# Resolving Tensions in Design & Engineering Practices Through a Semiotic Lens

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Dedicato a Nonna Angela
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## Abstract

This thesis investigates the tensions that run through shared design activity between designers and engineers, debunking the presumed ontological opposition between the two disciplines and taking as its object the ongoing practices and the dynamics that orient their course of action. Starting from a semiotic reformulation of the research problem, design and engineering are framed as complex design practices, internal to socio-technical configurations in which actors, objects, criteria of validity, value regimes, and situated constraints co-produce the meaning of the project. From this perspective, the tensive dynamic is treated as a structural category of meaning, understood as a state of instability in the course of action produced by the interference among different praxic logics and regulated through accommodations; tension, in turn, is considered as the phenomenal emergence of the effects produced by this dynamic, and is therefore not to be understood as a synonym for conflict, friction, or disagreement.

The theoretical framework is grounded in Jacques Fontanille's semiotics of practices and, in particular, in the notions of the practical scene and the resolution sequence (involving the succession of gaps in meaning, schematization, regulation, and accommodation), adopted here as the descriptive key to the tensive dynamic.
On the empirical plane, the research adopts a qualitative design articulated into two complementary phases: a situated mini-ethnography of the laboratory reviews of 12 mixed teams from the Design & Engineering programme at Politecnico di Milano, engaged in a corporate brief, and a subsequent series of semi-structured, episodically oriented interviews with two comparatively selected groups.

The analysis shows how the review functions as a privileged practical scene for making tensive dynamics observable, insofar as it publicly re-problematizes the project, tests its provisional robustness, and forces the team to reposition itself with respect to constraints and priorities. Conflictual effects recur under conditions such as the opening of gaps in meaning, the instability of evidence and mediating objects, methodological misalignments, asymmetries of role and recognition, axiological trade-offs, and extra-project interference.
The most theoretically relevant result is that such effects cannot be reduced to the designer-versus-engineer dichotomy and, more often, take shape as local outcomes of a tensive dynamic that traverses dense practical scenes, in which a plurality of actors, objects, strategies, pathemic states, and values intervene.

## Abstract in italiano

Questa tesi indaga le tensioni che attraversano la progettazione condivisa tra designer e ingegneri, smentendo la presunta opposizione ontologica tra le due discipline e assumendo come oggetto le pratiche in atto e le dinamiche che ne orientano il corso d'azione. A partire da una riformulazione semiotica del problema di ricerca, design e ingegneria vengono inquadrati come pratiche progettuali complesse, interne a configurazioni socio-tecniche in cui attori, oggetti, criteri di validità, regimi di valore e vincoli situati co-producono il senso del progetto. In questa prospettiva, la dinamica tensiva viene trattata come categoria strutturale del senso, intesa come uno stato di instabilità del corso d'azione prodotto dall'interferenza tra differenti logiche prassiche e regolato tramite accomodamenti, e la tensione viene considerata come emersione fenomenica degli effetti prodotti da questa dinamica, non da intendersi quindi come sinonimo di conflitto, frizione o disaccordo.

L'impianto teorico si fonda sulla semiotica delle pratiche di Jacques Fontanille e, in particolare, sulla nozione di scena pratica e sulla sequenza di risoluzione (che vede il susseguirsi di lacuna di senso, schematizzazione, regolazione, accomodamento) assunta qui come chiave descrittiva della dinamica tensiva.
Sul piano empirico, la ricerca adotta un disegno qualitativo articolato in due momenti complementari: una mini-etnografia situata delle revisioni laboratoriali di 12 team misti del corso di Design & Engineering del Politecnico di Milano, impegnati in un brief aziendale, e una successiva serie di interviste semistrutturate a orientamento episodico su due gruppi selezionati comparativamente.

L'analisi mostra come la revisione funzioni come scena pratica privilegiata per rendere osservabili le dinamiche tensive, poiché ri-problematizza pubblicamente il progetto, ne verifica la tenuta provvisoria e costringe il team a riposizionarsi rispetto a vincoli e priorità. Gli effetti conflittuali emergono in modo ricorrente in corrispondenza di condizioni quali apertura di lacune di senso, instabilità delle prove e degli oggetti mediatori, disallineamenti di metodo, asimmetrie di ruolo e riconoscimento, trade-off assiologici e interferenze extraprogettuali.
Il risultato teoricamente più rilevante è che tali effetti non si lasciano ridurre alla dicotomia designer vs ingegnere, e più spesso si configurano come esiti locali di una dinamica tensiva che attraversa scene pratiche dense, nelle quali intervengono una pluralità di attori, oggetti, strategie, patemi e valori.

## 1. Introduction

As a student in the Design Engineering programme, I have always questioned the motives and the meaning of it. Before even starting the course, I was told: “You will become a complete designer”. By “completeness” they probably meant the acquisition of technical skills that are impartially distributed across the various three-year design programmes, often unbalanced or perceived as complementary. Specifically, the programme focuses on the design and engineering of industrial products. Is it therefore a merely reciprocal acquisition of skills, aimed at making designers a little more like engineers, and engineers a little more like designers? Ultimately, the subject matter is the same: objects made to be mass-produced.
During my studies, the design teams were always mixed, including designers and engineers from different schools and backgrounds. Ultimately, we can think of these two disciplines as two languages that speak about the same thing, but with different characters and expressions. And what better way to learn a language than to practise with those who speak it. It is therefore inevitable that, when engaging with professionals from the other discipline, difficulties and inconsistencies will emerge: “How would you produce it?”, “It doesn’t stand up”, or “who do you expect to understand it?”, or “if we change this, the project loses its meaning!”.

I could not help but notice, both through firsthand experience and by observing other colleagues, that moments perceived as “tensional” were constitutive of the design process. The investment is enormous, and certain scenes have undoubtedly remained etched in my memory.
I vividly remember, and with belated fondness, a fairly frequent scene, experienced firsthand and observed during the research. Extremely high expectations for project progress were shattered by thunderous comments from reviewers, which generated a chain of considerations that led to the proposal of a complete change of the concept presented. In those moments, the maintenance of the “face game” (Goffman, 1967) - in order to preserve a minimal semblance of control over the project, even though it would no longer exist except in a completely different form - was evident, and then vanished in the post-review exchange among colleagues, where there was a rapid succession of a series of states including disbelief, resentment, discouragement, and then acceptance, followed by solidarity.

It is amusing to think how, at the end of every design workshop, we would always promise ourselves we’d somehow avoid similar situations, only to once again fall into recurring and almost inevitable situations, like sleepless nights spent trying to deliver by the next day's review deadline (with the ensuing collapse onto the keyboard while still on a call), disconcerting indecisions and inconsistencies between different methodologies, trying to mediate between group members who did not think in exactly the same way, or who, for one reason or another, harboured subtle antipathies, trying (whether out of desire or necessity) to bring everything back to the conditions that would allow the design work to continue.

Regardless however of the kinds of decisions made and the moods involved, the design process would continue on its course, and the artefact that emerged would somehow bear the weight of it. During the process, if one reasons in separate terms - the designers dealing with one aspect, usually the research phase, the elaboration of the concept, and the

identification of mood and target, and the engineers dealing with the engineering phase proper - the product becomes like a ping-pong ball bouncing from side to side, undergoing continuous variations with each swing, introducing difficult-to-manage variables into the process, extending timelines, and leading the designers involved to absorb a significant amount of mutual frustration.
Taking charge of, and overseeing the various phases regardless of disciplinary background creates the essential foundations for managing the project differently, aware of the constraints and variables, both engineering and human, that shape the project.

I therefore ask myself: why do moments of subtle conflict and misunderstanding arise with such frequency? Is it possible to identify the source of these events? Are they intrinsic to the process, do they lie in the differences between ways of doing, or do they derive from a lack of competences? In what way do they influence the project? Are they, in some sense, “avoidable”? I have considered semiotics and its themes as a descriptive instrument of analysis. Through situated ethnographic research and targeted interviews involving students and professionals from the fields of industrial design, mechanical engineering, and design engineering, I will identify examples and case studies where the concepts explored in this thesis will be applied to define these tensional dynamics.

## 2. Pre-analysis of the disciplines of Design and Engineering

In order to address the tensional dynamics between design and engineering practices, we must first define the concept of semiotic practice, understand what is meant by tensional dynamics, and frame design and engineering as concomitant design practices within which these very dynamics are embedded, develop by influencing the project, and ultimately find resolution. In this chapter, we begin precisely from this latter situation: that is, by framing design and engineering outside a semiotic framework in order to identify the research problem and ultimately understand how and why semiotics itself can be validly used as a descriptive lens to shed light on these occurrences.

### 2.1 Contemporary relevance and cultural belonging

Today it is possible to observe how, both in professional contexts (such as emerging studios and established companies) and in educational settings (universities, laboratories, courses), the co-presence of specialised figures with different educational backgrounds is evident, if not necessary, throughout the design process or at specific moments within it. Product designers who design or interface with different kinds of engineers; architects who discuss with construction managers; graphic designers who discuss with clients; students who interface with professors. Interfacing, discussing, accepting, re-proposing… all actions that arise from the continuous relationship established among the multiple actors involved in the entire design process - which is, in every respect, a social process (Bucciarelli, 1994) - from the initial request or idea up to the potential production of the artefact.

Among the human actors actively involved in the process, we consistently find figures specialised in one or more aspects of the project. In real cases, whether large or small studios, corporate departments, or university laboratories, the specificity of these figures is never an end in itself, and the actions and lines of reasoning tied to one person's competences complement (or clash with) the actions and lines of reasoning of another professional trained in an adjacent field, but with different ways of doing and thinking. Whether it is a direct dialogue, such as simple discussions to decide the shape of a component, or a structured handover of information in phases - for example, a linear structure in which a company commissions a product from a studio of designers only, which produces a design that is then passed on to the engineering team, which in turn passes it on to those responsible for manufacturing - inevitably multiple professional figures come into contact and sustain a continuous and natural process of negotiations and translations that influence (positively or negatively) the project's outcome.

It is also obvious, however, that not everything always goes according to plan, and situations may arise ranging from passive-aggressive looks directed at a colleague for having modified a component "to their own taste", to immeasurable delays due to a clumsy CAD model design. The time window in which multiple individuals design together is populated by a series of inconveniences, discussions, and conflicts of many different kinds which, in the way

they are managed and in the way they present themselves, modify the project's result, the process, and, to some extent, the designers themselves.

Whether these clashes are to be attributed to different ways of doing or thinking, to differences in competences, to misunderstandings, or to factors "external" to the project (frictions, antipathies, inconsistencies…), we know that they can potentially punctuate the various moments of the design process and the interactions among those involved, producing effects that influence, modify, and contribute to the project itself. Referring back to Bucciarelli's (1994) idea of thinking of design as a genuine social process rather than as a concatenation of phases, it becomes even more spontaneous to understand how all those situations not foreseen in the canonical models of "how to design" carry enormous weight in the design outcome. It is enough to imagine, for example, a conversation between two people deprived of tone of voice, expressions, gestures, glances, postures, and rhythms, and left exclusively to a monotonous exchange of words and information. In doing so, we would strip it of all the essential ingredients that contribute to articulating its meaning.
Similarly, design would not be such if we considered it exclusively as a succession of phases and actions that leads from one point to another (presumably from an idea or a request to an artefact), deprived of all those potential and unforeseen situations and of the ways of managing them, which we will frame under the concept of "accommodations" (Fontanille, 2010) which, between a quip and a rendering, contribute to defining and orienting the project's trajectory.

Our specific interest will be divided between the two fields, design and engineering, and those who embody their praxis, designers and engineers, stereotypically perceived as antagonistic because of presumed ontological distinctions. The focus of this investigation will therefore be directed towards all those episodes of conflictuality arising from the fruitful interaction between these two figures, trained in domains that share, as a common way of doing, a design-oriented sense, each dedicated to an analogous "face" of the matter of the project. The co-presence and collaboration of designers and engineers within the same design scenario is today a preferable standard compared to linear models - also not without tensions - which envisage the transfer of concepts, sketches, ideas, and forms from the design department to constraints, objectives, data, and tests now belonging to the engineering department, all of it aimed at the concretisation of a product that is viable in functional or economic terms.
Predictable and frequent situations see the project bounce from one department to another according to paradigms of authority and design priorities (for instance, choosing whether to give greater importance to the design side or to the engineering side, and seeing which prevails), subject to prior confirmation or shared agreements that suspend the project in order to proceed to subsequent phases.
Such a "cascade" development (Royce, 1970) stands in opposition to non-sequential design logics adopted, for example, in corporate contexts such as Apple and Dyson, which involve the co-presence of designers and engineers across the various phases of the design process.

Apple's case is an illustrative one, as reported in Walter Isaacson's biography "Steve Jobs" (2011), where the company structured its spaces and processes so that the Industrial Design team would not work in isolation from the hardware engineers. The development of the "MacBook Unibody" (Fig. 1) is cited, whose chassis was the result of a collaborative design between designers and metallurgical engineers, crafting it from a single block of aluminum.

Figure 1: *MacBook unibody frame and the original aluminium block*

A more radical position on the differentiation of professional roles is taken by Dyson, where design distance is reduced to such an extent that the boundary between the two figures is considered blurred. In several interviews, former CEO and founder James Dyson has in fact stated that within the company "everyone is a designer and everyone is an engineer", reiterating the inefficiency of rigidly marking the difference between "those who think aesthetics" and "those who build the technology" when working on real and complex innovations. In order to achieve this, considerable effort has been invested in the preparation of these figures, with engineers being trained as designers.

Remaining on the subject of training and moving from corporate to university contexts, programmes such as Design & Engineering at the Politecnico di Milano (where I come from) aim at a crasis between the two figures through a hybridisation of competences in design, materials science, and mechanical engineering (Fig. 2). Within the programme, in addition to the teaching of subjects belonging to the aforementioned fields, designers and engineers work side by side during the various workshops in order to foster cross-fertilisation between competences.


Figure 2: *Poster of the Design & Engineering course at Politecnico di Milano*

The cross-functional collaboration shown in these examples is driven by direct advantages that can be leveraged in economic, qualitative, and efficiency terms (obviously depending on how design work is organised, managed, and conducted), as shown by research published in the Harvard Business Review and the Journal of Product Innovation Management, which highlights benefits linked to reduced time-to-market and rapid technical feasibility (Eisenhardt & Tabrizi, 1995; Griffin & Hauser, 1996).

Now, regardless of the models (linear or collaborative), of their possible advantages, and by virtue of these differences (between designers and engineers, which will be explored further below), it is evident that design is not exempt from all those situations of suspension, questioning, judgement, and reformulation that are acknowledged, then pathemised, and finally managed according to specific dynamics.
Prototypes produced by the designer as an exploratory and communicative tool are called into question by the engineer as lacking functional or performance value (“but in what sense?” - “trust me”)…
Formal and material choices, deemed essential to the perceptual and relational quality of the product, immediately come into conflict with constraints of manufacturability, cost, or

technical reliability raised by the engineer - thus imposing a renegotiation of design priorities and a shared redefinition of the criteria by which the solution's validity is assessed ("you're ruining the project" - "you're ignoring reality")…
These are only a few examples of possible situations that manifest within the process, which we will identify and understand as scenes arising from essential dynamics that contribute to the project's signification.

Worthy of consideration will be the proposition, as seen in previous cases, of the figure of the design engineer: a professional hybrid between designer and engineer, capable, on paper, of operating between the two worlds while maintaining the approaches and sensibilities of both professions. This consideration is taken up not so much because of any exceptional nature of the design engineer, given that the condition of a "hybrid" profile is fairly common across many disciplines, but rather because of the way this actor is inserted within the process, responds to potential unexpected events, and relates to all the other elements.
The introduction of this new character into the story will certainly alter the tensional dynamics that stretch and develop its plot, and it will be fascinating to observe how and whether there are substantial differences both in relation to, and alongside, the two figures of the designer and the engineer, without focusing too much on the relative advantages and disadvantages they bring to the project.

### 2.2 Historical context: Science–Humanities schism

The professional narrative rooted in the common imagination assigns to design the creative, humanistic, and imaginative character of design work, in opposition to the technical, scientific, and rationalised character of engineering. This distinction, often taken for granted, has historical and ideological roots that underlie the very structures of classification between cultural worlds, which still today continue to influence how these disciplines are perceived.
Since modernity, Western culture has institutionalised a fracture between art and science, between evaluative forms of knowledge and demonstrative ones, producing an epistemological divide (Snow, 1959) that does not merely organise fields of knowledge, but still contributes to modelling the professional imagination by influencing the way design practices are understood, narrated, and legitimised.

Within this framework, design occupies a structurally ambiguous position, attributable neither to the paradigm of the exact sciences nor to that of the traditional arts, despite maintaining constitutive relationships with both (Buchanan, 1992). Design shares with engineering the necessity of confronting material, productive, and technological constraints, and at the same time intervenes on use values, meanings, and experiences - domains that modernity has progressively associated with the humanistic sphere. It is precisely this interstitial position that makes design a discipline difficult to classify, and that contributes to reinforcing its representation as "other" with respect to technical practices properly so called.

The reduction of design to an eminently social practice and of engineering to an exclusively technical practice thus appears as the effect of a pre-existing cultural

categorisation. It is not the act of designing that is radically different, but rather the way in which it is inscribed within systems of values, regimes of legitimation, and disciplinary narratives that privilege separation over continuity. On the other hand, historical attempts to configure design as a recomposition of the fracture between art and technology are well known (Flusser, 1999), as reflected in the motto "art and technology: a new unity", emblematic of the Bauhaus school and indicative of the attempt to overcome inherited disciplinary dichotomies.

It is interesting to observe how this perception of continuity and discontinuity is relative, depending on how we set the discipline in opposition. If we place design between art and engineering, it takes up a median position. If we set it in direct opposition to engineering, design takes on a shamelessly "humanistic" polarity, whereas if we compare it to art, design is attributed a "technical" character. A representative effort, in an explicitly discursive and modelling sense, to organise these oppositions in a modern context is shown, for example, in Neri Oxman's "Krebs Cycle of Creativity" (2017) (Fig. 3). Although the original intent of this model is to explain how creativity is the fruit of a cycle that moves through the various quadrants, what interests us here is the distribution of the various disciplines, science included, in the form of a semiotic square that articulates logical-semantic relations through the opposition between nature and culture, institutionalised by modernity (Latour, 1991).

