on early development, manufacturing, and lifecycle management of products. The main goal of the project was to explore the potential in creating better treatment outcome through improved application guidance of topical treatment and identifying solutions to support it.

Two teams in the department of Device & Packaging worked on the project in succession, both led by a project manager: One team, consisting of an engineer and a pharmacist, initiated the project and did the preliminary research, exploration, and ideation, while the second team, composed of two anthropologists and a design engineer, was mainly responsible for user research and validating the potential of the project. The project involved internal stakeholders from the departments of global marketing, local marketing/affiliates, global product supply, quality, and a doctor, in addition to users/patients as external stakeholders. The study depicts activities over a 3-month period including some prior activities, as illustrated below in Figure 3. The project was studied on a participatory basis starting from the review meeting where the second project team entered the project. The main challenge was to identify a solution that would accommodate a wide range of patients needs.

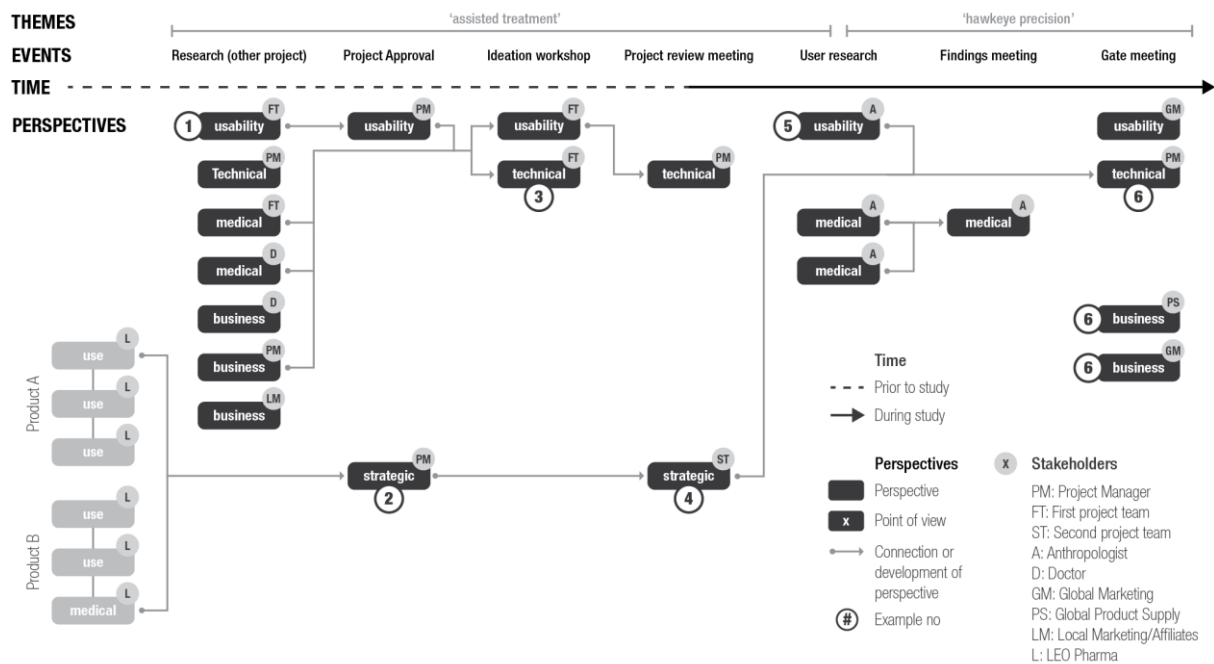


Figure 3. Simplified timeline mapping the perspective of the LEO Pharma case

1. Early in the project, the first team established a design brief with the goal of facilitating better treatment guidance, making it easier for users to dose the drug and enhance/complement compliance (correct treatment). The project manager saw this as an opportunity to differentiate LEO Pharma's products on the market.
2. The first project team estimated that the best strategy was to create a solution that could be added to existing products by focusing on two of LEO Pharma's most original products (Product A and B).
3. Based on the goals created at the beginning of the project, the first project team, along with a doctor and two design consultants, explored various technical and functional solutions to facilitate better treatment guidance (1).
4. During a review meeting, the project manager argued that it would be difficult to create market differentiation for both Product A and B since the patent for the drug used in Product A would expire in a few years. The second project team decided that the best strategy would be to concentrate on Product B in the upcoming user studies to determine the market potential.
5. Based on user studies, the anthropologists found that improving the treatment instructions and creating a solution with high precision would be valuable to the patients. This would enable them to target the affected skin area more easily as it varies in size and placement on the body.
6. During a gate meeting, the second project team presented their goals, insights, findings and concepts of the project and proposed a strategy for proceeding to an extended Device & Packaging governance board. The representatives from the departments of global marketing and global product supply disagreed that a redesign of Product B could be justified commercially as it would result in a higher production and market price. The project manager, on the other hand, believed that the goals could be achieved by simply changing the size of one of the components of the product. In order to establish a business case, further design exploration was needed to strike the right balance between cost and functionality.