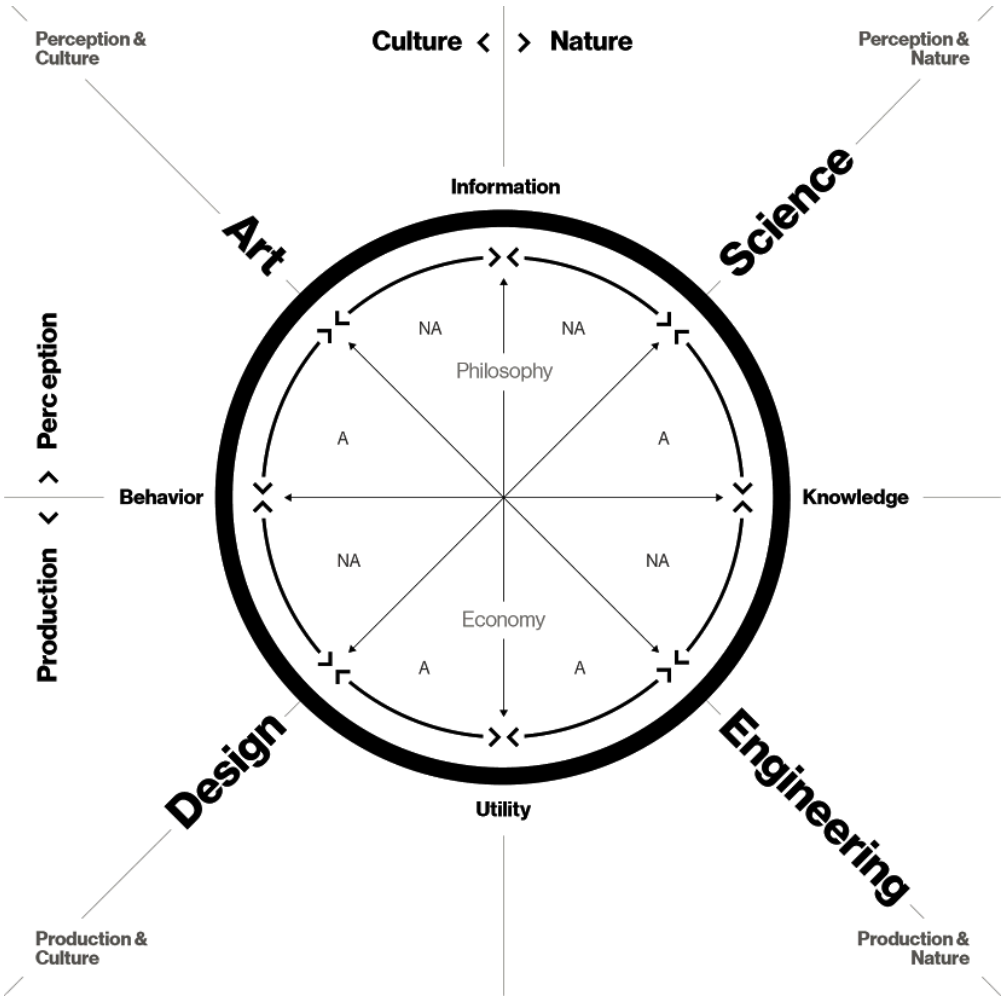



Figure 3: *"Krebs Cycle of Creativity" (Neri Oxman, 2017)*

Fontanille expands this dynamic of separation by introducing a historical discourse that examines the classification of domains of knowledge from the period prior to the introduction of the sciences (liberal arts and servile arts, trivium and quadrivium) up to modernity, and shows how the classification itself influences the way we perceive practices. He shows how the distinction between arts, sciences, and techniques does not derive from ontological differences in activities, but from historically determined principles of classification: sociological criteria of dignity or unworthiness, cognitive criteria grounded in the opposition between verb and calculation, and axiological criteria that separate the pleasant from the useful (Fontanille, 2010).
Such classifications, however, are not simple labels; they structure the cultural meaning of action, orienting what is deemed appropriate or inappropriate for a discipline, what it is expected to do, whether it is considered more "important" than another (according to a value system), how it should work, and what determines its success or failure. For example, engineering is normatively required to be efficient, measurable, and verifiable, whereas design is required to be creative, sensitive, and socially attentive. If the two figures collaborate on the same project, the engineer is thought of as the one who sees forces at play and performance, while the designer is thought of as the one who sees users and user experience. Should the designer undertake a FEM simulation and the engineer reason about potential users, such actions would often be perceived as exceeding the expected roles.

In the same way, returning to the categories articulated in the previous image, the dominant classification attributes to science a status of truth, to engineering a status of utility, and to art a status of symbolic value. Design, having an "uncertain" status, is perceived as less rigorous than engineering, just as engineering is perceived as less rigorous than science, despite each addressing complex problems. This reveals the structuring of a system of hierarchies that authorises judgements and orients choices that bear on the design context (it is enough to think, for example, of cases in which designers cancel any form of negotiation in order to follow engineers' decisions precisely because of this principle of authority, even when other solutions are nonetheless available).

In light of what has been considered, the opposition between design and engineering can be interpreted as the effect of a deontic distribution of practices within a cultural system that assigns distinct roles to technical doing and design doing. Design and engineering are thus perceived as antagonistic practices because they are inscribed in different value regimes, despite sharing design as a central mode of intervention in the world.
We can therefore affirm that designers and engineers are not different on an ontological plane, as their presumed antagonism is the product of a system of unstable classifications: what truly differentiates them are, rather, discursive practices, the professional languages through which they articulate the project, and the roles assumed within historically determined socio-technical configurations.

### 2.3 Semiotics “between arts and sciences”

Practices, languages, roles… mainstays for semiotics, which provides analytical schemes and conceptual tools that allow us to observe these elements as relational components of processes of meaning production.
As anticipated, the focus of the research will be to analyse tensional moments through the observation of designers and engineers “in act”, as they design together. In order to analyse them, however, we must first identify these tensional moments, or at least delimit the area within which they occur, how, and between what.
Sociological, psychological, anthropological approaches, or those specific to one of the two disciplines involved (design and engineering), are certainly useful for investigating the causes, relational dynamics, or contextual conditions of such tensions, though they risk privileging causal explanations or interpretations oriented towards conflict resolution. The choice of a semiotic approach does not respond to the need to explain why conflicts occur between designers and engineers, nor, still less, to provide normative models for their resolution. On the contrary, it allows us to describe how such situations emerge, articulate themselves, and produce effects of meaning within the design process, by concentrating on the dynamics that make them possible.
The object of analysis is therefore certainly shared by the various disciplines mentioned above, but the manner in which it is addressed differs.

This approach proves particularly relevant in a context such as the one investigated here, because it allows us to consider tensions between design and engineering no longer exclusively as a function of the way they may manifest themselves - as explicit disagreements, inconveniences, or clashes between professionals - but as structural moments in the signification of the design process, deriving from practices that meet, overlap, and at times obstruct one another. Tensions are thus removed from a pathologising reading of the process - “anomalies” to be eliminated or reduced - and are reformulated as structural moments of its signification, which we will understand to be necessary to the development of design itself. Semiotics will be a descriptive lens, observing how the interaction between designers and engineers, the artefacts they design, the tools they use, the methods they adopt, and the actions they perform over the course of the project contribute to constructing configurations of meaning, without presenting itself as a normative theory or as a methodology oriented towards process optimisation.

The opening of semiotics to disciplines external to traditional textual analysis is not a recent event. As Jean-Marie Floch observes, «for over twenty years, semiotics has been interested in architecture, urban planning, the design of objects, and marketing strategies» (Floch, 1990). This openness has made semiotics particularly suited to the study of disciplines such as design and engineering, and of everything that orbits around them. Precisely along this line, the contribution developed by Jacques Fontanille on the semiotics of practices will be crucial, allowing us to shift the conception adopted so far of design and engineering from container-disciplines to constellations of practices that produce meaning as they unfold.

Returning to the discussion of classifications between worlds of knowledge, semiotics is historically and conceptually situated “between arts and sciences” (Fontanille, 2010), assuming a discursive position analogous to that of design, without being rigidly inscribed within one of the two poles of the modern dichotomy analysed above. However, it should be noted that semiotics' stance is an epistemological one, while design's is more of a classificatory legitimation, as discussed earlier. In this sense, semiotics does not engage in the separation between nature and culture, between technical doing and symbolic doing, but proposes itself as an instrument capable of traversing and suspending such classifications, as a practice able to observe other practices in order to investigate what actually happens between them and to make describable the relations that constitute them.

This theoretical posture also finds an effective formulation in the definition of semiotics as a “platform-discipline”. As Giacomo Festi has stated, semiotics can be understood as «a methodology for the human sciences and for every type of design practice, capable of reformulating questions, translating problems, and mediating between different roles and perspectives involved in processes of meaning production», considering it as an organon of conceptual tools without replacing the disciplines involved.

Applied to the context of shared design between designers and engineers, this perspective makes it possible to describe how the interaction between the actors, the objects designed, the tools used, the actions undertaken, the methods adopted, and the decisions made contribute to the construction of the project’s meaning.

In this framework, semiotics configures itself as a descriptive lens that does not take a position in favour of one practice over another, nor does it privilege technical efficiency or symbolic quality - a desirable situation given my provenance from the Design & Engineering programme, burdened with a background in Industrial Design. Precisely starting from this descriptive capacity, in the following chapters we will finally frame design and engineering as complex design practices, analyse the tensional dynamics that traverse them, and understand how these contribute to the signification of the project.

### 2.4 Research Framework

“If it were possible to identify a single frontier for semiotic research (which is obviously not the case), it would consist in the question of practices. The reasons for such a claim are manifold and concern both the possibilities that emerge and the resistances encountered when observing this heteroclite mass of possible objects of analysis.” (Mangano, 2005).

In recent years, semiotics has progressively extended its field of inquiry beyond the analysis of verbal and visual texts, turning toward the study of social practices, processes, and situated configurations of meaning production. Within this framework, the theoretical proposal advanced by Jacques Fontanille (2010) on the semiotics of practices represents one of the most systematic attempts to describe action as a complex semiotic phenomenon.

Despite the theoretical relevance of this model, the applied literature remains relatively limited, particularly with regard to complex and technologically mediated professional contexts. Many contributions, in fact, focus on conceptual elaboration or on the analysis of everyday and cultural practices - suffice it to recall, for example, studies on culinary practices (Marrone, 2016), as well as "amorous," poster-posting, or conversational practices (Fontanille, 2010) - whereas empirical studies that test its operativity in fields such as industrial design, engineering, or socio-technical innovation are comparatively rarer. The latter tend to remain entangled in approaches that attempt a systemic examination, without moving far beyond a merely technical-operational analysis of the individual components of the process (whether professional figures or the tools employed). The reasons for this anchoring likely lie in the dual character of technical design processes, which are highly regulated (rules, conventions, standards) and at the same time "free" from pretexts that rigorously define the manner in which one arrives at the production (physical, or even only on paper) of an artefact, as well as in the complexity of the actors, objects, actions, and orientations of action that define the design process.

Particularly relevant, with respect to the problem under investigation, is the issue of the preventive schematization of design action. Design and engineering practices are in fact grounded in a plurality of anticipatory devices - such as diagrams, models, procedures, methods, and guidelines - that contribute to orienting project development and to programming the possible trajectories of action.

From this perspective, these devices may be interpreted as specific forms of "programming discourses," according to the category proposed by Greimas and subsequently reworked by Basso Fossali (2020). By programmability is meant a discursive configuration that articulates a purpose of action (telos) and the technical organization of the means and the sequence of operations necessary to achieve it (tekne). Programming discourse does not merely prescribe a course of action; rather, it models action through an exemplification of order, a modal regulation of competences (who must, who knows, who can act), and a technical partitioning of operational phases.

Applied to the design context, this notion makes it possible to interpret methodologies and methods beyond merely regulatory instances that distribute roles, hierarchies, and criteria of legitimacy. In this sense, design is configured as a space traversed by multiple regimes of action programming, which may converge or simply compete, subject to an (implicit or explicit) agreement on methods and methodologies among the various members involved in the design process, agreement that may itself become a site of tension.

It follows that the design process can be described as a dynamic continually suspended between programming and accommodation, constitutive elements of the semiotics of practices that will be examined in greater depth in the following chapter. While, on the one hand, programming devices tend to stabilize action through a preventive modeling of its course, on the other hand the practical scene exposes such schematizations to the test of situated contingencies. Read through the lens of the semiotics of practices and of the model proposed by Jacques Fontanille, these devices function precisely as prescriptions of a certain way of doing, and the deviations, reformulations, and progressive adjustments that emerge over the course of the project do not represent anomalies with respect to an ideal plan, but rather constitute the local effects of the interference among different praxic logics.

The contribution of this research thus makes it possible to put these theoretical categories to the test through the analysis of a specific practical scene - the design review - in which the various constitutive elements emerge with particular clarity, revealing the processes of meaning production beyond the analysis of the individual components that compose it.

To this end, the conduct of a situated ethnography and semi-structured interviews will be essential. If the meaning of practice is constructed in its unfolding (Fontanille, 2010), a speculative analysis would not allow for the grasping of details and nuances that can be understood (or rediscovered) only through field observation, with all the attendant rules and ways of proceeding that such social research methods entail, being themselves practices. Ethnography has produced refined analyses of the most disparate contexts; however, it has historically encountered greater difficulty in approaching design and engineering practices. Unlike domains characterized by a relatively stable co-presence of actors and clearly delimited objects of observation, technical design is configured as a set of distributed practices, temporally extended and strongly mediated by artefacts.

The nature of design contexts (whether design, engineering, or hybrid) is opaque and markedly dislocated, as it is mediated by an innumerable and typified array of human and non-human actors, and characterized by boundaries that are not clearly defined (design, for example, does not begin and end in the studio or in the company; suffice it to consider how a designer may "take the project home," involuntarily mulling over ideas or possibilities). Since the 1990s, several ethnographies have highlighted the social, negotiated, and situated character of product development processes. Research has shown how engineering design, enveloped in an apparently inviolable shell of rigor and mathematical laws, is a negotiated social activity rather than a purely rational process, and how it emerges as a collective practice traversed by interpretative conflicts and ongoing negotiations (Bucciarelli, 1988). Other studies have emphasized how design is composed of micro-practices often invisible within canonical models of design practice, and have begun to shift the focus from the process to the set of objects that enable its development (Vinck, 2003). Others, in turn, have concentrated precisely on the ways in which such objects mediate the entire design process (Henderson, 1998).

These studies have made evident the methodological difficulty of ethnography in design contexts: what is to be observed? A meeting? A CAD file? A technical decision? A conflict of competences?

The field does not coincide with a single, unified place nor with a stable group; rather, it is distributed across different spaces, times, and material supports, and design presents itself as a network of partial situations.

Semiotics is particularly well suited to addressing this problem, insofar as it allows the field of analysis to be conceived not as a single place, object, or tool, but as a constellation of design practices. By assuming design not as a linear process but as a complex practice, ethnography becomes fundamental in rendering visible those minute operations (negotiations, translations, compromises, rewritings) that constitute the core of design work. In this sense, collaboration between design and engineering represents a particularly

significant case. Although both practices share the predicate of designing, they are grounded in different axiological orientations, methods, and evaluation criteria, which may generate misalignments in the course of action. Such misalignments should not be interpreted exclusively as interpersonal conflicts or organizational inefficiencies, but rather as local outcomes of a deeper dynamic linked to the interference between different praxic logics.

The present research therefore proposes to analyze these situations through the lens of the semiotics of practices, considering tensions not as anomalies to be eliminated, but as structural moments in the signification of the design process.

Although this is a study on a limited scale, its objective is twofold. On one hand, it explicitly situates itself within an attempt to relaunch the operativity of Jacques Fontanille's semiotics of practices through an empirical application in a contemporary socio-technical context; on the other, it aims to offer a more fine-grained description of the interactions between designers and engineers, thereby overcoming the stereotypical representation that opposes them as bearers of irreconcilable rationalities.

## 3. Design and engineering as complex practices

Despite several - if not a few - anticipations, it has proved difficult not to repeatedly use the term “practices” in relation to Design and Engineering, even though up to now we have tried to maintain a neutral position by referring to them as disciplines. This designation is not incorrect, given the intention to approach a semiotic background only after first having understood the research problem.

The term discipline, in fact, citing the dictionary definition (Treccani), has primarily two meanings: “Teaching, doctrine, or even the set of norms that regulate the life of a community, an institution, a body” and “Each of the branches into which knowledge, science, or a theoretical and practical activity is divided, as an object of study or teaching.” Both have been sufficient for us, so far, to address design and engineering and to understand how these are “subjects” that can be taught, that have a set of rules by which they can define themselves as such, and that seek to contain a portion of knowledge as classificatory domains. We have thus understood the discipline as an organised field of knowledge, characterised by its own language, a method of inquiry, and a shared body of knowledge.

When it becomes necessary to investigate the moments in which these two unfold, we notice that this definition begins to feel somewhat constraining. In order to analyse what we have so far called “tensions”, it would be sterile to seek them solely in the differences between design and engineering as such, especially since we have previously seen how many of these (and those we most readily perceive) are determined by the cultural system within which they exist.

The interest, therefore, is to observe them while they “do”, or rather, in the actions, actors, objects, programmes, modes, and situations in which the multi-level relation between them allows them to exist within the predicate that both share as their principal mode of intervention in the world: designing.

In this sense, the discipline is a historically stabilised institutional device, which defines a set of programmes, norms, and criteria for the legitimacy of doing. What interests us, however, is the way in which such programmes are actualised, adapted, or renegotiated in the concrete course of action, which is precisely what concerns the concept of semiotic practice.

In this chapter we will delve into the semiotics of practices and frame how design and engineering are complex practices, identifying them as design practices. We will then define the concept of tension as a structural category of meaning, clarifying how clash, friction, or disagreement are not synonymous with it, but represent only some of the possible effects generated by tension itself. Finally, through the analysis of Greimas’s lexemes, we will proceed to narrow the perimeter of investigation, moving from design and engineering to product design and mechanical engineering, in order to better identify internal practices and prepare the foundation for field research.

### 3.1 Introduction to semiotic practices

The common definition of practice is usually linked to an "activity through which something is concretely achieved" (Oxford Languages), which has a purpose referable to the attainment of an objective, and is set in opposition to the term "theory" precisely in order to highlight the material result deriving from the transformation that a specific practice enacts, whereas theory highlights a set of principles, norms, and rules on which a practice is founded. Cooking, eating, driving, and conversing are examples of everyday practices: all activities oriented towards a purpose, recognisable by a certain regularity of actions and by a relative stability of the contexts in which they unfold.
The focus of analysis, however, shifts when we speak of semiotic practice. From this perspective, we no longer refer to practices as actions aimed at obtaining something, placing the ultimate end as the key to interpretation. Rather, we are interested in them within the processes through which they produce meaning. Meaning is not given a priori, presupposed in the terms of the specific practice, but is produced by the way in which a practice is conducted, by the choices, adjustments, interactions, and contingencies that punctuate its unfolding, emerging in the doing of action.

Following the framework proposed by Jacques Fontanille, a semiotic practice can be defined as a delimited course of action, endowed with a beginning and an end, and articulated according to a certain way of proceeding. It has a plane of expression (that which makes meaning perceptible), constituted by gestures, tools, rhythms, postures, and operational sequences, and a plane of content (that which is signified), in which values, regimes of meaning, modes of doing, and criteria of success are articulated. He shows how practices cannot be reduced to simple behaviours or to the mechanical execution of predefined programmes. On the contrary, they are complex configurations, in which human actors, objects, regimes of value, temporalities, and modes of adaptation are intertwined.

To make a practice analysable, Fontanille introduces the concept of the practical scene, which represents the minimal unit of observation of semiotic practice. Practice unfolds within a scene, which is not to be understood as a generic "context" serving as its backdrop, but as a structured configuration that brings into relation a plurality of elements such as:

- an actor (or operator), understood as an embodied and situated subject;
- one or more objects involved, material or symbolic;
- a predicative core, that is, the central action that defines the practice;
- a mode of intervention, which specifies how the action is conducted;
- an environment within which one intervenes;
- a set of rules, expectations, and criteria of validity.

The predicative core provides the "theme of the practice itself" (Fontanille, 2010) and represents what different practices have in common: drawing, calculating, modelling,

verifying, discussing. However, the same predicate can be inflected in very different ways depending on the actor who assumes it, the tools employed, and the values that orient it.
In our case, drawing can mean exploring, visualising, testing hypotheses, communicating an idea. Likewise, it can take on the character of a rigorous technical representation aimed at dimensional verification or production. The predicate remains the same, but the mode of intervention changes, and with it, the meaning of the practice.
The practical scene is thus the place where the meaning of action is distributed among actors, objects, tools, and norms, rendering the practice observable as a situated semiotic phenomenon.

Following this framework, we can immediately frame design and engineering in terms of semiotic practices, albeit with the necessary qualifications. These in fact have actors who embody their praxis (designers and engineers), involve objects - whether tools (software, models, prototypes), concepts (constraints, proposals, concepts), or materials - and the intervention is delimited by specific spaces and times (studios, laboratories, companies). Each has its own expectations and criteria of validity (what defines a good project as opposed to a poorly realised one), and modes of intervention that characterise its action, each with specific regimes of attention that privilege certain ways over others, thus defining the identity of the practice. More specifically, we will refer to design and engineering as design practices, insofar as designing is the shared predicate that thematises them.
At this point, however, to say “doing design” and “doing engineering” suggests only a certain way of engaging with the project, greatly narrowing the operational field. Sketching, 3D modelling, discussing the selection of materials, approving concepts - these are all other practices and other practical scenes that typically take place within design and engineering. We will therefore also refer to them as complex practices, insofar as they incorporate and articulate within themselves a plurality of heterogeneous practices.
Finally, following this definitional line, we can also consider design and engineering as professional practices, as they imply responsibilities, role expectations, deontic codes, criteria of legitimation, and shared forms of evaluation. Their professionalism is manifested not only in the necessary technical competences (know-how, being able to), but in the way practices are conducted, justified, and made recognisable as appropriate within a given socio-cultural context that, consequently, institutionalises them.

Continuing with the theoretical framework, a central point in the semiotics of practices concerns the role of accommodations. Practices, in fact, never unfold under ideal or perfectly programmable conditions. They are constantly exposed to the interference of other practices, physical contingencies, constraints, and new conditions. Accommodations represent the modes of adaptation through which a practice reorganises itself in the course of its unfolding in order to respond to such contingencies. They show how action is never an application of a programme, but rather configures itself as a dynamic process of adjustment between what was foreseen and what actually happens.

This aspect will be applied and explored in depth in the analysis of design methodologies in the next chapter. Methods, indeed, often propose an ordered sequence of practices (from analysis to concept, from design to verification), but real design work always

exceeds these structures, generating deviations, returns, suspensions, and renegotiations that modify its trajectory.

This is all as far as practices are concerned, but there is more. In Fontanille's theoretical framework, practices are situated within a hierarchy of levels of pertinence of meaning, that is, "levels of analysis" within which one chooses to look at a phenomenon. Alongside the levels of signs, texts, and objects, we find:

- practices as situated courses of action;
- strategies as modes of coordination and management of multiple practices;
- forms of life as cultural stabilisations of values, styles, and sensibilities.

Strategies operate at a higher level than practices, describing how multiple practices are organised, hierarchised, and oriented with respect to one another. Planning, optimising, deciding priorities are all operations of a strategic nature. "Strategies organise complex processes … that control, regulate, order, or optimise the practices themselves." (Fontanille, 2010, p. 24). When these strategies are reiterated over time and privileged over others, they contribute to generating forms of life: relatively stable configurations that define "how things are done" in a broad sense, which values are considered legitimate, and which style of action is recognised as appropriate.

From this perspective, the notion of discipline, previously introduced in relation to programmes, norms, and criteria for the legitimacy of doing, can be situated predominantly at the levels of strategies and forms of life. Discipline, in fact, defines a relatively stable horizon of action programmes, regimes of attention, and shared values, within which practices are recognised as appropriate or legitimate. Practices therefore unfold within a disciplinary framework, while nevertheless being able to deviate, adapt, reorganise, and produce meaning even beyond what is prescribed. In this sense, practice is internal to a discipline, but discipline does not exhaust practice.

| TIPO D'ESPERIENZA | ISTANZE FORMALI | INTERFACCE |
|---|---|---|
| **Figuratività** | **Segni** | |
| | | Formanti ricorrenti |
| **Coerenza e coesione interpretative** | **Testi enunciati** | Isotopie figurative dell'espressione |
| | | Dispositivi d'enunciazione/iscrizione |
| **Corporeità** | **Oggetti** | Supporto formale d'iscrizione |
| | | Morfologia prassica |
| **Pratiche** | **Scene pratiche** | Scena predicativa |
| | | Processo d'accomodamento |
| **Congiuntura** | **Strategie** | Gestione strategica delle pratiche |
| | | Iconizzazione dei comportamenti strategici |
| **Ethos e comportamento** | **Forme di vita** | Stili strategici |
| | | |

Figure 4: *Hierarchy of planes of immanence (Fontanille, 2010)*

This theoretical framework will constitute the basis of the entire research. It will allow us to orient observation by providing descriptive tools useful for looking at design and engineering outside of a narrative circumscribed to the object of design.

In order to better digest all the concepts presented so far outside a frame made up of designers, projects, design processes, and designing, I propose an example related to a civic recurrence that is equally complex: grocery shopping.

"Grocery shopping" is a practice insofar as it has a purpose (purchasing goods), involves an operator (the person who shops), takes place in a specific environment (the supermarket), and follows a sequence of actions (enter → search → choose → purchase → pay → exit). At the same time, it is a complex practice because it contains many sub-practices and micro-actions, such as reaching the store, walking the aisles, selecting products, carrying them, putting them away, paying, etc.

However, the practical scene of "doing the grocery shopping" rarely unfolds in a linear way. Although these individual practices and the way they are schematised represent an ideal sequence, it is not exempt from all those unexpected situations that can arise and with which each individual practice must contend. Finding a product on sale (which potentiates a choice between it and the product already chosen), a shopping trolley that squeaks (and perhaps forces me to change it), meeting an acquaintance (and greeting them, or pretending not to have seen them)… accommodations make a practice alive, situated, and non-linear.

At a strategic level, grocery shopping can be oriented by logics such as “saving time”, “optimising the budget”, “privileging quality”, or “reducing environmental impact”. When such strategies are reiterated and somehow privileged, they stabilise, giving rise to a general style of how we conduct ourselves and to a set of values that orient choices and preferences, described at the level of pertinence of forms of life. And this is how we obtain “the cheapskate”, oriented towards a way of saving at the expense of certain values (such as care of the self or of others), “the ecologist”, who privileges products that have a lower impact than others (respect for nature), “the gym rat”, who selects products as a function of their protein intake, and so on. Conversely, from the level of practices downwards, we integrate objects (trolleys, consumer goods, coins), text-utterances (directions, labels, warnings), and signs.

This kind of articulation between practices, strategies, and forms of life finds confirmation also in now-classic semiotic analyses, such as those by Jean-Marie Floch on the spaces of the Paris métro (Floch, 1990), and the case study on posting proposed by Fontanille himself (Fontanille, 2010), in which an apparently simple practice reveals a complex stratification of scenes, strategies, and values.

In light of what has been set out, design and engineering can be rethought as complex professional practices, equipped with different tools, norms, values, and ethos. Within the overall practice of designing, they represent two operational modes that coexist and intertwine. If designing is the common predicative core shared by both, the design process acts as a strategic instance that coordinates these practices.

Considering design and engineering as practices makes it possible to shift the analysis from the final artefact to the way it is constructed. Many micro-practices share the same predicative core (drawing, modelling, verifying) but are carried out differently depending on the actor who assumes them and on the regime of values that orients them. In this sense, practice is not exhausted by its purpose. Analysing design and engineering as design practices means questioning not so much what they produce (starting, therefore, from the analysis of the artefact produced), but rather how they produce, and how their operational modes enter into relation, overlap, and come into tension over the course of the project.

### 3.2 Defining the concept of tension

If practices are courses of action defined by the relation among multiple elements within a scene, and thus not merely goal-oriented actions, we must treat tensions in the same way—and even more so tensions between practices.

Up to now we have considered the term “tension” in its pathemic and causal sense, as if it were a state arising from potential incompatibilities between things that happen, or that could happen. The project being bounced back by the engineer because it is too expensive to realise, leading them to request or propose modifications; a disagreement between two designers over the thematic rendering of the concept, which flows into a lively discussion; excessive attention devoted to modelling one component, which forces a reconsideration of the time allocated to modelling other components in order to meet the deadline. One can see

how, in these possible scenes, tension is inferable as a background sensation arising from the emergence of one or more unforeseen or unwanted situations. In the examples we find the simultaneous presence of multiple practical scenes that regulate themselves, flowing into other scenes and other practices. From this perspective, one might also think that clashes, misunderstandings, frictions, disappointments, discussions, and cross-references are analogous by-products of the co-presence of multiple practices, managed in a certain way. This approach, however, given the internal complexity of the relations among the elements involved in the scene and of the regulations among multiple practices, carries reductive risks.

First, considering tension as synonymous with conflict, friction, disagreement et al. imposes a purely negative sense, already inscribing it within a system of categories (right vs. wrong, preferable vs. unpleasant) deriving from the unfolding of the course of action, as a function of what is expected or of how things ought to go. Second, if we were to observe tension exclusively as a product or effect, then we would look at it in terms of its resolution. What interests us is to single out tensions as signifiers within the design process, in order to understand their dynamics of development and the ways in which they influence designing.
To anchor this perspective within a semiotic framework capable of describing meaning in the making, we adopt Fontanille's model of the "gap of meaning" and the consequent sequence of resolution. In this framework, a concrete practice never begins as an action already fully formed and fully meaningful: the beginning (and, more generally, any contingent reactivation of the course of action) entails a lack linked to the fact that the action has "just begun" and neither its definitive form nor its definitive meaning are yet known. Such a lack always emerges within a "situation-occurrence", that is, a space-time in which the practice confronts specific circumstances, other actors, other concomitant or competing practices, and material or organisational resistances. The encounter with this otherness makes a progressive construction of meaning necessary.
Fontanille describes this process as a recursive sequence articulated in four moments:

Gap of meaning → Schematisation → Regulation → Accommodation.

The gap is the phase in which the situation actualises itself as problematic (resistance/non-resistance, strangeness/familiarity, congruence/incongruence); schematisation is the search for an organising scheme that renders the situation legible and orients action; regulation is the interactive projection of such a scheme onto the occurrence; accommodation is, finally, the strategic giving-form to the course of action, that is, the production of a provisional coherence between the practice underway and the practices/conditions with which it enters into relation. In this perspective, the construction of meaning coincides with the way in which action organises itself and finds a practicable form.

Let us return to design and engineering, and take as an example the scene in which a project must be reconsidered for specific reasons. A designer, having reached a certain point in the modelling of a component, submits the model for review by an engineer. The latter,

examining the project, determines its infeasibility in relation to certain economic and production constraints, and consequently requests or proposes some modifications.
This portion of the design process can be described as a succession of practical scenes that follow one another within this segment of the macro-design scene: the modelling of the component, the interruption of work and the sending of the model, the review by the engineer, the assessment of constraints and the identification of critical issues, and finally the discussion between the two actors in view of possible modifications. Some of these scenes, and in particular the identification of critical issues, emerge as unforeseen effects of the design process and require the integration of new accommodations in order to be able to continue the course of action.

Such accommodations can be managed according to design strategies established upstream, for example by deciding to privilege certain aspects of the model over others, or they can be regulated by contingent logics such as scarcity of time or resources.
Up to this point everything seems to proceed as planned. The sequence "modelling → sending → review" falls within a relatively orderly unfolding of the process. The review, however, introduces a significant discontinuity. The CAD model, which up to that moment existed as a stabilised form of the project, is put into relation with a set of constraints that call its validity into question. Incongruences thus emerge between what the model presents in its current state (and which exists as an actualisation of the designer's design intentions) and what, on the basis of the criteria considered by the engineer, ought to be the case for the project to be feasible.
At this juncture the course of action is suspended before the opening of all those potential scenarios that present themselves when the actualisation of design intentions does not coincide with the potentiality of established constraints, anticipating a real that "would not work". A plurality of possible practical scenes then opens up - rejecting the model, requesting modifications, reformulating the project, negotiating solutions - which compete with one another to orient the continuation of the process.
The distinction is thus clarified between competing practices, which exist as alternative possibilities in competition for actualisation, and concomitant practices, which are instead simultaneously actualised and interfere within the same temporal span of the practical scene (Fontanille, 2010).

In this case, the engineer chooses to initiate a discussion with the designer, reopening the project to further possibilities for reorientation. In this momentary suspension, a resolution process has occurred insofar as a strategic principle has organised the sequence of practices that, at that moment, although not actualised, were in competition (rejecting the model, requesting modifications, speaking with the designer, etc.). In this subsequent phase of dialogue, different praxic logics come into play, which can converge or diverge in the selection of this or that modification to be made to the project.
We note how, not only in the scene of discussion but throughout the whole sequence of scenes considered, different praxic logics coexist within the same course of action: that of the designer and that of the engineer. A praxic logic describes the internal functioning of a practice, and thus the way in which it is conducted.

However, we must distinguish the actor who mediates those practices from the role they assume. In that moment, someone "acts" as a designer and someone "acts" as an engineer.

For example, up to now we have assumed that the way in which the engineer reviews the model has been carried out appropriately, something that is not taken for granted, since by praxic logic we do not mean the professional role. Possibly, for external reasons, a review conducted inattentively or hastily will limit the potential modifications and will alter the competing scenarios.

It is also important to emphasise that the interference between praxic logics does not necessarily require a plurality of actors. Even in the case in which a single designer, in the course of designing, autonomously detects that the model does not comply with certain constraints, tension can emerge from the interaction between a logic of formal configuration and a logic of feasibility verification, both internal to the same practice.

In both cases, the design object, until then stabilised as actual, is made to exist simultaneously according to different and partially incompatible modes: both as a coherent form to be preserved and as a configuration that is unfeasible with respect to certain constraints. The situation described cannot therefore be reduced to a simple disagreement between professionals or to organisational friction, but rather manifests a state of instability of the course of action produced by the interference between different praxic logics which, operating on the same design object, activate modes of existence of meaning that are not fully aligned. It is in this gap, and in the need to integrate it through new accommodations, that what is here defined as tension takes shape.

Conflicts, frictions, and disagreements are thus effects of tensions between practices, which we now understand as a structural category of meaning, given in this case by the interference between multiple praxic logics.

Conflict is a polemical and oppositional category that presupposes antagonistic subjects, incompatible action programmes, and a logic of resolution (which may culminate in victory or defeat, domination or compromise, abandonment, and so on). Tension does not oppose subjects but logics, which do not necessarily have to be incompatible, but may also only partially interfere. Moreover, rather than speaking of the resolution of tensions, it would be more appropriate to speak of regulation, since the different logics are not eliminated but integrated within a new operational arrangement.

Friction is an evaluative category linked to performance, often used metaphorically to indicate slowdown or inefficiency, understood as something to be limited or optimised when the scene is that of design. Tension, by contrast, is not a defect, but a condition of recurring instability for the production of meaning.

Finally, disagreements - especially disciplinary ones - are an epistemological category and presuppose historically determined differences in language, methods, and professional cultures. Tensions emerge from practices and do not depend exclusively on disciplinary identities, insofar as we have previously seen how praxic logic does not necessarily coincide with the professional role.

That said, we define tension as a structural category of meaning that designates the unstable state of a course of action produced by the interference between different praxic

logics engaged in the management of contingencies. It emerges between internal practices that share or contend for the same course of action, and, by operating on the same design object, they activate multiple modes of existence of meaning (virtualised as the set of anticipated design possibilities; potentialised as the set of constraints and conditions of feasibility; actualised as a temporarily stabilised configuration of the project; realised as the concretisation of that configuration) which compete to reorient it, temporarily suspending the course of action and prompting its reorganisation.
Tension does not interrupt practice, but constitutes a dynamic principle of transformation, thus impacting design decisions and the material outcome of the artefact.
What we here call the tensional dynamic can be understood as the reactivation (more or less intense and more or less visible) of the Fontanillian sequence every time the course of action is suspended, diverted, or reoriented by the management of contingencies. The point is to present this sequence of resolution as a "tensional" dynamic: something, by its very nature, in continuous movement, which occurs recursively whenever practice unfolds and inevitably encounters other practices, producing different effects. The tensional dynamic is therefore definable here as the very form through which practice confronts its own openness and its encounter with otherness.

This new point of view detaches tension from being synonymous with the effects it produces, and now allows us to consider also the "positive" ones. Confirmations, approvals, but also the simple continuation "according to plan", are now understandable as outcomes deriving from the interference between aligned or partially aligned praxic logics, which determines one or more modes of existence of the same design object.
Within this general framework, the notion of interference between praxic logics does not claim to replace the "gap of meaning", but rather represents a condition of emergence that recurs in the observed design domain. In many scenes of shared design, the gap presents itself primarily as an instability generated by the alignment or misalignment between logics (in this case, praxic ones, since that of practices is the level of pertinence within which we are observing the phenomenon) that insist on the same course of action, and often on the same design object as well. When different logics activate different criteria of pertinence, the practice does not come to a halt, but must produce new schematisations and new regulations, until a temporary accommodation is achieved.

So far, some manifestations of tensions have been identified predominantly at the discursive level, through position-takings, assessments, requests for modification, or reformulations of the project. However, even before their theoretical explication, such situations are often accompanied by a marked pathemic imprint, perceptible in the waiting, hesitations, and affective reactions that traverse the design scenes. From this perspective, passions can be understood as one of the most evident ways through which tensions manifest and become observable on the affective plane.
Following Fontanille, pathemisation is not to be understood as an element external or secondary with respect to action, but as a semiotic effect that emerges when the course of action is subjected to instability, suspensions, or reorientations. Pathemisation constitutes a mode of investment in the process that accompanies the interference between practices and the management of accommodations (Fontanille, 1996). Reference to the canonical passional

trajectory can be useful as a schema of intelligibility for affective dynamics. However, analogously to what happens with the narrative trajectory in relation to practices, this is not sufficient to account for the complexity of passions, which in design practices do not necessarily arrange themselves according to a linear and stabilised sequence, but emerge and overlap as a function of tensions between practices and of the ways in which accommodations are managed.

If action is not only a path towards a goal, then passions are not mere epiphenomena either, but participate in the regulation of practice, influencing the way practical scenes articulate with one another. Relatively aligned affective regimes (such as trust or security) can, for example, favour a smooth continuation of the project, whereas states of uncertainty, frustration, or fear can slow down, divert, or reorient the course of action. At the same time, a persistent and unproblematised trust can lead to a less careful management of contingencies, producing undesirable effects on the project itself.

Let us return to the example of the review of the CAD model. The moment in which the project is subjected to the engineer's gaze constitutes a pathemically dense threshold. The waiting for evaluation, the hope of confirmation, or the fear of rejection accompany the suspension of the course of action. The identification of critical issues can generate frustration or astonishment, whereas the negotiation of possible modifications can reactivate forms of trust or, on the contrary, discouragement. Such affective configurations do not merely reflect the state of the project, but contribute to orienting its continuation, impacting design choices and the ways in which accommodations are integrated.
It is therefore possible to distinguish different levels for observing tensional dynamics:

- a praxic level, in which it configures itself as interference between praxic logics and as misalignment between the modes of existence of meaning;
- a discursive level, in which it translates into position-takings, judgements, and requests for modification;
- an affective level, in which it is pathemised through states such as hope and fear, satisfaction and dissatisfaction, certainty and uncertainty, and so on.

In this sense, passions constitute a structuring dimension of the meaning of practice, capable of impacting the organisation of the course of action and the very outcome of the project.

### 3.3 Lexeme analysis

Up to now, we have referred to design and engineering as the primary objects of this research. These two terms, however, function in common and disciplinary discourse as "umbrella terms" designating heterogeneous sets of practices, sharing designing as a common mode of intervention and distinguishing themselves by objects, purposes, tools, and operational logics.
Design and engineering should not be understood as monolithic practices, but rather as families of complex design practices, internally articulated across a multiplicity of branches:

product design, interior design, communication design, service design, but also mechanical, electronic, energy, management engineering, and so on. Such articulations do not directly define practices, but constitute classificatory stabilisations that emerge historically from the repetition of certain operational configurations, of specific tools, and of recurring aims. Branches often share similar operational predicates (drawing, modelling, simulating, prototyping, revising) and distinguish themselves by the way these predicates are integrated within the practical scene, by the aims of the project (living spaces, technical systems, communication media, consumer goods…), by the priorities that orient action, and by the regimes of pertinence that structure design attention.

The branch can thus be understood as a horizon of interest, that is, as a relatively stabilised set of privileged objects, legitimate tools, evaluation criteria, and shared aims. This horizon is constituted a posteriori as a result of the sedimentation of the practices themselves, without preceding design action as its cause, configuring itself as a classificatory reference, as in the case of disciplines. Indeed, recurrent modes of doing produce over time recognisable forms of specialisation, subsequently designated through disciplinary categories. During design work, practitioners will primarily deal with a certain type of object for certain uses or applications (in product design, for example, the designer will tend to design industrially produced objects, just as the mechanical engineer will primarily deal with the components of that object) that fall within the branch to which they belong. Yet, over the course of the project, it may happen that practitioners also have to engage with horizons of interest that are adjacent but not entirely proper to their specialisation (for example, when designing a product one may find oneself considering interfaces, or reasoning about possible electronic components).