### 3.3 Zenit Design case

The following section presents the findings from a project at the Swedish design consultancy, Zenit Design. The consultancy has 35 employees working within product design, service design, graphic

design and CGI for a large variety of national and international clients. In this project, they were working for a new client that develops products for the distribution industry. The client wanted to differentiate their brand in the market by introducing a new version of their heavy-duty, industrial product. The product consists of a functional part, on which a handle helps the user with carrying and coupling/decoupling the product into an opening. When doing so, the handle needs to be twisted manually with significant force, which, in the long term, causes pain in the wrists and shoulders of the user. The goal of the collaboration was therefore to develop the next generation of the product mainly focusing on the creation of a more ergonomic handle.

At Zenit Design, two design teams worked in parallel: One responsible for research and analysis and another for concept development. Both teams were consulted by an ergonomist. The external stakeholders involved were departments of the client (management, sales and engineering), a branding agency, as well as users and customers of the product. The study depicts activities over a 2-month period including some prior activities, as illustrated below in Figure 4. The project was studied on a participatory basis starting from the field study as part of design team 2. A core paradox was to align the stakeholders' perspectives in a conflict regarding the ergonomics and aesthetics of the product, as illustrated below in Figure 4.

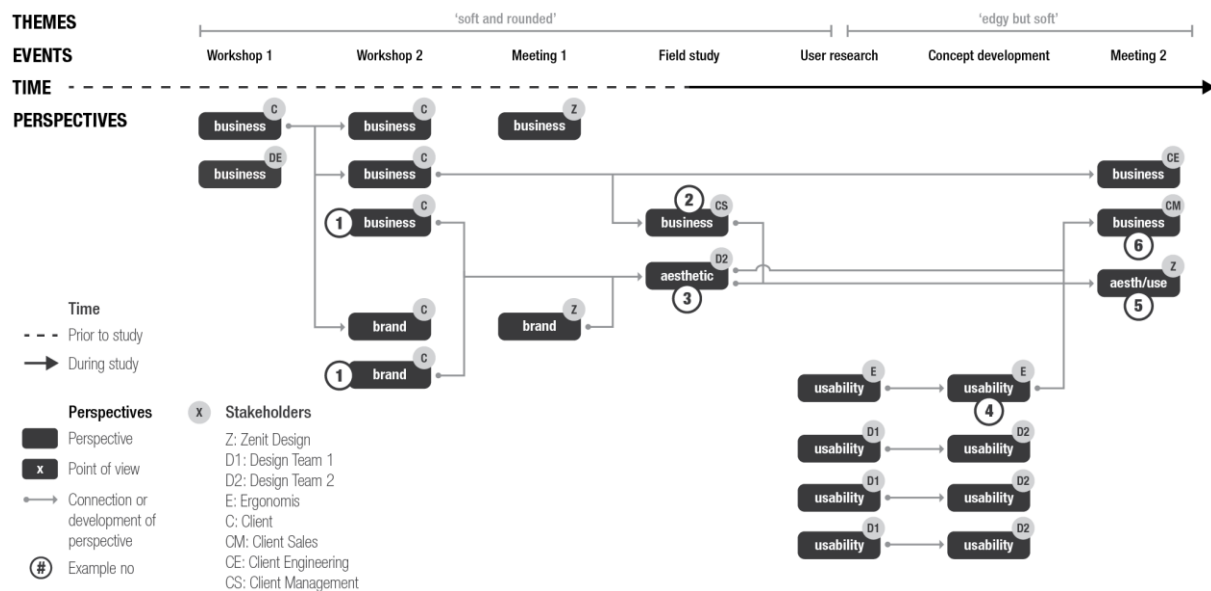


Figure 4. Simplified timeline mapping the perspectives of the Zenit Design case

1. Through the initial design brief, the client communicated that the product needed to look robust and reliable and fit into their corporate identity, which represents a sharp and industrial look.
2. On a field study, the design teams discovered that representatives from the client's sales department wanted the handle to be soft and rounded in order to create an impression of an ergonomic product.
3. In parallel, the second design team suggested a robust design language with sharp edges at certain areas to make the product fit into the male-dominated, industrial context, while also accommodating the client's corporate identity and providing the desired reliable look (1).
4. The concepts, that the second design team developed, were based on the findings from user research and the data provided by the ergonomist. From the ergonomists perspective, the handle needed to have a circular cross section at a certain diameter and additionally look soft and rounded to be cognitively perceived as ergonomic, similar to what the client's sales department had earlier suggested (2).
5. During a stakeholder meeting, the second design team presented concepts alongside a style board proposing a solution for the aesthetics of the product. Here the stakeholders determined to follow through with an aesthetic the designers named 'edgy but soft' - a merge of the conflicting

perspectives the stakeholders had proposed beforehand: A handle with an overall sharp and edgy design language, but with soft and ergonomic shapes at defined interaction areas.

6. Through the following concept selection and discussion, the balance between edgy and soft was negotiated. Subsequently, the client’s management saw potential in utilising the edgy design language to stand out on the market and therefore suggested to push this aesthetic further than what the designers had presented. As it was discussed whether the edginess would compromise the ergonomics of the handle too much, user studies were performed to establish the right balance between ergonomics and aesthetics.

## 4 ANALYSIS & FINDINGS

In the following section, we will present and analyse the findings from the three cases. We will identify the frames of stakeholders based on the concept that frames are composed of ‘aspired values’ and ‘working principles’ (Dorst, 2011), and that they are communicated through storytelling (Bruner, 1990; Simmons, 2006) by the use of themes and metaphors (Dorst, 2011; Lakoff & Johnson, 1980). Additionally, we approach the creation of frames based on the notion that not only designers, but all stakeholders, create them (Møller & Tollestrup, 2013) through a subjective process (Dorst & Valkenburg, 1998).

When comparing the cases with ‘The four phases of the framing cycle’ (Hey, Joyce and Beckman, 2007), we found that the framing process of stakeholders in organisational settings is different and more complex than those of classroom-based teams. One of the things that complicate the process is that aspired values and/or working principles are introduced as isolated entities, which we call ‘partial frames’. These partial frames are introduced without the connection of a frame. Based on our findings, we propose a model of the framing process as an iterative loop of six phases that the stakeholders have been observed going through (Figure 5).