The dependence on the materiality of the objects with which a practice engages, or that it proposes to transform, is undeniable, understood as the set of characteristics and conditions that determine and define the material existence of the object. In the case of product design, linked to industrial production and seriality, it is impossible to disregard the physical properties of the object to be designed, such as weight, volume, resistance, feasibility, and manufacturability. Such properties do not necessarily constitute the primary object of design reflection, but represent conditions of possibility for the action itself.
This dependence on materiality, however, is not exclusive to design or engineering, insofar as it characterises every practice that operates on artefacts or transformations of the physical world. In the same way, for example, a sculptor cannot ignore the consistency of the clay they model or the type of chisel they use, just as a painter must reckon with the quantity of paint a brush is able to hold. Such characteristics are not always the object of a thematised attention, and are taken into account with a certain weight.

In this sense, it is possible to speak of differentiated domains of attention. Materiality orients selections, priorities, the practices involved, and the strategies adopted, to the point of coming to influence forms of life. As Bucciarelli observes, “the object itself strongly influences how participants relate” (Bucciarelli, 1988, p. 161), indicating how the object of design influences both the organisation of design work and the relationships among participants, to the point of impacting the professional forms of life that stabilise over time. The repetition of certain operational strategies, in fact, contributes to defining not only the

project, but also the practitioner him- or herself and the way in which they are socially perceived.
Particularly relevant for the purposes of the present research is the case in which the matter of the project is shared, as occurs in product design conducted jointly by designers and engineers. In such situations, the same object becomes the site of coexistence of multiple regimes of pertinence, where formal, use, and interaction aspects coexist with structural, production, and performance requirements. These dimensions do not constitute separate planes of the object, but emerge as a function of the selections made by practice. The designer, in fact, cannot ignore the physical conditions of the object, just as the engineer cannot disregard the social and use-related effects of the product. What varies is the priority attributed to these aspects, and the way in which they are integrated over the course of design practice.

In light of these considerations, it becomes necessary to narrow the field of investigation, moving from the general terms design and engineering to specific branches that allow for greater precision in defining internal practices. From now on, we will therefore refer to product design and mechanical engineering (or mechanical product engineering), domains in which the matter of the project is shared, and we will observe their direct collaboration within the same design scene.
In order to make this selection, we resort to lexeme analysis according to the Greimasian model, articulated in configural, taxic, and functional components. Following the definition proposed by Greimas and taken up by Mangano (Mangano, 2008), this analysis allows us to describe:

- the configural component, relating to the elements that make an object or a practice recognisable;
- the taxic component, which defines its differential status with respect to other related sets;
- the functional component, which concerns the uses, values, and purposes to which the object or practice is associated.

Lexeme analysis is not employed here to define, in an essentialist manner, two disciplinary identities, but to make visible the framework of semantic expectations within which such practices are recognised, interpreted, and evaluated.

Product design is a design practice oriented toward the configuration of artefacts intended for industrial production. The object is conceived as an integrated unity of form, function, and experience. From a taxonomic point of view, product design is situated within industrial design practices, in proximity to fields such as architecture, interior design, and interaction design. It distinguishes itself from other branches of design by its direct relation to materiality and serial production, and from engineering by the priority attributed to the use-related, formal, and relational aspects of the object. On the functional plane, the lexeme product design activates predicates such as configuring use, designing experience, and

mediating between social needs and technical constraints. Processes are predominantly iterative and negotiative, and the designed object assumes the role of a mediating device among actors, practices, and contexts.

Mechanical engineering, or product engineering, configures itself as a design practice oriented towards the conception and realisation of technical systems composed of functional elements subject to physical laws, safety constraints, and criteria of reliability. On the taxonomic plane, it belongs to the set of applied sciences and is situated in relation to other engineering branches. In relation to product design, it shares the same matter of the project, but distinguishes itself by the regime of pertinence that privileges control, quantitative validation, and the technical stabilisation of solutions. Functionally, the lexeme mechanical engineering activates predicates such as dimensioning, calculating, simulating, verifying, and optimising. Design action is oriented towards predicting the behaviour of the object and reducing uncertainty, and the artefact functions primarily as a support for verification and technical coordination.

Lexeme analysis shows how product design and mechanical engineering share the same matter of the project, organising it according to different forms of content. In the former case, the object tends to be interpreted as a mediator of experiences and values, whereas in the latter as a technical system to be stabilised and made reliable. Such differences do not produce separate practices nor rigidly determined roles, but contribute to stabilising distinct regimes of attention that coexist and intertwine over the course of designing. One thus expects that a product designer will, within certain limits, attend to what concerns the design of artefacts in view of serial production, whereas one expects that a mechanical engineer - assuming they are operating within the same project - will attend to making that artefact physically stable.

Considered instead in terms of design practices - as discussed for the more general “design and engineering” - the practices of product design and mechanical engineering do much more within the design process, and the variables that influence the specific role that the individual practitioner will take on depend precisely on the elements that define the practical scene of designing. Moreover, insofar as they are complex practices, one must consider how internal practices integrate contingencies and relate to other practices. We nonetheless know that, broadly speaking, a designer will deal with certain things in a certain way as compared to an engineer, without the classification into branches categorically excluding certain practices in relation to others, and irrespective of the modalities that render the operator able to carry out those actions (such as, for example, the reasons that drive them to design and the competences necessary to do so).

## 4. Design Processes and Methodologies

In order to observe tensional dynamics, we certainly need to look at the moment in which professional figures interact. If the shared predicate is designing, we must look at the moment of the act of design, which establishes itself and is schematised within a shared framework that both parties, broadly speaking, follow or agree to follow. In order to speak about the effects of tension and the ways in which they influence the project, we must first identify the moment in which these occur.

Design and engineering, as disciplines, produce and adopt schemes that operationalise the process and indicate an order of practices to be followed. It is enough to think, for example, of all those diagrams and graphs that set out to structure a path oriented towards specific objectives or ways of operating, by relating a series of practices or macro-practices (for instance, research, ideation, prototyping, verification). However, these representations rarely describe what actually happens during design work.

Fontanille (2010) emphasizes that the unfolding of a practice cannot be reduced to a linear progression, since it is a "continuous negotiation" with constraints, resistances, counter-practices, opportunities, and accidents, and also includes schematisations emerging from use. Furthermore, even when a course of action is strongly programmed, it does not eliminate the adaptive dimension: no procedure, "even if perfectly programmed", can escape some form of accommodation.

In this chapter, we will treat canonical methodologies and processes as inscribed programmatic strategies (and often iconised in diagrams), that is, as devices that organise and hierarchise practices by indicating a "privileged way of doing".

Subsequently, a series of recurring methodologies and models in both design and engineering will be presented, first observed in the way they are proposed and then in the way they propose to orient design doing. Finally, still following Fontanille, we will note how such programmings do not exhaust the meaning of designing, which instead emerges from accommodations and interferences between practices in the course of action.

### 4.1 Taxonomy and Translations

First, we need to bring some order to the various terminologies used so far. Methodology, methods, processes, schemes, and diagrams are all elements that differ from one another and have a specific sphere of pertinence, which is why it is urgent to set out a brief taxonomy in order to avoid overlap.

Starting with methodology, we commonly understand it as the study of methods, a sort of broad operational framework that organises a piece of research or a complex work by indicating its roles, phases, and criteria of success. It is the theoretical and logical analysis that justifies the choice of one method over another and defines how a study or an activity is conducted in order to reach specific objectives.

By method, instead, one means a specific procedure or technique for achieving a given objective (for example interviews, workshops, tests, CAD modelling, and so on), and it is

defined as “the procedure followed in pursuing a purpose, in carrying out any activity, according to a pre-established order and plan in view of the end one intends to achieve” (Treccani).
Schemes, models, and diagrams - usually used as synonyms - are representations, often visual, of what is envisaged as needing to be followed in order to reach that given objective, thus showing a path or an indicative order of unfolding. When they refer to methods, these representations illustrate a series of actions (for instance, if the method is to conduct interviews, the necessary steps will be illustrated); when they refer to methodologies, they illustrate a series of more general phases (for example, research, ideation, prototyping, verification).
What we commonly call an “approach” is positioned at a higher level of abstraction, and can be assimilated to a set of guiding principles and values on which a methodology takes hold for the organisation of a work, thus composing an operational framework.

Each term has a specific valence and describes a more or less precise portion of what happens, always remaining within a broad theoretical-organisational discourse that up to now has not made use of any applied example except for the discussion of the terms themselves. We must now, however, observe these terms within a semiotic discourse, since this is the lens we are using to describe what we have identified as tensional dynamics in design and engineering practices. Although we are speaking of an orientation of doing, not everything falls within strategy. Each term can in fact be traced back to one or more levels of pertinence, according to the hierarchy previously described (§ 3.1). As said earlier, the levels of pertinence are not rigid categories that include or exclude elements, but “levels of analysis” within which one chooses to look at a phenomenon. The same object can be observed as a strategic principle, as a circulating text, or as a set of concrete practices. Fontanille warns that there is no need to make the terms of natural language coincide with the distribution of levels, because what matters here is not a lexical taxonomy but a framework of pertinences constructed for analysis.

Starting, then, from methodology, when it orders practices, phases, priorities, and criteria, it functions as a strategic principle of composition between practices, guiding both the programming of paths and intersections and adjustment in real time. Fontanille in fact defines a strategy as “the principle of syntagmatic composition between practices”, which arises from the need for each practical scene to accommodate itself with respect to other concomitant or competing practices, and is linked to conjuncture, succession, overlap, and competition between practices (Fontanille, 2010).
At the same time, a methodology also exists as an object that circulates (manual, standard, slide, framework, document). Fontanille recalls that a practice can be integrated into a text (and vice versa) and that each plane can “take charge” of the others. In this case, the level of analysis shifts towards that of the text-objects that inscribe a strategy.

Methods, understood as a sequence of phases/operations, fall within the level of practices as the discursive programming of scenes. We have previously seen how the method presupposes a certain systematicity of the actions to be carried out, thus also implying a programmed doing. Among the constitutive dimensions of practices, a discursive programming can be oral, written, or iconic (“instructions for use, procedures, precautions,

tasks…"), but we will see how this programming does not completely exhaust the action, insofar as it must adapt to contingencies and interferences with other practices, and no procedure is entirely exempt from accommodation.
We recognise a method as a practice insofar as it meets all the conditions required in order for it to be defined as such (having an operator, an object involved, a predicate, and so on), but its "normed" and procedural nature calls for some specifications. A method is here understood as a practice if:

- the objective it pursues is relatively autonomous;
- the actant (operator) is recognisable;
- it makes use of stabilised tools or supports;
- it has a specific duration and an assessable success;
- it has typical contingencies.

In this chapter, methods will be treated as "variable-grained" practices: for example, within a possible research phase, the semi-structured interview constitutes a method insofar as it is a codified practice, but at the same time it can be broken down into multiple scenes (selecting interviewees, asking questions, noting responses, and so on) depending on the scale of analysis adopted. All those listed so far are practices (researching, interviewing, noting…), which can be seen as local scenes on the basis of their subordination.
We nonetheless take this classification as valid only for the purposes of describing the various practices presented in the subsequent examples, insofar as reality involves nuances and gradients that such a classification would not be able to grasp.

Regarding schemes and diagrams, we must draw a distinction. The schema is the form (the syntagmatic configuration) of the course of action, which can be prescribed or else reconstructed as emerging from action. The diagram, instead, is a textual/objectual support (a form of inscription, often iconic) that materialises a schema. A schema is prescriptive when it proposes an order and a concatenation to be followed (the programming side), whereas it is emergent when it is recognised a posteriori from action, as the outcome of the interpretive control of accommodation. Fontanille explicitly states that the metasemiotic activity linked to accommodation produces a pertinent form that he calls "schema", and that these schemas are "signifying forms of the syntagmatic unfolding of the practice" (Fontanille, 2010, p. 91).
In relation to methodologies, if these have so far been understood as strategic schemas (that is, as the giving-form to principles of composition between practices), the schema is the syntagmatic configuration that results when such principles are applied and stabilised in the course of action. Methodology does not simply coincide with the principle, but proposes a communicable and reiterable schematisation of it. The schema is the form that such schematisation prescribes or that, a posteriori, is recognised as the effective holding of the path.

Methodological diagrams are object-texts that iconise and render communicable a prescriptive schema of a strategic nature (a pre-schematisation). Design practice, however, also produces emergent schemas through accommodation, which diagrams tend to neutralise or reduce. If the diagram says "how to proceed", then it materialises a prescriptive schema; if,

on the other hand, it represents “how it went” or “how it usually goes”, it gives form to a schema reconstructed a posteriori by action (taking accommodations into account, as in the case of the “as-is process map”).
We have seen above how methodologies fall within the level of strategies as they are devices for organising the composition between practices, and how they can also be considered object-texts (manuals, frameworks, slides) that circulate, stabilising and rendering such schematisations communicable. The diagram is, in this sense, an integration at the level of object-texts of methodologies understood as strategic schemas. The schema is the configuration of the course of action according to those principles, which the diagram makes visible through an iconic inscription.
Approaches, finally (e.g., empathy, iterativeness, lean, inclusion, circularity), can be treated as axiological orientations that guide which choices are deemed legitimate or preferable. In Fontanille’s model, the substantive face of strategies can be formalised and generalised into stylistic classes and axiological dispositions that refer to forms of life.

Having shed light on the semiotic translations of the various terms used, we will now present examples concerning the most common methodologies, methods, and consequent representations that permeate the fields of design and engineering and operationalise a certain structure of design doing—one that circulates, is handed down, and often becomes scholasticised. The focus is not to provide a survey of design methodologies, but to analyse the way in which they signify within designing and to highlight possible imprints that contribute to exacerbating the frequency of “conflictual” effects of tensional dynamics (clashes, incongruences, frictions, and so on), by applying the analytical grid developed thus far. For convenience, we will use “strategic devices” to indicate those methodologies, approaches, and related inscriptions (diagrams, graphics, illustrations, maps) that inscribe a strategic principle of coordination between practices in a prescriptive, communicable, and reiterable form.

### 4.2 Strategic Devices of Design

Design literature is dense with texts, counter-texts, and meta-texts that describe approaches, methods, methodologies, and project “frameworks”, often with the (more or less explicit) intent of formalizing a correct way of proceeding or of making practical knowledge teachable (…; cf. Cross, 2008; Schön, 1983). Thus, there is no lack either of a historical genealogy of methodological formalization or of a critical discussion of how designers design and how such processes are rendered sayable and transmissible. It is nonetheless important to reiterate that the aim here is neither to offer a comparative examination of design methodologies nor to enter into the question of their status or effectiveness.
The task at hand here is rather to observe these models as semiotic objects, that is, as devices that, through their circulation, aim to guide practices and pre-order the course of action within which design practices (here design, later engineering) take shape.

The strategic devices of design become observable as attempts to give form (and often to iconize) the syntagmatic composition between practices, reducing the complexity of the course of action to topological and aspectual-temporal relations (phases, cycles, iterations,

divergences and convergences), and rendering this reduction shareable, teachable, and evaluable. It is therefore not a matter of asking whether such devices "correctly" describe what happens, but of understanding what they do when adopted and in what way they articulate the broader design practice. We will observe which practices they render central, which marginal, which passages they transform into obligatory ones, and above all which typical accommodations they tend to neutralize or leave in the background.
These devices, in particular, are characterized as they:

- stabilize an axiological orientation (what is desirable and legitimate to privilege);
- propose a strategic scheme for organizing practices;
- select and order (granular) methods within phases;
- iconize such order in diagrams and models.

The corpus we will draw upon will be deliberately limited and recurrent in product design. We will consider certain approaches (human-centered, inclusive, sustainable/circular), certain methodologies and process models (design thinking, the double diamond, and variants of the HCD cycle), and a couple of methods/techniques (personas, journey mapping, prototyping, and testing) understood as codified practices.
The selection serves to show, by way of cases, how these objects can be read along the translation grid previously introduced. The same methodological artefact can in fact be observed as an axiological orientation (approach), as a strategic principle and coordination scheme (methodology/model), as a set of normed practices (methods), and as a text-object (diagram/form of inscription) that renders the pre-schematization of action communicable and reiterable.
Consequently, for each device we will consider:

- Approach as axiological orientation (what is placed at the centre and what is rendered preferable/legitimate);
- Methodology as strategic scheme (which syntagmatics of practices is proposed, and with which topological and temporal relations);
- Internal methods as practices (which practices are invoked as typical and reiterable "passages");
- Diagrams as inscriptions (how the scheme is iconized and made to circulate);
- Neutralized zones (which typical accommodations and interferences are left out or treated as noise).

### 4.2.1 Axiological orientations: human-centeredness, inclusion, sustainability

A first set of devices operates primarily as an axiological orientation which, at this level, does not necessarily prescribe a detailed sequence of phases but establishes a system that legitimizes certain choices and renders others debatable. This is the case, for example, with human-centered design (ISO, 2019), inclusive design, and the derivations in sustainable and circular design.

In the case of human-centered design, the value orientation is already explicit in the very formulations: the user (or the user experience) is positioned as the regulating center of choices. This orientation can be translated axiologically through diagrams that display the centrality (for example, through set-based or layered configurations) of the user as the pole that redistributes priorities among domains (people, technology, business, etc.) (Fig. 5). In this translation, the device, rather than describing (and prescribing) a process, establishes which dimensions must be kept in balance and therefore which compromises are to be considered acceptable.

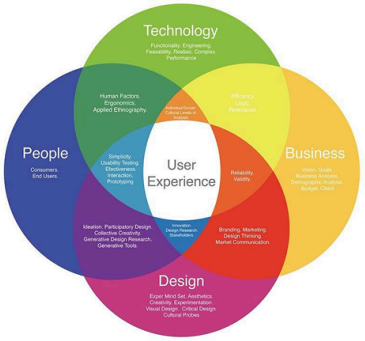
In contemporary discourse, HCD is a broad and non-univocal label. Recurringly, it implies at least research conducted with real people who are likely to use the product, and the use of such research to guide the design solution (Rampino, 2022). These two recurrences do not yet constitute a methodology in the strict sense (they do not specify phases or sequences), but they establish a criterion of value. The legitimacy of design choices derives from their anchoring to concrete and situated subjects.

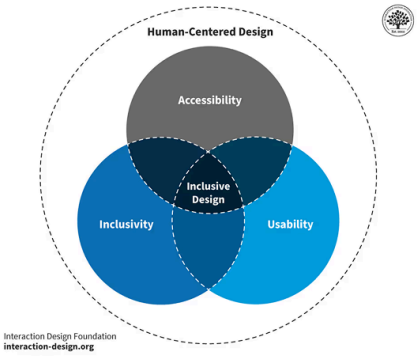
Inclusive design, in turn, tends to present itself as a specification of human-centered design. If HCD draws attention to subjectivity and the plurality of human dimensions, then "inclusive" devices radicalize this orientation: it is not sufficient to "place the human at the center" in the abstract; real differences among subjects and situations of use must be taken into account. This is observable, for example, in the way the user is represented as the intersection of sets of accessibility, usability, and inclusiveness conditions (Fig. 6).

In semiotic terms, inclusion can be treated as an axiological extension (and potentially as a strategic style) that renders the definition of "success" more demanding, no longer tied merely to problem resolution, but to doing so without producing systematic exclusions or "blindness" toward certain forms of experience. In terms of practices, this orientation produces selective pressure insofar as it obliges the introduction into the course of action of practices that take differences (physical, cognitive, and social) into account, and therefore modifies which tests, which criteria of success, and which constraints must be treated as non-negotiable.

Finally, sustainable/circular design devices shift the axiological center from the individual user to a broader horizon of consequences that burden the design process with socio-environmental responsibilities. Within this axiological constellation, sustainability is typically articulated across multiple dimensions (environmental, social, economic) and requires systemic thinking that exceeds the single object, encompassing value chains, life cycles, and consequences.

Here too, the typical diagram is not necessarily a linear sequence and is presented, in this example, once again in the form of an intersection (Fig. 7). "Circularity" further radicalizes this horizon and implies variations at the strategic level, whose organizing principle will aim not only at reducing impacts, but at rethinking flows and cycles (material, energy, logistical) in order to avoid those design decisions that optimize the immediate and later generate consequences that are unimaginably complex to manage in return.





From left to right:
Figure 5: *Axiological diagram of HCD*
Figure 6: *Axiological diagram of Inclusive Design*
Figure 7: *Axiological diagram of Sustainable Design*

In summary, the approaches (HCD, inclusion, sustainability/circularity) are treated here as axiological dispositions that select what is "worth" and therefore what must be included within the field of pertinence of the project (users, a plurality of subjects, society, ecosystems, life cycle, etc.). As these dispositions stabilize, they predispose the space within which a methodology can subsequently order practices and priorities.

### 4.2.2 Strategic principles: design thinking, double diamond

A second set of devices intervenes more directly at the strategic level, proposing a syntagmatics of the process structured into phases, iterations, divergences and convergences, and gates between "problem" and "solution." This is the case, for example, with variants of design thinking, the double diamond, and the "phased" formalizations of human-centered design and its offshoots.

We note how the same name (here "human-centered") can appear both as an approach and as a phased methodology. This ambivalence is not at all problematic, as it is precisely what the semiotic grid defined earlier allows us to bring into focus. The same object can in fact be observed as an axiology, as a strategic principle, as a circulating text, or as a set of concrete practices.

For this reason, an iconized strategic scheme is presented in a diagram in its "phased" versions of HCD (Fig. 8), which displays an iterative sequence alternating between comprehension, definition, solution production, and evaluation. Of note are the connections between phases, represented by returning arrows that depict loops. In strategic terms, this type of inscription does at least two things:

- it renders backward movement (iteration) legitimate as part of the process;
- it attributes a specific regulatory function to evaluation (testing, verification) as a control step.

Yet, precisely because it is a pre-schematization, this device tends to condense everything that exceeds the sequence, omitting interdisciplinary negotiations, frictions between technical constraints and usage preferences, ongoing requirement changes, etc. (which are instead an integral part of the accommodation of the course of action). We observe the same inscriptive behavior with regard to the sustainable design approach, where values such as circularity and sustainability become, at the strategic level, principles that articulate multiple practices (in this case in the form of phases comprising specific practices) (Fig. 9).

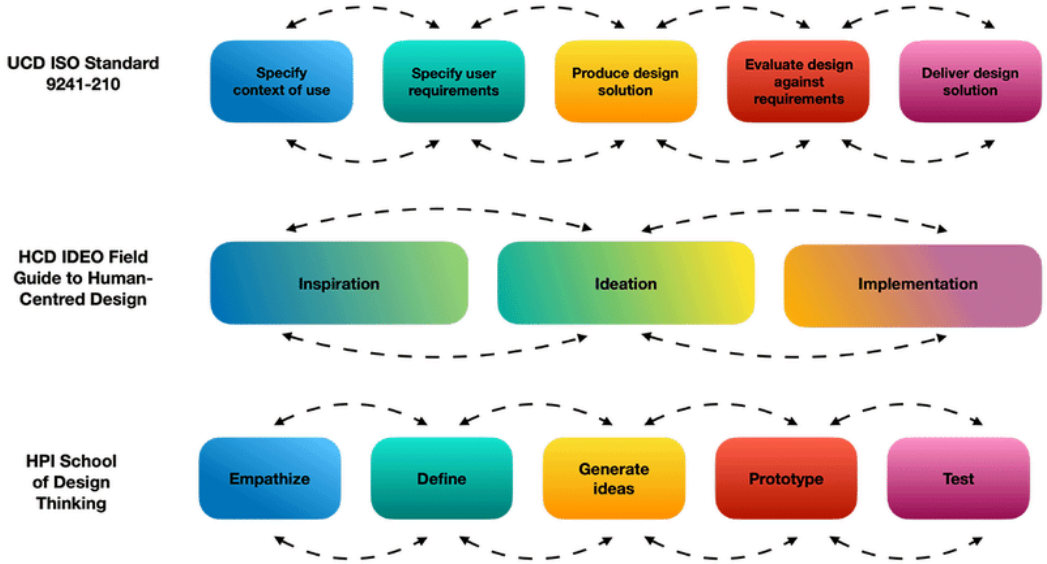



Figure 8: *HCD process diagram*

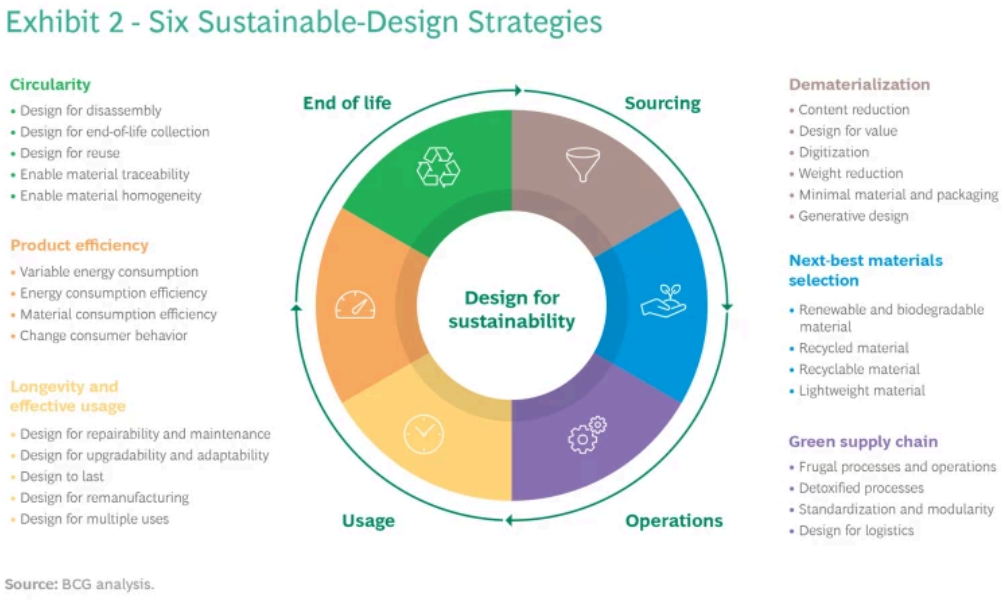



Figure 9: *Sustainable design process diagram*

Design thinking, in its most widespread variants, stages a similar logic, articulating phases such as empathy – definition – ideation – prototype – testing, often accompanied by a rhetoric of iteration. Its strength as a strategic device lies in the iconization of a certain ethos of doing, characterized by experimentation, provisionality, learning through feedback, etc. The figure, beyond prescribing "what to do," legitimizes a particular way of moving from one practice to another, that is, a specific style of composition among practices (Fig. 10).

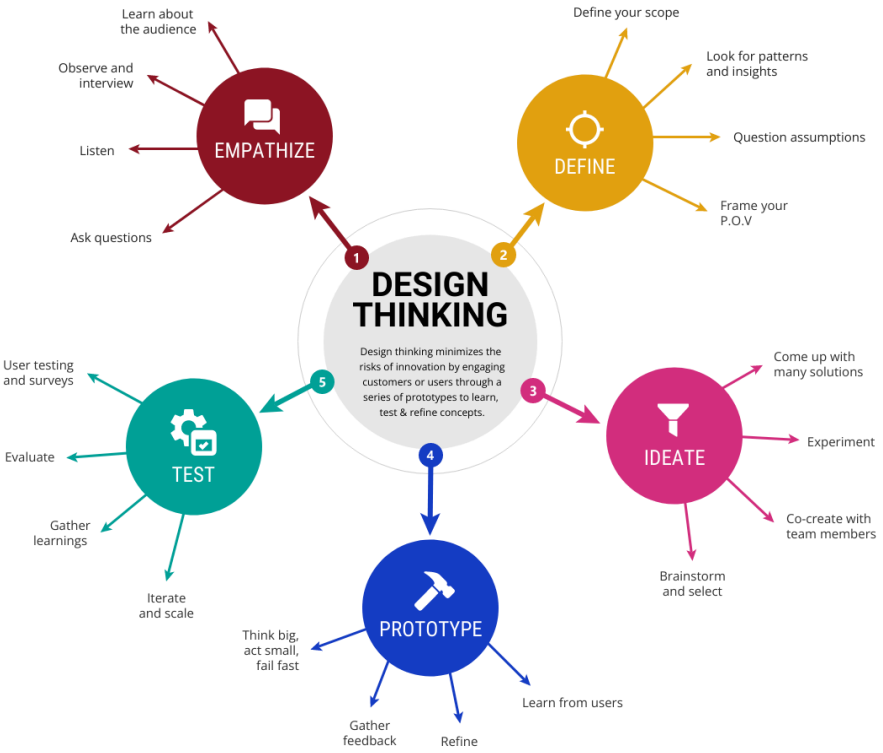



Figure 10: *Design Thinking Process Diagram*

The double diamond, finally, is perhaps the most transparent case of strategic conversion into topology. We observe two alternations of divergence and convergence, first on the problem and then on the solution, with a strong marking of the transition between the phase of problem definition and that of solution development (Fig. 11). In this sense, it is a powerful coordination device because it makes visible a principle that is often implicit: first one designs "the right thing" (framing), then one designs "the thing well" (delivery). At the same time, however, precisely this iconic clarity tends to naturalize what is in reality the object of continuous accommodation. The immediate questions that arise are therefore: when does a divergence truly close? Who decides convergence? What happens when concomitant practices (e.g., technical modeling, production constraints, cost requirements) impose returns and interferences that the diagram does not thematize? What the diagram presents as a "clean" transition is often, in practice, a point of friction and negotiation.

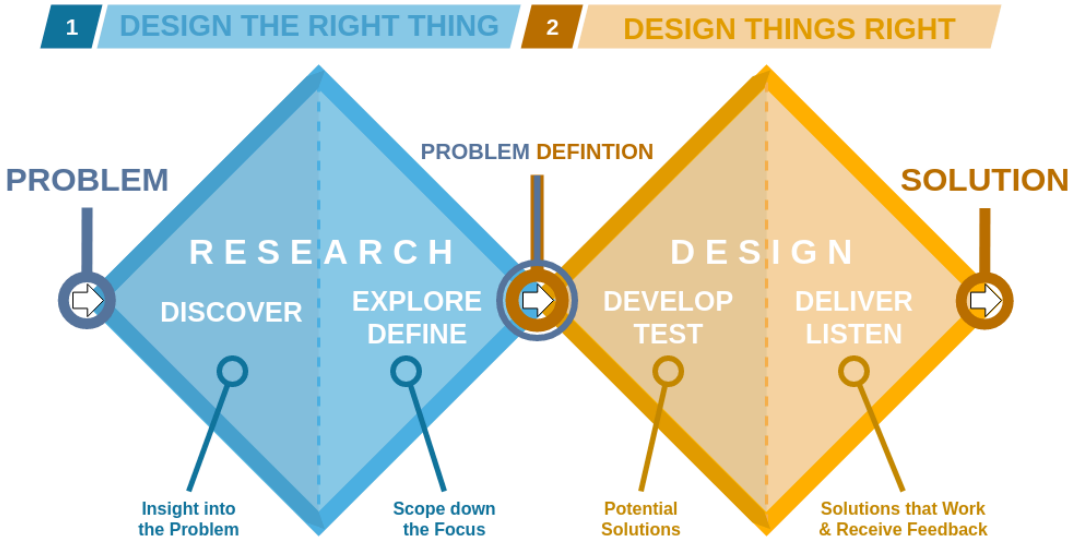



Figure 11: *Double Diamond Process Diagram*

### 4.2.3 Granular practices: interviews, brainstorming, personas

If methodologies organize, methods are the practices that are selected, codified, and sequenced. At this level, strategic devices present themselves as codified practices made repeatable through stabilized tools and supports, and they take the form of personas, journey maps, workshops, tests, prototypes, etc., rather than of overall "processes."

In the case of HCD, for example, the literature clearly shows how it is often presented as a group of methods aimed at giving form to "wicked problems" and generating solutions, including tools drawn from the sciences and the humanities as well as tools specific to design (Rampino, 2022). We can identify some recurring methods as normed practice scenes (variable-grain practices), often positioned at specific points within diagrams. Below, a table lists some of these methods and techniques (Fig. 12).

In these cases, the text-object dimension becomes even more evident. A persona or a customer journey map are not "results," but rather supports that enter the practical scene as elements of coordination and argumentation. On the one hand, they condense and render shareable a body of knowledge (typically qualitative) about the addressee; on the other, they impose a format of writing and visualization that selects what counts and what does not.

The device, however, should not be considered a "snapshot" of practice, since it orients practice by making certain operations easier to perform (to align, to discuss, to decide) and others more difficult (to maintain indeterminacy, to suspend choices, to leave requirement conflicts open). From the perspective of the semiotics of practices, these micro-practical devices thus function as "small" pre-schematizations which, by accumulating, construct an order of doing by normalizing segments of courses of action and rendering them composable within broader strategies.

Despite the arrangement presented in the diagram (Fig. 12), the point is to highlight that these methods function as programmable practices (with roles, timings, supports, criteria of success) and are inserted into a strategic order that claims to govern the course of action.

| Design phase | Qualitative methods | Quantitative methods | Design methods |
|---|---|---|---|
| Understanding the context | • Literature review<br>• Observations<br>• Expert meetings<br>• Delphi technique<br>• Diary studies | Surveys (not specified) | • Storytelling<br>• Metaphors<br>• Personas<br>• Experience mapping |
| Specify the problem or user need | • Focus groups<br>• Interviews<br>• Delphi technique<br>• Contextual inquiry<br>• Observations<br>• Critical incident technique | • Context assessments<br>• Needs assessments<br>• Surveys (not specified) | • Participatory workshop<br>• Personas<br>• Use case scenarios<br>• Decision matrix<br>• MoSCoW[a] method<br>• House of quality analysis<br>• Goal, question, metric approach<br>• Roleplay<br>• User journey mapping<br>• Intervention mapping<br>• System mapping<br>• Low functional prototype<br>• Use case diagram |
| Generate ideas and design solutions | • Observations<br>• Interviews<br>• Focus groups<br>• Literature review | • Usability surveys<br>• Feasibility surveys<br>• Surveys (not specified) | • Brainstorm<br>• Round Robin Concept Ideation<br>• Voting<br>• Round table discussions<br>• Sketching<br>• Visual mind maps<br>• Idea or concept voting<br>• Storyboarding<br>• User narratives<br>• Use case scenarios<br>• Low functional prototyping<br>• High functional prototyping<br>• Intervention mapping<br>• Heuristic evaluation<br>• Task analysis<br>• SWOT[b] or competitor analysis<br>• User journey map<br>• Wizard of Oz method<br>• Card sorting<br>• Weekly sprints<br>• Think-aloud techniques |
| Test solutions | • Interviews<br>• Observations<br>• Focus groups<br>• EMA[c] | • Usability surveys<br>• Feasibility surveys<br>• Viability assessments<br>• EMA<br>• Surveys (not specified) | • Low functional prototyping<br>• High functional prototyping<br>• Roleplay<br>• Story boarding<br>• Card sorting<br>• Simulations<br>• Intervention mapping<br>• Cognitive walkthrough<br>• Brainstorm (general)<br>• Heuristic evaluation<br>• Workflow evaluation<br>• Participatory workshop<br>• Wizard of Oz method<br>• Value versus effort matrix<br>• Think-aloud techniques |

Figure 12: *Table of possible methods and techniques in the design phases*

### 4.2.4 Schemas and diagrams: iconizations and pre-schematizations

Technically, we have so far implicitly relied on diagrams as iconized expressions of strategic schemas, which further highlights their inscriptive nature, allowing for a specific mode of manipulation and dissemination, here presented in the form of on-screen (or printed) images.

One of the most visible characteristics of strategic design devices is precisely their strong iconic component. We have in fact encountered phased processes, diamonds, iterative cycles, intersections, maps, and finally lists.

Here, it is useful to reiterate the distinction introduced earlier, which differentiates the schema as a syntagmatic configuration of the course of action (it may be prescriptive or emergent) from the diagram as a form of inscription that materializes the schema as a text-object. This distinction follows Fontanille's (2010) framework, according to which strategies derive from

the conversion into a device of expression of the experience of conjunction and adjustment among practices, and may be further iconized as strategic behaviors. A methodological diagram (whether presented as a “process” or a “framework”) also functions as a discourse of instruction, that is, as a form that does not merely propose an initial contract but intervenes throughout the entire course of action, step by step, similarly to a recipe or an assembly manual (Fontanille, 2010).
This analogy is not merely rhetorical; it reveals the praxeological nature of inscription. The diagram, in addition to describing, in some way claims to guide.

### 4.2.5 What they neutralize: accommodations and interferences among practices

Collected in the form of strategic devices, design approaches and methodologies tend to produce an implicit promise: that a concrete outcome will be achieved if the prescribed schema is followed. In reality, what Fontanille places at the center is that the signification of practice is forged precisely in the adaptive process, that is, in the strategic accommodation among concomitant and competing practices. Moreover, models and canonical sequences are not “executed” by practice. Rather, they function as horizons of reference and persuasive pressure, useful for resolving local problems, but not coinciding with what occurs “in action” (Fontanille, 2010).
For this reason, strategic design devices tend to neutralize (or at least render less visible) a series of phenomena typical of real design work, particularly when design takes place in interprofessional contexts. While these devices order practices and render the process communicable, they risk transforming design into a linear or “diagrammable” narrative precisely where design is instead a field of accommodations, returns, deviations, and adjustments, often determined by the concomitance of multiple competing strategies and practices.
From this perspective, the strategic devices of design (HCD/UCD, inclusion, sustainability/circularity, design thinking and their related iconizations) present themselves as a set of pre-schematizations that seek to render the heterogeneity of design practice governable.

## 4.3 Strategic Devices of Engineering

As in the case of strategic design devices, the engineering literature is likewise rich in models, standards, and frameworks that describe “how” one ought to proceed in design and technical development, and that purport to render design action governable. These objects are rarely proposed as “neutral” descriptions of what happens; rather, they present themselves as forms of framing that organize action through the determination of priorities, the distribution of responsibilities, the definition of control checkpoints, and the prescription of evidence and documents to be produced.
Unlike many contributions from design, however, these devices tend to present themselves less as explicit axiological declarations (for example, “putting the human at the center”) and more as architectures of control. The value orientation is often implicit and manifests itself

through formalized criteria of success (quality, reliability, compliance, performance, efficiency).

For this brief analysis as well, the corpus will be deliberately limited and oriented toward the perspective of product design. We will take as examples Systems Engineering (V-model), Lean Engineering, Six Sigma, Concurrent Engineering, Root Cause Analysis and FMEA (Failure Mode and Effects Analysis), FEM (Finite Element Method), and CAD (Computer-Aided Design) as specific techniques and methods.

The adoption of texts not originally tied to the reference practices (engineering as well as design) is a frequent situation, and is considered here through the example of "Six Sigma," originating in business management contexts. Indeed, instances of methodological transpositions from one discipline to another are not new, provided that the macro-practices aggregated into phases do not preclude certain typical and essential scenes of the reference discipline, and are therefore open to a certain degree of interpretability.

Structure and premises are the same as those previously outlined (§4.2). The evaluative intent once again gives way to observation in a semiotic key of the identified corpus, through the same analytical grid. Once again, the various elements are not confined to a single level and may be read at each level.

### 4.3.1 Axiological orientations: quality, prevention, control, efficiency

A first distinctive feature of engineering devices is that axiology is often implicit. Rarely do we find diagrams that declare "who or what is at the center" with the same boldness as HCD or inclusive design. Nonetheless, values are present and act as regulatory criteria at the level of strategies, often formalized in the form of requirements, metrics, tolerances, acceptable levels of risk, evidence of compliance, and more.

Devices such as Systems Engineering carry with them a value orientation centered on coherence and traceability. This axiology is also institutionalized in standards such as ISO/IEC/IEEE 15288, which defines processes and activities supporting the systems life cycle and their definition and control.