### 4.1 The Interdisciplinary Framing Loop

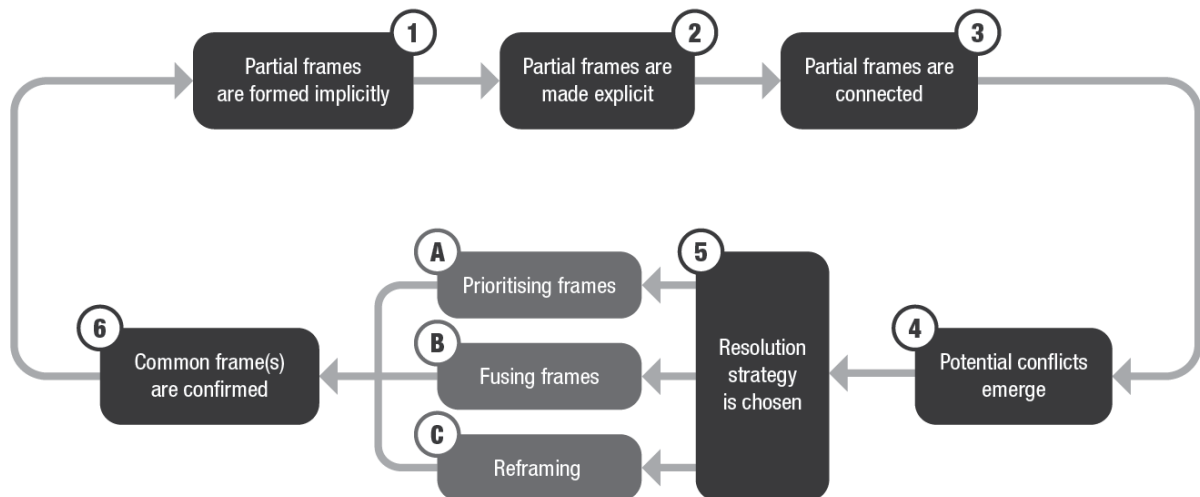


Figure 5. The Interdisciplinary Framing Loop

#### 4.1.1 Partial frames are formed implicitly

The case studies imply that the circumstances of the project set boundaries around the problem and solution spaces, causing the stakeholders to form isolated aspired values and working principles individually. These partial frames are driven by project-specific goals, assumptions, and expected outcomes, e.g. based on design briefs and gate meetings but also on the stakeholders’ professions, modes of reasoning and prior experience, i.e. their appreciative systems. In the LEGO case, the first design proposal developed, ‘Tech Dragon’ (1), was based on the designer’s initial preconception of Ninjago®

and its previous releases, in which the dragon was always related to the main character of the storyline. This implied a strong solution direction for the designer, influencing him to implicitly form isolated aspired values of creating a close relation between the dragon and the main character through a ‘Tech Dragon’ metaphor.

#### **4.1.2 Partial frames are made explicit**

When stakeholders make project decisions, the individual and implicitly formed partial frames are compelled to become explicit. This can happen under different circumstances, e.g. client meetings, gate meetings, and design reviews through actions such as presenting findings, sketches, and prototypes. Looking at the gate meeting in the LEO Pharma case (6), the representatives from global marketing and global product supply assumed that to improve precision for the product, any of the proposed concepts would predicate a redesign of the product, resulting in a higher production and market price. By proposing only to change the size of an existing component, and thereby improving the precision of output for Product B, the project manager explicated his personal idea of what the solution could be.

#### **4.1.3 Partial frames are connected**

Through activities like concept development, design synthesis, design exploration and discussion, stakeholders form frames by connecting the now explicit partial frames. As an example, connections can be established between the aspired value of one stakeholder and the working principle of another, and can also be created across different points of view. Our study indicates that fully defined frames are not exclusively connections between one aspired value and one working principle - several partial frames can be connected simultaneously: One aspired value might be solved by multiple working principles linked together, and several aligned aspired values might be solved with a single working principle. This can be exemplified by the Zenit Design case, where the second design team suggested a frame that connected the client’s two initial aspired values with a working principle from a frame the designers had created earlier: The client’s first