Some orientations, closer to organizational rationalization, place at the center the "leanness" and "fluidity" of the process, as in the case of Lean Engineering, which translates into organizational principles oriented toward the elimination of waste and the creation of flow. Others, by contrast, emphasize "measurability" and "determinacy," later translated into principles such as the quantification of improvements and the reduction of variability, as in the case of Six Sigma.

Finally, a significant portion of engineering axiology is oriented toward prevention, articulated as preventing failures, anticipating failure modes, and reducing risks before they become incidents or catastrophic breakdowns. It is here that tools such as FMEA, while presenting themselves as operational methods, also convey a value orientation (prevention > correction).

Already at this level, a potential difference with respect to design becomes noticeable. While in the latter axiology is often "argued," in engineering it tends to manifest itself as a criterion of governability (but also measurability, verifiability, and controllability). This difference,

however, should not be treated as essential or stereotypical, since we will see that even an axiological exchange gives form to strategic principles that orient practices regardless of disciplinary affiliation, that is, independently of what we consider "proper" to one practice or another, even though the resulting schematizations may appear unusual or atypical, or even lead to the production of new branches and perspectives.

### 4.3.2 Strategic principles: decomposition/integration, verification/validation

If axiologies define what is valuable, the strategic level defines how practices are composed and managed in relation to one another. In the selected engineering corpus, recurring strategic principles emerge:

1. Decompose to control and integrate to validate (Systems Engineering / V-model).
   The V-model iconizes an organizational principle: decomposing needs and requirements into progressively more specific levels (left-hand side), and then implementing and ascending through integration and testing up to verification and validation (right-hand side). Within this logic, practices are not only arranged sequentially, but are also related through traceability and correspondences between levels (requirements ↔ tests) (Fig. 13)

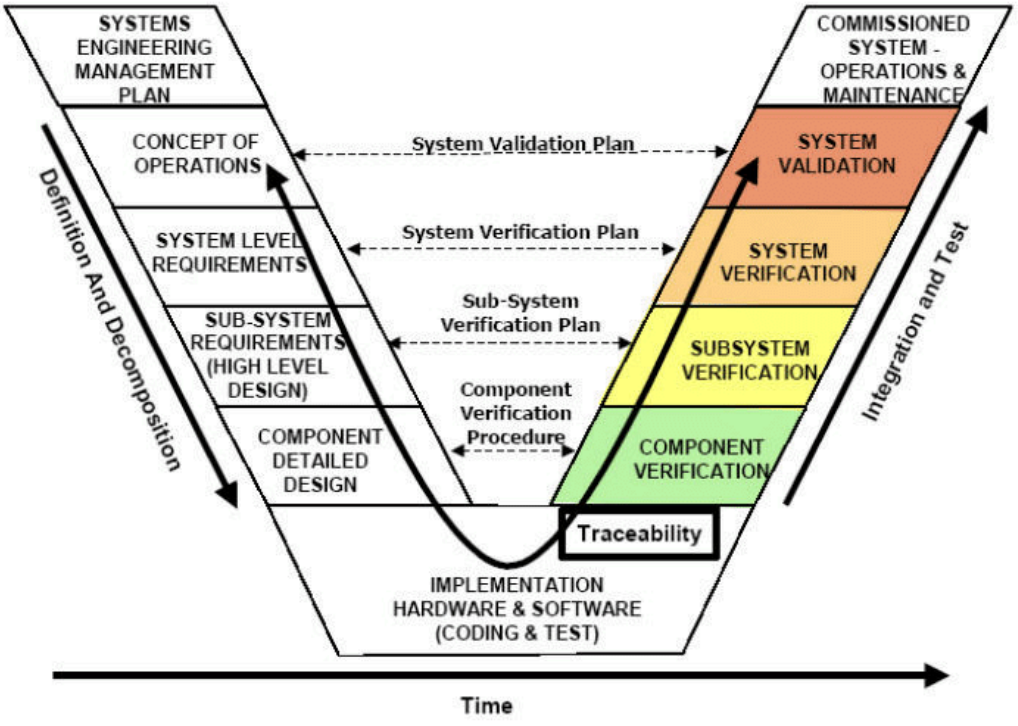



Figure 13: *V-model structure*

2. Measure to intervene and intervene to stabilize (Six Sigma / DMAIC).
   The DMAIC cycle composes practices in a prescriptive syntax: define the problem, measure, analyze, improve, control (Fig. 14).

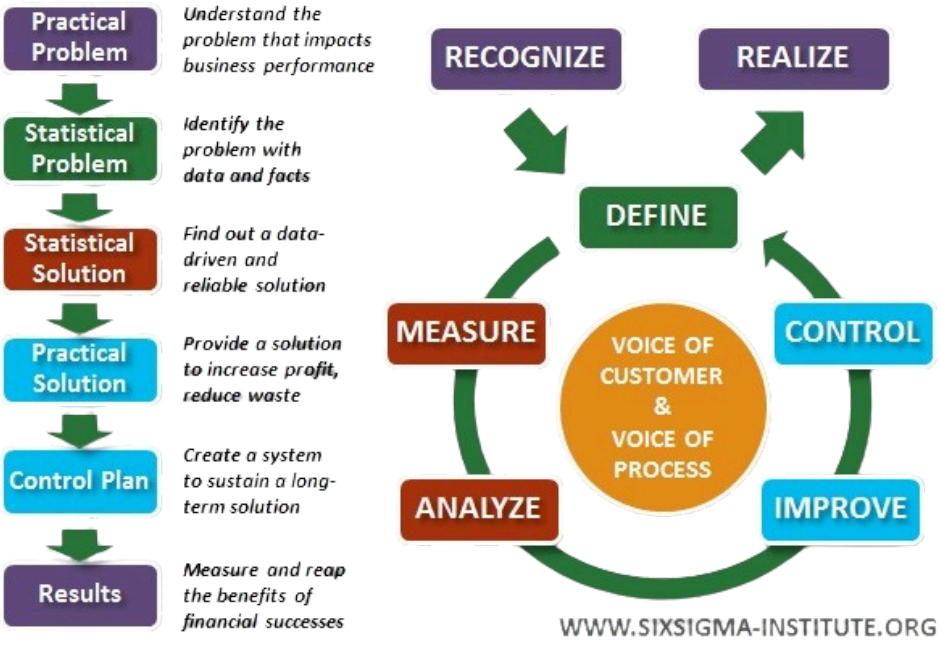



Figure 14: *DMAIC cycle*

3. Render recognizable (Lean Engineering).
   Here the strategic principle is sequentially distributed among identifying value, mapping the flow, eliminating waste, building flow, establishing pull, and pursuing perfection. This syntax is not always a phased “project process”; rather, it can be understood as a way of organizing practices and decisions by orienting them toward value and toward the reduction of interruptions (Fig. 15).


Figure 15: *Lean Principles*

4. Superimpose practices (Concurrent Engineering).
   Particularly interesting here is the preference for a logic that, up to now, has been expressed as a possible mode of presentation of practices. The concomitance of practices becomes, in this case, a principle of syntagmatic composition: placing activities in parallel and allowing different functions to interact early in order to anticipate constraints and reduce timeframes. The trajectory is thus no longer structured "as a relay," to which this principle stands in opposition, and the co-presence of practices is envisaged as a condition of operation (Fig. 16).

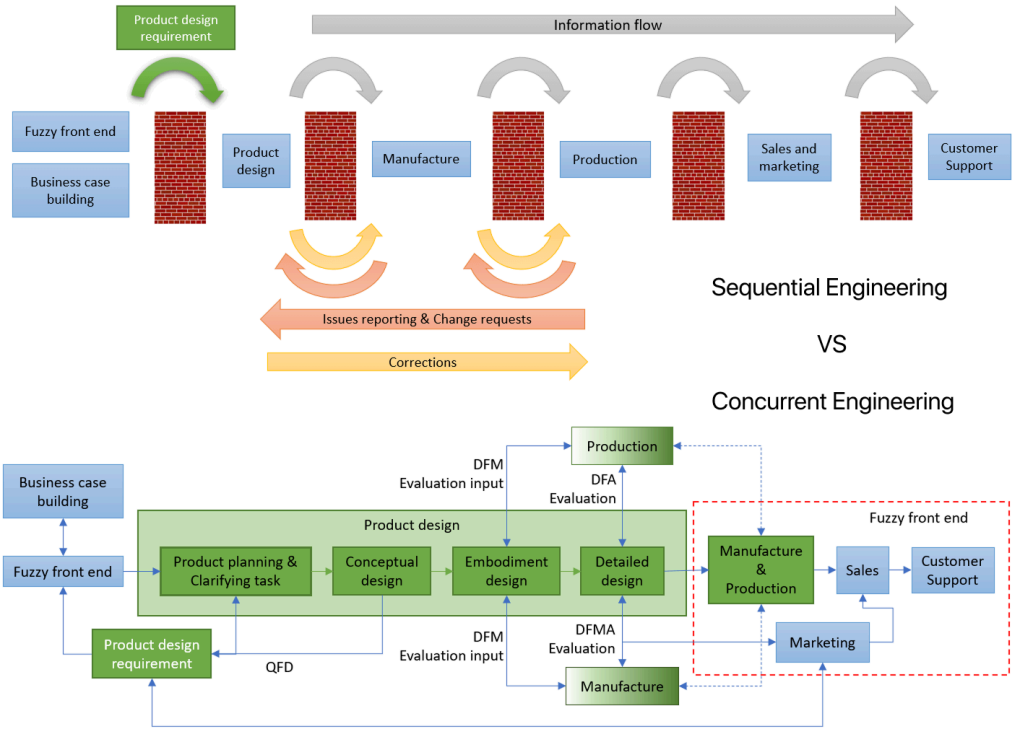



Figure 16: *Sequential Engineering VS Concurrent Engineering*

5. Prevent failures (FMEA).
   Another recurring strategy is the anticipation of the unexpected, which, as a compositional principle, orders practices according to the logic of identifying possible scenarios and their subsequent analysis. FMEA (Failure Mode and Effects Analysis), considered as a preventive strategy, articulates practices of determination and evaluation (Fig. 17).

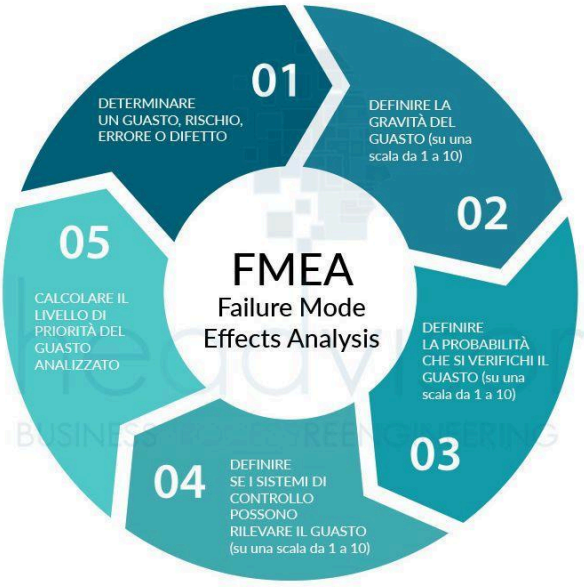



Figure 17: *FMEA operational sequence*

These strategic principles should not be treated as “substitutes” for one another. As will be discussed more in detail, in the course of action multiple strategies coexist and compete, resulting in the preference (which settles into stabilization) or the elimination of other principles.

### 4.3.3 Granular Practices: Methods and Techniques as Operational Scenes

If strategies compose sets of practices, methods and techniques are variable-grain practices that enter the course of action as normed scenes.
In the engineering field, many practices are highly structured and instrumented, which makes it even more evident, as Fontanille notes, that discursive programming (oral, written, iconic; procedures, precautions, assignments, etc.) is a constitutive dimension typical of professional practices that transform material objects. However, even this dimension must always adapt to real-time contingencies and interferences.

At this level, FMEA becomes a preventive practice that organizes the identification of failure modes and effects, prioritizing actions. As often occurs, practice is inseparable from its supports (ratings, tables, lists), which in this case stabilize what “counts” as risk and make different assessments comparable (Fig. 18).

| COMPONENTE | MODI DI GUASTO | EFFETTI | CAUSE | PARAMETRI FMEA | | | | MODIFICHE | PARAMETRI FINALI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Occurence | Detection | Severity | RPN | | Occurence | Detection | Severity | RPN |
| recipiente | rottura dei supporti di ancoraggio | possibile caduta o ribaltamento del serbatoio | dilatazione termica ripetuta del recipiente, ambiente non conforme | 3 | 6 | 6 | **108** | rivedere il posizionamento nel recipiente, prevedere sensori deformazione | 1 | 2 | 6 | 12 |
| | | | Urto meccanico con altri componenti | 2 | 1 | 6 | 12 | | 2 | 1 | 6 | 12 |
| | | | Corrosione per ambiente contaminato | 4 | 5 | 6 | **120** | proteggere adeguatamente la superficie | 2 | 5 | 6 | 60 |
| | rottura del recipiente | esplosione o perdita del recipiente | spessore materiale non conforme | 4 | 3 | 8 | 96 | | 4 | 3 | 8 | 96 |
| | | | materiale non conforme | 5 | 3 | 8 | **120** | controllo del materiale scelto a progetto | 1 | 3 | 8 | 24 |
| | | | fatica del materiale | 4 | 4 | 8 | **128** | dimensionamento a fatica del materiale | 1 | 3 | 8 | 24 |
| collegamenti | perdita di fluido dalle giunzioni | Intossicazione personale, incendio | materiale non conforme | 3 | 2 | 6 | 36 | | 3 | 2 | 6 | 36 |
| | | | corrosione | 4 | 5 | 6 | **120** | rivestimento esterno/interno dei collegamenti | 2 | 5 | 6 | 60 |
| | | | dilatazione eccessiva | 5 | 2 | 6 | 60 | | 5 | 2 | 6 | 60 |
| | deformazione collegamenti | mancato o ridotto flusso in ingresso ed uscita | urto con corpo esterno | 4 | 1 | 4 | 16 | | 4 | 1 | 4 | 16 |
| | | | dilatazione termica | 4 | 3 | 4 | 48 | | 4 | 3 | 4 | 48 |
| valvole controllo e sicurezza | .... | .... | .... | | | | | | | | | |

Figure 18: *FMEA application example*

Root Cause Analysis (RCA) is a practice of diagnosis and learning from anomalies that relies on different tools and typically produces inscriptions (reports, cause trees) that

transform an event into a debatable and shareable causal chain (Fig. 19). We observe how many micro-practices are presented as valid insofar as they are articulated within a pre-schematized process, divided into phases according to a strategic principle of cause identification.
These are presented as "tools," understood here as sub-practices with related scenes that in turn integrate objects and texts.

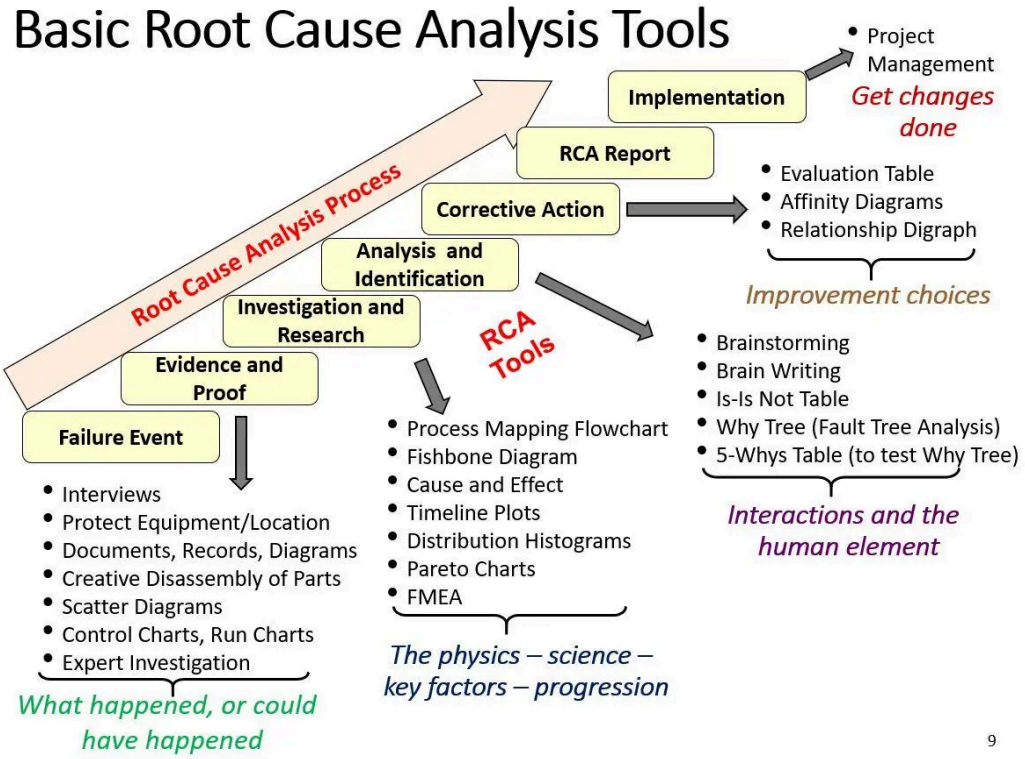



Figure 19: *Process diagram of RCA and its tools*

CAD and FEM/FEA can be interpreted as methods/techniques, but above all as instrumented practices. "Modeling" and "simulating" imply roles (operator), objects (model, mesh, constraints), tools (software), success criteria (geometric consistency, convergence, safety margins), and a temporality of iterations, which makes them practices in their own right.
CAD, often understood as a design tool, becomes here a modeling practice that constructs a technical object as a set of constraints, geometries, and parameters, producing a text-object (digital model) that mediates interactions (decisions, revisions, compromises, verifications). FEM/FEA is a virtual test that translates a design configuration into modeling hypotheses to predict a product's response to plausible or hypothetical forces and conditions, generating evidence (stresses, deformations) that becomes argumentative material for decision-making (Fig. 20).
CAD and FEM/FEA establish a regime of representation of the object that makes certain verifications and decisions possible while rendering others more difficult or less visible.

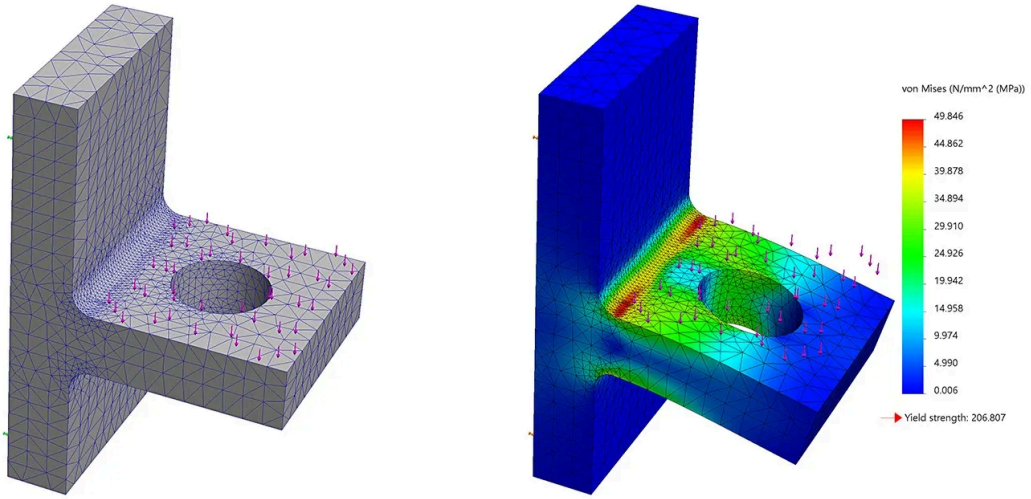



Figure 20: *FEM analysis of a generic component*

### 4.3.4 Schemas and Diagrams: Iconizations and Teaching Devices

As in design, in engineering the strategic schema circulates and is transmitted through text-objects. We have so far examined diagrams, flowcharts, tables, and templates, and it is now evident that it is difficult to separate the device from its iconization, which enables its proliferation, transmission, teaching, and facilitates its use as a tool (inscription into text-objects). Fontanille's definition is useful here: the strategic dimension results from the conversion into an expressive device (topological and aspectual-temporal relations, typologies of order and intersection) of an experience of conjunction and adjustment between practices (Fontanille, 2010).
The iconic function is evident in each of the examples proposed:

- In the V-model (Fig. 13), the mirrored topology makes the requirements↔test parallelism "natural" and conveys the idea that verification/validation is the counterpart of definition;
- In DMAIC (Fig. 14), we see a cycle that normalizes the sequence define → measure → analyze → improve → control, transforming improvement into a grammar of action;
- Lean principles (Fig. 15) constitute a diagram that instructs a value-oriented transformation path;
- The one presented for Concurrent Engineering (Fig. 16) is a comparative diagram that iconizes the difference between succession and concomitance, making the overlap of activities appear "desirable";

- FMEA/RCA (Fig. 17 and Fig. 19) are forms that explain and teach a way of proceeding (which steps, which categories, which outputs to produce). It is interesting to note the dual nature of the tabular diagrammatic iconization of FMEA (Fig. 18): it functions as the expressive substance of an emerging schema when it gives form to the strategic principle of risk prevention, while it expresses an implicit, not yet formalized, prescriptive schema when it is used to identify the steps required to improve the system (and thus address critical issues).