aspired value represented a business point of view; ‘needs to look robust and reliable’, and the second one a brand point of view; ‘needs to fit into the corporate identity’ (1). The aspired values were both connected to the working principle ‘design language with sharp edges at certain areas’ (3), which was initially solving the designers’ aspired value ‘needs to fit into the male-dominated, industrial setting’. In this way, one working principle solved three aspired values across different stakeholders and points of view.

#### **4.1.4 Potential conflicts emerge**

As the partial frames are connected to become fully defined frames, possible conflicts between frames are likely to emerge. This happens due to faulty interpretations and contradicting aspired values and/or working principles.

#### **4.1.5 Resolution strategy is chosen**

Once a conflict between frames has become apparent, a strategy for coping with it can be chosen. Depending on the circumstances of the project and the type of conflict, the following three approaches were identified:

##### **A. Prioritising frames**

In situations where multiple frames seem to conflict in terms of potential, relevance or influence, a prioritisation can ensure that the most crucial frames are kept in scope and others are postponed or discarded. In the LEO Pharma case, the first project team initially determined to explore solutions for both Product A and B (2). During a prioritisation meeting (4), the project manager argued that there was a high probability that Product A would be taken off the market in a few years as the patent for the drug used in the product would expire, which, from a marketing point of view, would be contradictory to the aspired value of creating ‘market differentiation’. The team resolved the conflict by prioritising the aspired values and working principles related to Product B, practically leaving the frames associated with Product A out of scope.



## **B. Fusing frames**

If the root of the conflict stems from frames that seemingly pursue contradicting goals, it might be possible to fuse frames into one that can accommodate multiple aspired values and/or working principles and thereby generate a balanced compromise between the conflicting frames. In the Zenit Design case, the client had proposed working principles in the form of a ‘robust, sharp and industrial’ aesthetic (1) and the sales department a ‘soft and rounded’ aesthetic (2). Additionally, the second design team had created the working principle ‘robust design language with sharp edges’ (3), and the ergonomist ‘soft and rounded handle with circular cross section’ (4). Here a conflict surfaced as the working principles were clearly contradicting. The design team resolved this conflict at the second meeting by suggesting a fused frame, which unified the conflicting working principles as; ‘overall sharp and edgy design language with soft and ergonomic shapes at defined interaction areas’.