The key distinction remains the same: the schema is the syntagmatic configuration of the course of action (which can be prescriptive or emergent), and the diagram is the expressive substance that makes that schema communicable and circulable.

### 4.3.5 What They Neutralize: Accommodations and Ambiguity

Reinterpreted as strategic devices, engineering frameworks often put forward a strong promise of governability based on the assumption that careful planning of steps and subsequent monitoring are sufficient to neutralize risks, stabilize progress, and render even complex situations legible.

Following Fontanille (2010, p. 23), we observe the inevitable gap between prescribed schema and action-in-progress, since practice cannot be reduced to a linear progression or a decision tree because it is "a continuous negotiation between multiple actants: an object intended for action, a horizon of reference and/or consequences, possible resistance from substrates and counter-practices, occasions and accidents, canonical forms (habits, training routines, norms, etc.), and schematizations emerging from use (apprenticeship, adjustments, tactics, etc.)".

To quote Bucciarelli (1988, p. 160): "Design, even though done by engineers, is not a mechanical process. So while a block diagram might be useful to us in going about our business, helping us to organize our design work, schedule and plan, or teach our students, it is not a faithful or factual description of designing as it occurs, except at a very superficial level."

Similar to design devices, we find typical neutralizations linked to their programmatic nature. The omission of real, non-"clean" interactions is evident, such as changes in requirements, feedback loops imposed by production or supply-chain constraints, redesigns triggered by unexpected test outcomes, or performance–cost trade-offs that do not follow an orderly loop. When present, these interactions are framed as phenomena to be measured, reduced, or even eliminated according to a principle of process efficiency. The interpretation is clear, and according to the definition of tension introduced earlier (§3.2), these real interactions can be explicitly understood as effects of tension dynamics produced by misalignments between praxic logics. Minimizing their effects is an entirely legitimate strategic principle and consistent with engineering practices, yet it is impossible to eliminate at the root the structural component that also generates as an effect even the simple progression of actions. Without it, there would be no conflicting logics and therefore no mode of action, resulting in a sort of stalemate of signification.

Another factor that remains unaddressed is the ambiguity and negotiation of relevance, which in the proposed examples truly emerges around what the "problem" actually is (Define), what counts as a relevant measure (Measure), what risk is acceptable (FMEA), and what evidence is sufficient (V&V).
Moreover, the social construction of numbers is omitted. In preventive practices, ratings and scores (FMEA, KPIs (Key Performance Indicators), defect rates) may appear "objective," yet they often result from interpretations, compromises, or even internal policies within a "corporate subculture" (Bucciarelli, 1988).
Also unconsidered are the possible effects of over-planning the design process. In Concurrent Engineering, for example, concurrency overload may occur: parallelization anticipates constraints but also increases coordination density and thus the frequency of micro-frictions. The NPD literature notes that coexistence accelerates the process but introduces risks and requires careful assessment of error costs (Rampino, 2022).
Finally, the potential interference between different strategies is not addressed at all (reducing waste vs. exploring alternatives; freezing requirements vs. maintaining openness; optimizing performance vs. protecting user experience).
The presence of neutralized zones in no way undermines the "practical" validity of these tools. Like those in design, these too, from a semiotic perspective, function as examples of pre-schematizations of action. In the composition (or typical emergence) of these tools, selections have clearly been made according to a logic of prioritization and evaluation that excludes what is not considered useful, relevant, or essential. These neutralized zones are certainly treated as less relevant for direct instruction and for the legitimate execution of the path they propose. If the aim, as in this research, is to analyze the tensional effects between design and engineering practices, then these devices are not particularly suited to providing direct insight into the dynamics that generate such effects, precisely because they tend to exclude a series of phenomena that actually occur during design and significantly influence the course of action. Further considerations are therefore necessary.

### 4.4 "Not everything happens as if..."

I venture once again, this time distorting it by adding a negation to "Greimas's favorite expression, ..., when he abandoned purely deductive reasoning to adapt his analytical discourse to the textual 'facts' under analysis" (Fontanille, 2010, p. 80). In this case, I refer to a different development, rhetorically appropriating his phrase to address those pre-schematizations perpetuated by methods and methodologies that do not describe the actual unfolding of action. In reality, indeed, "not everything happens as if," even when one has merely attempted to follow procedures and protocols to the letter. Fontanille reminds us, in fact, that the implementation of a practice cannot be reduced to a linear transformation or a textualized progression, and that its processual unfolding is a "continuous negotiation" with constraints, resistances, counter-practices, occasions, and accidents, as well as with canonical forms and schematizations emerging from use.

The premise of this brief analysis lies in observing methodologies, approaches, and methods in order to understand how they structure design as "places and moments" within which the design act takes place and professionals interact. The central problem, however, is that these places and moments are programs of what is envisaged to be done. We have, in fact, framed them as devices that aim to orient the composition of practices by (partially) pre-ordering the course of action within which design takes shape.

If the objective here is to understand how the effects of the tensional dynamics between design and engineering practices influence the project outcome (but also the designers and the process itself, as we will see later), then attempting to observe them within static boundaries, within programs not yet enacted, is not a viable approach. We have repeatedly emphasized that reality cannot be constrained by any form of strict planning, and that any practice, however strongly programmed, can never be exempt from "fortuitous contingencies and real-time interactions" (Fontanille, 2010).

However, framing design methods and methodologies as devices makes it possible to develop useful reasoning to further define the nature of these tensional dynamics and significantly highlights a series of fundamental aspects.

First, it should be noted that all the devices discussed so far are not neutral, as they iconize and make repeatable only certain recurring configurations of design practice. We can therefore think of them as a sort of "imprints," that is, typical forms that stabilize axiological orientations, organizational principles, and granular practices, translating them into communicable forms (phases, cycles, iterations, diagrams). By stabilizing over time, these orientations, principles, and practices (the most recurrent ones), together with their supporting objects, come to be regarded as "canonical."

The point of interest here is not so much the device's fidelity to a presumed real process (also because, by definition, a method or methodology does not claim to describe what happens), but rather its institutionalizing character, which lies in its capacity to circulate as normal what in practice is merely one possibility among others.

It is precisely this stabilization over time that characterizes the transition from strategies to forms of life, where we have situated discipline (§3.1). Discipline, understood as a community of training, evaluation, and legitimation, tends to make recognizable a way of composing practices and addressing problems, stating — explicitly or implicitly — what design "usually" does or what engineering "usually" does. Disciplinary imprints can be understood as a semiotic effect: a typification that stabilizes languages, organizes roles, assigns priorities, and produces cultural expectations. Indeed, beyond speaking about practices, they also speak about practitioners. Roughly speaking, a designer and an engineer are expected to address certain variables in certain ways, without this resulting in rigidly separated practices.

It is important to note that these imprints are not a natural property of the practices, as if they were inherent to them. Disciplinary recognizability is constructed as a regularity of composition rather than as the exclusivity of practices. It is a regularity made visible and assessable because, as seen in the examples discussed, it is inscribed in devices that formalize it and presuppose its repeatability.

Precisely because disciplinary imprints are typifications, they do not imply that the principles organizing the composition of practices are exclusive properties of a discipline.
We can therefore speak of strategic polyvalence: just as individual practices cannot be defined as exclusive to a discipline, the principles that organize their composition — and the axiological pressures that shape them — are not private properties of design or engineering, and can be transposed, grafted, or translated into different courses of action.
This polyvalence should be understood as an operational phenomenon rather than as a simple exchange of values, in that the transposition of an axiological orientation materializes through the reorganization of the assemblage of practices.
Polyvalence becomes observable, for example, precisely in the transposition of "typical" axiological orientations from one discipline to another.
When a criterion typified as belonging to "design" (e.g., human centrality) begins to orient an engineering course of action, it tends to redistribute priorities and constraints, making certain steps mandatory (forms of comparison with use, explicit assumptions about the user, verification against interaction scenarios, etc.) that would otherwise remain marginal or implicit.
Conversely, when a criterion typified as belonging to "engineering" (e.g., controllability, measurability, prevention) begins to orient a design course of action, it tends to shape validation principles, threshold criteria, and decision rules that restructure the articulation of practices (what is measured, when it is measured, which results are considered sufficient to proceed, etc.).

The point is that this does not automatically transform engineering into design or design into engineering. Rather, it indicates that disciplines function as instances of typification and legitimation, whereas strategic principles and axiological orientations circulate more broadly, can be incorporated into different assemblages, and produce hybrid configurations that can only be analyzed by observing how sequences, overlaps, passage criteria, and control regimes change.

In the translation framework used to analyze the various examples, we first positioned approaches as axiological orientations and methodologies as strategic schemes, that is, as planning practices grounded in principles of composition. It should be reiterated, to avoid misunderstandings, that the strategic level does not coincide with a specific value, nor with an abstract objective. Strategy, rather, means that each practical scene must accommodate itself in space and time with respect to other concurrent or competing scenes and practices (Fontanille, 2010).
The adoption of a methodological device can be interpreted as the formulation (and often the iconization) of a principle of composition. As we have seen, phases, cycles, iterations, divergences, and convergences translate an experience of conjuncture and adjustment into a shared expressive device.
If the design course of action is always traversed by multiple practices, then technically it also allows for multiple ways of assembling and regulating them.

To differentiate the principle of composition — modulated by axiological and modal pressures — we will define strategic logic as the set of regulatory operations that, within a conjuncture of practices, determines their assembly (succession, overlap, alternation,

suspension), ensuring the accommodation of the ongoing practice with respect to objectives, consequences, other actors, and other practices.
This logic concerns the way in which a course of action maintains practical coherence despite the competition of multiple possible configurations and can be described through a repertoire of assembly operations. Here we highlight some of them, in a deliberately general form, because they recur both in "ordinary" and in "undesired" or even "problematic" effects (ordinary and problematic, regardless of their connotation, are always effects of tensive dynamics, as noted in §3.2):

- Prevalence: one practice functions as the primary framework, and the others are grafted onto it as secondary elements, as if there were a dominant frame.
- Alternation: practices follow one another in temporal segments, with passages that establish when one can interrupt or suspend the other, almost segmenting them.
- Controlled overlap: multiple practices proceed together, but under compatibility constraints (resources, attention, tools, criteria).
- Syncope/suspension: one practice is temporarily suspended to allow another to emerge, with effects on the rhythm and continuity of the course of action.
- Parallelization and delegation: different practices are advanced simultaneously through the distribution of tasks, tools, and responsibilities.

With reference to the mechanisms analyzed, these operations are not yet methodologies. They are forms of regulation that methodological devices seek to capture and render prescriptive, weighted according to the prioritization of certain axiological pressures, often simplifying them or reducing their variety.
More specifically, we define a pressure as axiological when one or more values "push" the course of action toward a certain direction or favor certain criteria (even without being explicitly formulated as rules); we define a pressure as modal when the modalities that qualify action (having to do, being able to do, wanting to do, knowing how to do, and often also believing / being authorized to do) become constraints or operational drives that redefine what is actually possible or necessary within the course of action.

Once again, let us ground this in an example relevant to the design sphere. Imagine a team composed of designers and engineers tasked with designing, for instance, a food container for a company that intends to market it. Upstream, the team agrees on a methodological device that outlines a relatively stable sequence (research → ideation → development → prototyping → verification) and that, precisely because it is shared, functions as a coordination framework by establishing the steps involved, when it is legitimate to move forward, and according to which criteria intermediate outcomes are to be evaluated.
During the design process, however, the emergence of a stringent time constraint (an early deadline, the need to submit a prototype, or an unexpected request from the client) can reconfigure the planned assembly. The course of action is thus reconfigured. The principle of composition underpinning it is modulated by a modal pressure (the need to deliver within a

given timeframe) and, often, also by an axiological pressure (which may coincide, for example, with the value of punctuality, responsiveness, or "accountability" toward the client). In such cases, recurring assembly operations can be observed, such as anticipation (bringing verification or validation practices forward in time), reductions (eliminating variants or scenarios), parallelization (advancing development and prototyping in synchrony), or more intense alternations (micro-decision cycles, frequent reviews, rapid transitions between production and control). In this context, "meeting the deadline" acts as a pressure that selects and intensifies certain assembly operations, transforming the form of the sequence and the distribution of practices.
A project team, however, is a set of distributed roles and responsibilities, in the sense that each actor embodies different practices and brings with them different criteria of sufficiency. It follows that coherence within the course of action is achieved through negotiations and continuous local redefinitions of priorities. In other words, time pressure modifies not only the sequence of practices, but also the criteria through which they are enforced and made compatible.

Let us now consider a second occurrence, seemingly minimal and extra-projectual, yet recurrent. A course of action may be interrupted by a physiological event that arises without warning. Someone modeling or drafting a project may be forced to suspend their activity to address an immediate need. If the deadline is imminent, two pressures manifest simultaneously in this scene: on the one hand, the modal pressure of having to deliver on time; on the other, an equally binding pressure linked to the management of the body (understood here as a condition of possibility for action). What matters, once again, are the assembly operations activated by the encounter between one practice and its other.
If, in a first possible outcome, the practice of caring for/managing the body prevails, we observe a syncope, that is the temporary suspension of the planning practice followed by a shift in the dominant frame (the practice of "going to the bathroom" becomes the primary framework) and finally a resumption of work. Accommodation then occurs through a chain of well-defined practices (standing up, moving, entering, re-entering), which temporarily reorganizes the course of action.
Planning is then reassembled through a brief alternation and subsequently brought back to the main trajectory. In a second outcome, the pressure of delivery may prevail: the planning practice retains its prevalence but incorporates concomitant practices of "containment" (shifting position, or attempting to finish even faster in order to finally address the need). Here, the situation is not resolved through syncope but through a form of overlap and competitive management (attention, posture, tolerance), often accompanied by a further compression of pace (acceleration). Here as well, the coherence of the course of action is an effect of regulation.
These deliberately simplified examples show that strategic plurality coincides with a plurality of operational configurations, that is, with multiple ways of composing practices within the same course of action.

What has been said so far allows us to circumscribe a fundamental limitation of methodological devices: they tend to neutralize or render invisible what, for Fontanille

(2010), constitutes the very principle of praxis: permanent accommodation to circumstances and to the interferences between practices.

The analysis of design and engineering devices has certainly enabled us to identify what is typically foregrounded, how it is institutionalized, transmitted, and applied, and how such devices aim to pre-structure the design process. However, these programmings in no way exhaust the meaning of design, precisely because the meaning of practices is forged as they unfold (Fontanille, 2010).

We may therefore further affirm that, in concrete reality, action never stops. There is no real moment in which one ceases to act and "the doing" simply vanishes. For analytical purposes, defining the boundaries of observation is necessary to avoid drifting into an endless domain where everything becomes relevant. Practical scenes overflow their boundaries, evolve, and transform into other scenes, continuously involving other actors and other practices. Clarifying the transformational (rather than interruptive) nature of reality (Ingold, 2012) thus helps reiterate that the present analysis does not aim to provide definitive answers about mechanisms and effects, but rather to highlight how reality is far more complex, presenting itself as a sort of snapshot that delimits a scene including certain elements and necessarily excluding others.

To observe where and how instabilities in the course of action arise, what accommodations are required, which practices compete, and which strategic configurations tend to structure (or exacerbate) tense dynamics, it is therefore necessary to shift the analysis from devices to occurrences.

It is from this shift that it becomes possible to address, in an empirically grounded way, what devices often leave in the background,what we metaphorically call the "skeletons" of the project, that is what is neutralized in prescription but proves decisive in action.

## 5. Unveiling the Skeletons

"And when it comes to unveiling skeletons, who better to ask than designers, who design closets?"

With this happily borrowed quip, we now turn our attention to what actually happens, observing portions of design moments in situ.

The previous chapter sought to bring some order to what, in design contexts, is presented as a way of proceeding, prefiguring certain ways of structuring the project's progression. Such representations, however — while operational, communicable, and often indispensable, rarely describe what truly happens during design. Not so much because they "lie" in some sense, but because we have seen how they function precisely as programs, or rather as imprints that stabilize certain typical configurations of action and, inevitably, neutralize others (including returns, deviations, suspensions, and renegotiations). Fontanille (2010) clearly states that a practice never coincides with the linear application of a program, precisely because its meaning is constructed through progressive adaptation, in a permanent negotiation between programming (hetero-adaptive value) and adaptation (auto-adaptive value).

To observe tensive dynamics, we must therefore transcend static and prefigured boundaries, examining practices at the moment they encounter otherness, when the course of action is suspended, diverted, or reoriented.

To produce empirical evidence that does not remain confined to prefigurations or mere methodological declarations, I conducted a situated mini-ethnography involving designers and engineers engaged in the development of a shared product within a laboratory context. "Mini" and "situated" designate the specific boundary of the observed practical scene, understood as a fragment of the broader and more complex design scene. The moment of revision will indeed serve as our privileged window for observing and understanding those well-known "tensions" that we initially assumed to be inherent to the interaction between design and engineering practices.

We therefore return, as a theoretical and descriptive framework, to the previously introduced concept of tensive dynamics and to the Fontanillian resolution sequence (§3.2), according to which every practice, when it begins or encounters another practice, faces a gap in meaning precisely because its meaning is not yet given. It seeks an organizing schema to project onto the occurrence, thereby producing a provisional coherence between the practices involved. The effects generated by this dynamic, in relation to the alignment or misalignment between logics that determine the emergence of the initial gap, will coincide with what we directly observe and will serve as an anchor for entering this dynamic: conflicts, discussions, frictions, changes of direction, intensified gazes, shifts in posture, but also adherence to plans, relief, and agreements.

This clarification is also essential to avoid a recurring misunderstanding regarding the term "tension." We have previously emphasized that tension, understood in analytical terms, is not synonymous with conflict, friction, or disagreement, even though these may emerge as effects of the tensive dynamic without exhausting its meaning. Tension, as a structural category of meaning, instead designates an unstable state of the course of action produced by the interference between praxic logics engaged in managing contingencies, and the tensive

dynamic is the recursive form through which that instability is regulated and integrated into a new operational configuration.

In this chapter, however, we must initially operate on two registers: on the one hand, we will continue to refer to tensive dynamics as a process (gap → schematization → regulation → accommodation), that is, as a structure that transforms the course of action; on the other hand, we will initially use the term "tension" in its more common and phenomenological sense of a perceived state or effect, to refer to those initial, generic, and not yet clearly defined conflictual effects (the very "skeletons") which will serve as entry points for recognizing moments of suspension in the course of action and for delving into the tensive dynamics that bring them about.

Delimiting observation, beyond being necessary to define the field of analysis, also implies acknowledging the partial nature of what is being shown. The primary observation tool has been identified as ethnographic research, however, from a semiotic perspective, this too constitutes a practice in its own right and, according to the translation framework outlined above (§4.1), ethnography falls within the domain of research methods.