## **C. Reframing**

When the conflicting frames seem unsolvable through a prioritisation or fusion, a novel frame that redefines the way the problem is approached and perceived may prove to be a solution. Looking into the LEGO case, the designer and the design manager had based their design proposals on their own preconceptions of working principles related to dragon building. They repeatedly created frames that built upon the same working principles and interpretations (1-4), restricting the design proposals from accommodating the values aspired by the marketing lead (5) and ultimately causing the process to be brought to a standstill. The conflict was resolved by reframing the previous understanding of the problem, instead creating a new perception of what a dragon could be.

### **4.1.6 Common frame(s) are confirmed**

Following the choice of resolution strategy, the stakeholders engage in a negotiation of one or more common frames. In all three cases, it was found that resolution strategies were discussed and adjusted at meetings to ensure alignment between stakeholders.

## **5 CONCLUSION & DISCUSSION**

### **5.1 Contribution**

In our research, we have investigated the framing activities in the early design phases of three NPD projects. We have gained insights into how stakeholders work with aspired values, working principles, and frames, and handle misalignment between them. Additionally, we have found that professional interdisciplinary compositions go through a different and more complex framing process than classroom-based teams which ‘The four phases of the framing cycle’ is based on (Hey, Joyce and Beckman, 2007). Our research implies that the characteristics of the framing process in the early design phases of New Product Development projects involving interdisciplinary stakeholders can be described through a model of six iterative phases that we call ‘The Interdisciplinary Framing Loop’. The model describes how stakeholders create isolated aspired values and working principles implicitly, which are later forced to become explicit. As these ‘partial frames’ are connected to form fully defined frames across stakeholders and points of views, potential misalignments become salient and conflicts emerge. By utilising the methods of prioritising, fusing or reframing, the conflicts between frames can be negotiated and resolved, ensuring that alignment has been achieved. Given that our findings can be generalised through further research, we believe our research makes a significant contribution to understanding the complexity of framing.

### **5.2 Implications**

Based on our findings, we encourage organisations working with interdisciplinary NPD projects to perform frequent iterations of ‘The Interdisciplinary Framing Loop’ during the process, ensuring that all stakeholders create shared understanding. By doing so, conflicts are likely to be identified and resolved as soon as they emerge, rather than later in the process, where they might implicate the project more severely and potentially result in loss of resources. Stakeholders are likely to change opinions over time and create new and different frames as the project progresses, which is why iterations of the loop should be performed regularly; especially in the early phases of NPD where the project is often ambiguous and final decisions are yet to be made. Therefore we recommend documenting decisions

made, e.g. through design briefs, image boards, and mappings to decrease the risk of the stakeholders misinterpreting what was agreed upon. Since misalignment is inevitable, we recommend that stakeholders are brought together as often as possible to interact with each other through a shared and explicit process, where frames and the conflicts between them can be made salient and alignment can be ensured.

### 5.3 Limitations and further research

The study considers a low number of cases and just a few possible team compositions, project types, and industries over a limited time span studied through different levels of participation. The findings can therefore only be seen as indications, and may limit the generalisability of the research. To clarify the general applicability of the findings, similar research should be conducted on a larger scale and through longer durations of time.

One of the things we have observed is that frames appear to be created on different levels of abstraction, e.g. working principles ranging from vague initial ideas to concrete technical features. This might be a reason why stakeholders misalign as they present and discuss goals and concepts. Another observation is that stakeholders seem to be influenced by organisational strategies and philosophies (espoused values), which might affect project goals and cause the creation of conflicting frames. Lastly, it would be interesting to investigate how the Interdisciplinary Framing Loop relates more specifically to user/customer involvement in NPD processes. Further research is needed to understand the impact these parameters have on the development of frames in interdisciplinary settings. We suggest looking into the following research questions:

1. How do different abstraction levels of frames influence alignment and negotiation in interdisciplinary organisational settings?
2. How do espoused values influence the creation of frames in New Product Development?
3. How does user/customer involvement influence the creation and development of frames in ‘The Interdisciplinary Framing Loop’?
4. Can the insights that ‘The Interdisciplinary Framing Loop’ provides be translated into a tool that can assist stakeholders in navigating in the early phases of NPD?

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