Observation, annotation, case selection, transcription, and textual rendering are practices in themselves and, above all, metasemiotic practices of description and re-representation. Fontanille recalls that the definition of practices also includes an interpretive dimension, since the practitioner is simultaneously actor and interpreter, and that practice can be grasped, in its projection onto a textual level, as self-description/self-representation. A text can exhibit a metasemiotic dimension with respect to practice, whether it belongs to the practice itself or to another practice intended to comment on it (Fontanille, 2010, p. 78). What is reconstructed in this chapter is an emergent schema recognized a posteriori, through an interpretive scrutiny that constitutes one of the conditions for the intelligibility of practice.

That said, the chapter's objective is to show how, in ongoing design processes, interferences between praxic logics generate recurrent instabilities in the course of action and how such instabilities are regulated through accommodations. In particular, how these adjustments can produce conflictual effects (discursive, praxic, and affective) that impact the project, the designers, and design itself - without reducing them to a stereotypical opposition between two disciplines or positioning them as sporadic events or mere incidents along the way.

In the following paragraphs, we will therefore proceed to describe the research design and the corpus; subsequently, the revision will be reconstructed as a practical scene (with its actors, mediating objects, and interaction regimes). Finally, a series of recurring tensive nodes will be presented, alternating episodic micro-vignettes with analytical decomposition, so as to render visible the tensive dynamics and their effects, with particular attention to conflictual ones.

### 5.1 Research design

Starting from the need to shift the analysis from devices to occurrences, a qualitative research design is constructed, articulated in two complementary but non-overlapping phases: first, a situated mini-ethnography and, subsequently, a series of semi-structured interviews with an episodic focus. Ethnography makes it possible to map the review as a practical scene and to identify where tension becomes legible in the form of discursive and affective cues. Interviews, by contrast, allow episodes and interpretations to emerge that in the review often remain implicit, compressed, or neutralized by the performativity of the situation (the review understood as a circumscribed performance when the design process is interpreted within its canonical narrative framework).

The field consists of workshop reviews of final-year students enrolled in the Design & Engineering program at the Politecnico di Milano. The sample includes mixed groups in which designers and engineers collaborate on the design of a product within a semi-academic environment oriented toward realistic design dynamics (company brief, review with multiple evaluators, technical and time constraints).

The workshop brief concerns the design of new components or systems for domestic dishwashers, proposed by a partner company. The ethnographic corpus includes 12 teams of four to five members each, with at least one engineer per group (except in isolated cases). The teams are reviewed by four reviewers, respectively two professors, a company representative, and an in-house designer. Each review lasts approximately 15 minutes.

The choice to observe groups from the final workshop of the program is linked both to their greater design maturity, this being their third experience of designing in mixed teams, and to a higher likelihood that students have already experienced tense moments in previous interdisciplinary work and can therefore produce richer accounts during the interview phase.

The ethnography is brief and focused, concentrating on the review as a “fixed point” of observation, understood semiotically as a portion of the macro-design scene in which multiple micro-practices intertwine (presenting, showing a model, justifying a choice, rejecting a proposal, sketching, etc.).

Operationally, I positioned myself as a silent observer during the reviews, occupying a sort of interlude between the frontal configuration with students-professionals on one side and professor-reviewers on the other. What emerges from the observation are notes on elements useful for describing:

- the stage layout (spatial arrangement, distribution of turns, and time management);
- the modes of project presentation (slides, 3D model displayed on screen, model in software, diagrams, simulations);
- the forms of interaction with the reviewers (opening/closing, defense/justification);
- the internal relationships within the team during the public moment of the review (who speaks for whom, who corrects whom, who takes notes, who withdraws);
- the praxic and pathemic cues (pauses, silences, reformulations, jokes, glances, changes in tone, posture, gestures).

These focal points respond to the need to observe how the unfolding of design involves a plurality of interlocutors, mediating objects, intentions, and criteria at play. The unit of analysis in this research is not exclusively the designer or engineer as such, but rather the practical configuration produced in the review, which redistributes roles, powers, evidence, and responsibilities. This approach aligns with the ethnographic literature on design engineering, which emphasizes the socially mediated and non-manualizable nature of design work (Baird et al., 2000; Bucciarelli, 1988).

The ethnography also serves as a screening phase for selecting two groups to be further examined through semi-structured interviews. The comparative selection of groups was guided by observable parameters recorded during the reviews, including team composition (balanced or unbalanced with respect to the professional figures present), project phase relative to submission deadlines, modes of interaction with the reviewers, communication tools employed (sketches, models, technical explanations, etc.), internal relationships, and signals of disagreement or harmony (pauses, silences, reformulations, jokes, glances, changes in tone).

The expectation was to identify at least two groups differentiated by their internal dynamics: a "harmonious" group, characterized by fluid collaboration and the absence or limited presence of overt conflicts, and a "tense" group, marked by frequent misunderstandings and negotiation clashes. This allows the variability of dynamics to be addressed without assuming a priori that tension is the only possible mode of interaction.

After selecting the two groups, I conducted semi-structured interviews with them, designed to elicit moments of tension through episodic accounts, without immediately imposing a critical framework that might rigidify or censor the narrative. The methodological reference is the episodic interview (Flick, 1997), which enables a more natural emergence of relevant episodes, allowing "tensions" to arise directly from the accounts rather than from questions that presuppose them.

For conducting the interviews, I adopted a two-step structure:

- First, a conversation with the group as a whole, aimed at reconstructing the overall progress, roles, working methods, and status of the project, as well as introducing the research without explicitly revealing its objective (which would have risked shaping expectations about the questions asked);
- Then, brief individual interviews were held to explore in greater depth "sensitive" episodes, reducing the pressure of the collective setting (where participants might have moderated their discussion of disagreements or mutual judgments).

The interview script functioned as a flexible guide, structured around an initial sequence of questions defining who the members are and what they are designing, followed by questions addressing changes in direction, decision-making blocks, modes of agreement, difficulties, and moments that "remained imprinted" during the review process. If a point of friction emerged during the conversation, the line of questioning was redirected to explore it further through direct narration. It is noteworthy that even the researcher is not free from emerging

patterns: in this case, the interview structure also adapts to contingencies and unexpected information, strategically guided by a principle that favors the emergence of tense events through the real-time reconfiguration of questions (hence its “semi-structured” nature).

The material underpinning this chapter includes both ethnographic notes and annotations collected during the 12 reviews, with particular attention to praxic, discursive, and affective cues, as well as recordings and transcripts of the semi-structured interviews conducted with the two selected groups (with prior consent from each member of the two interviewed teams). These interviews aimed to identify episodes and reconstruct narratives of moments perceived as “tensional.”

In the text, the groups are identified by numbering (Teams 1–12) to ensure clarity and comparability. Finally, it is important to reiterate that all the material presented is already shaped by practices of description and re-representation. Notes, transcripts, and the interviewees’ accounts themselves constitute metasemiotic texts that participate in the construction of the analytical object. Precisely on this point, the Fontanillian framework clarifies that the reconstructed emerging schema is always a construction (economical and optimized) that reduces heterogeneity in order to bring out the constituents and syntax of a meaningful practice (Fontanille, 2010).

### 5.2 Revision as a Practical Scene

To make tension dynamics observable, we take the moment of revision as the analytical scene: a relatively circumscribed portion of the macro-design scene in which the course of action is publicly exposed, questioned, and, to some extent, redirected. The choice of revision over a comprehensive analysis of the entire design process is justified both by a contained research investment and by the definability of the event under analysis, which consequently ensures greater simplicity in its treatment.

Revision is a particular, compressed, and performative scene, in which many things are made visible and many others are silenced. It should be regarded as a privileged scene because it renders, within a bounded and easily analyzable portion, some of the fundamental operations described earlier — such as the opening of gaps, negotiation, the production of orientations and, above all, the transformation of the project from an object “proper” to its designer into an object that is “exposed” and therefore potentially re-founded.

From the perspective of a semiotics of practice and drawing on Fontanille’s model, what matters here is treating revision as a descriptive unit in which relatively stable instances (operator, act, objective, strategic horizon) and syntagmatic links organizing the course of action can be identified. In this perspective, revision is understood as a practical scene that articulates at least two other scenes in relation to the subjects involved: that of the designer (with their routines, constraints, and strategies) and that of the evaluator (with their criteria, expectations, and powers of confirmation or refutation).

We will therefore proceed to analyze the elements composing the scene and their relationships, paying particular attention to the intertwining of multiple actors, the objects employed, the practices and strategies at play, and a single object of value which coincides with the artifact to be designed.

### 5.2.1 The Minimal Syntax of "Reviewing"

The first finding that emerged from observation is that, despite the diversity of teams and project contents, revision tends to repeat itself according to a recurring and recognizable syntax: the group begins to explain → the reviewer intervenes → negotiation takes place → a verdict is reached that orients the outcome of the review and implies possible modifications.
This minimal syntax is important for two reasons. First, it establishes common ground. Through this recurrence, it becomes possible to compare reviews without transforming them into twelve excessively detailed individual accounts. The interest of the following research extends beyond the specificity of each project and lies in the structure of the course of action that enables certain articulations of practices (comments, objections, requests for evidence, requests for reformulation) and, consequently, certain types of effects (stiffening, "forced smiles," accelerations/decelerations, changes in posture, etc.).
The second reason is more theoretical, as this syntax demonstrates how revision functions precisely as a site of discontinuity. This characteristic has already been addressed in the mini-example of a hypothetical review between a designer and an engineer (§3.2), where it introduces a gap between a stabilized form of the project (e.g., a CAD model) and a set of constraints/criteria that call its validity into question, opening up multiple alternative scenarios (rejection, negotiation, reformulation, etc.).
Within this discontinuity, we observed the tensive dynamic that begins with the opening of a gap in meaning, generated in this case by the interference between two non-aligned praxic logics. The artifact that until a moment before "stood upright" (at least for the person presenting it) is re-problematized, requiring schematizations, adjustments, and accommodations to allow the course of action to continue.
We also clarified that the interfering praxic logics do not correspond exclusively or entirely to professional roles, since the latter represent only one way of acting within the scene, but not the only one. Consequently, the way in which the elements of the scene relate to one another is reformulated (precisely identifying this relation as a praxic logic).

### 5.2.2 Actors, Roles, and Instances

Observed as a practical scene, the review makes evident the non-biunivocal nature of praxic logic. The actors who embody the practice are multiple, and the roles of designer and engineer are insufficient to describe what occurs, nor are they the only roles assumed by each operator. During the review, actors take on much more specific and situated roles: presenter, advocate, technical translator, annotator, negotiator, silent observer and, on the other side, reviewer, evaluator, solution proposer, the one who introduces incongruity, or even simply the one who implies it.

During observation, this aspect emerges in an extremely concrete way. In Team 10, for example, the presentation is highly structured, to the point that it appears carefully rehearsed during the explanation, almost recited. The two designers lead the presentation, while the engineer intervenes when the scene requires it, typically when needed or when

technical components are addressed, and the other members remain more silent. In other teams, however, the engineer may speak more frequently because the nature of the project is strongly technical (understood as a greater focus on mechanical and constitutive relationships among the various components to be modified or implemented), or the group may alternate roles more symmetrically.

This redistribution of roles corresponds to what Fontanille (2010) means when he argues that signs, texts, and objects can be integrated into the scene as figurative manifestations of canonical instances (operator, objective, horizon) or of the bonds that connect them, and that practice is not the sum of individuals but a configuration in which modal roles (knowing how to / being able to / having to / wanting to) are distributed and negotiated throughout the course of action.

On the reviewers' side, the scene is similarly structured: four figures (professors and company representatives) appear united in evaluating the work and proposing/justifying requests for modifications. Here too, a sort of collective agency emerges, alternating between confirmations, refutations, suggestions, and requests for evidence. Cohesion was particularly visible among the professors, likely driven by a shared interest not only in the project's success but also in the learning process and the productive professional/experiential growth of team members (i.e., students who learn and gain experience through co-design). In several cases, it was easy to observe how the two professors would discuss the multiple variants of each individual project and the potential constraints and possible modifications to one or another potential use scenario (feasible/unfeasible, realizable/unrealizable, functional/defective, etc.).

On the company side, however, comments were more moderate and the interest slightly different, oriented toward the selection (at the end of the workshop) of one or two of the best projects to be subsequently refined for potential production.

It is crucial to consider how this dual cohesion (team on one side, reviewers on the other) does not eliminate internal tensions but simply makes them less expressible, more subtle, and more reliant on cues that the observer must grasp or interpret. Each stakeholder in fact has a different vision and understanding of the project, and is characterized by specific forms of investment (each has a different wanting to do, knowing how to do, being able to do, and having to do). For example, within the same design group, internal "factions" may form that are inclined to defend one idea over another. These relational dynamics can emerge when the reviewer comments on or implies greater validity or preference for an idea proposed by some team members over another, even though groups often presented themselves as a single body defending or proposing the design decisions made up to that point. In such cases, grimaces, changes in posture, variations in the pace of explanation, and shifts in gaze among the members involved become visible, revealing on one side the "winners", whose project expectations appear aligned with the reviewers' approval, and on the other the "losers," who must now either align themselves or accept the new project trajectory, barring further unforeseen events or changes in direction. The perceived complicity and cohesion present at the outset further unravel during individual interviews, where different positions emerge regarding project intentions and perceptions of the review's outcome (and consequently the modifications to be made to the project).

### 5.2.3 Space and Time

Reviewing is also, quite simply, a highly defined space–time scene, and this definition is part of its meaning. Each team has approximately 15 minutes, and the session takes place entirely within a classroom, in a configuration of desks joined together to form a “macro desk,” with designers on one side and reviewers on the other, facing each other. Mangano (2008, p. 54) states that “space ... is the place where a complex system of relationships is produced that are a prerequisite for any other investment of meaning.” With respect to space and desks, it is worth revisiting the opposition between the cognitive and pragmatic dimensions, and how the “macro desk,” which appears to function merely as a surface supporting review activities, also mediates the practices unfolding in the scene and, in some ways, informs us about the way reviewing is conducted and about the subjects involved through the unidirectionality of the interface.
Returning to space–time compression, it produces at least three significant practical effects.

1. Expectation and urgency: the team enters the scene with expectations (usually concerning “how the review will go” and “how solid” their presentation is). When the outcomes do not match these expectations, the emotional state shifts, and the weight of the subsequent work is immediately perceived. It was previously noted that passions can be understood as one of the most evident ways in which tensions manifest. A recurring pattern observed in nearly all teams is precisely the perceived change in state when preferable modifications or changes in direction are proposed or implied, directly proportional to the team’s subsequent effort and to the chain of investments that such changes prefigure.
2. Visibility regime: everything that is said and done occurs before an evaluative instance. This encourages “orderly” and persuasive forms of presentation and can inhibit the display of internal conflicts or group relational dynamics (which often emerge only as micro-signals during the review).
3. Segmentation of the course of action: the review functions as a “junction” that divides the macro-scene into a before and an after, producing a threshold (“up to now we have done it this way”; “from now on we must change”). In this sense, the review is a device that re-segments the design process and realigns its horizon, even when the comments remain vague and therefore destabilizing.

In each case, we observe how the review constantly puts the objective of the practice (the current state of the design outcome) in tension with a broader strategic horizon (feasibility criteria, educational criteria, business criteria, use prospects). This tension can generate performance-oriented objectives, compromise-based objectives, or even unrealistic objectives that must subsequently be reformulated.

### 5.2.4 Mediating Objects and Evidence

Another point that inevitably becomes central during the review concerns the status of the designed artifact, which coincides with the object of design and thematizes this portion of the design scene. In the observed setting, the artifact does not yet physically exist except as a proposal under definition, and yet it is already treated as if it were coherent, functional, and justifiable. For this reason, the object "lives" through a constellation of mediating objects such as presentations, 3D model screens, cross-sections, diagrams, graphs, equations, sketches on paper or on screens, 3D-printed prototypes, and gestures that mimic mechanical movements.

These are not simple communicative media - intermediaries between the communicator and the listener - but constituents and mediators of the scene: writing tools and inscription-support objects, together with the space-objects that localize the moment of the review.

Here the dual nature of representational devices is clearly visible (§4). On the one hand, they steer the discussion by making certain aspects immediately tractable (for example, 3D model sections that show interference between components, simulations that confirm performance, or graphs that render the project's feasibility plausible or justified). On the other hand, it is evident that these devices often perform a persuasive function. Technical representation tools such as equations or graphs may serve more to convince reviewers than to genuinely demonstrate functionality or feasibility, especially when the listener lacks the tools, specific knowledge, willingness, or time to examine them in depth.

Sketching deserves separate attention because, recursively, it emerges as a key object of negotiation, referring to its minimal operational requirement (all that is needed is something to draw on, something to draw with, and the prerequisite skill of drawing to describe). In Team 8, for instance, a comment on a critical component leads to negotiation, and, to clarify the issue, the group is asked to sketch the idea precisely because the problem concerns interference between a designed component and an existing one. In other cases, the sketch functions as a tool for clarifying the feasibility or coherence of a modification, making it possible to imagine an as-yet untested mode of functioning and thus producing provisional evidence that allows the course of action to continue. In all cases, the sketch reactivates or reduces potential by actualizing, through graphic clarification, a series of possibilities. This point is delicate because the sketch does not physically resolve reality but rather allows its absence to be managed, that is the fact that the object is not yet physically present. In terms of tensive dynamics, it is a concrete way in which practice attempts to fill, at least locally, a gap in meaning, reducing uncertainty sufficiently to enable an operational decision.

The same reasoning applies, at varying levels of coherence, to all object-tools used during the review that relate to the artifact being designed.

### 5.2.5 Observable Effects

It is useful to conclude this reconstruction of the scene by highlighting another recurring empirical pattern: reviewers' comments often act as triggers for visible transformations in the group's state.
In Team 10, after the reviewer's final comment (perceived as "general guidelines" concerning unconvincing technical points), we observe that members immediately become more serious, in the sense that they change their pace of explanation, posture, gaze, and tone of voice. We clearly perceive that state of "tension" linked to the subsequent effort required to implement changes. In Team 8, perceived "tension" increases after the final non-confirming comment, and from their expressions one can further sense the effort needed for future adjustments; the designer who most strongly led the discussion appears the most affected. In other teams, more generally, "tension" is directly proportional to the severity and potential scope of the changes implied by the comments, especially when these concern technical aspects. It is also noted that such comments are more informative, both in terms of possible confirmations and in terms of changes in direction or modifications, as they directly indicate specific areas or parameters for intervention.
All these signals, however subtle, make different levels of practice perceptible (practical, discursive, affective) and demonstrate how affects participate in regulating the course of action and in restructuring the project.

## 5.3 Nodes of Tension

We have just outlined all the elements necessary to define the moment of the design review as a practical scene within the complex macro-design scene in which designers and engineers collaborate, and we have examined its stable forms through ethnography.
We will now proceed to isolate a series of recurring nodes of tension, considering both the ethnographic notes concerning the various groups involved and the interviews conducted with the two selected teams, in order to render observable the dynamics of tension and the conflictual effects produced by its resolution.
The decision to proceed by nodes is consistent with the semiotic approach to practices adopted in this thesis. The aim is to describe recurring configurations of interference among logics, criteria, roles, and mediating objects, showing how they generate instabilities in the course of action and how such instabilities are regulated through accommodations (Fontanille, 2010), while adhering to the principle of immanence of the levels of analysis described and avoiding the production of psychological portraits on a group-by-group basis.
What follows will therefore consist of an alternation between ethnographic micro-vignettes (what is observed during the review) and echoes from the semi-structured interviews (what participants recount and reinterpret).

### 5.3.1 The Comment as Opening Gap

One of the most evident patterns emerging from observation is that the reviewer's comment, especially when it concerns critical components or calls into question the overall soundness of the idea, functions as a recurring trigger of instability. Rather than constituting the mere reception of feedback, it represents a moment in which the current state of the project is reformulated as insufficient, ambiguous, or not yet convincing, and thus returned to the team as a situation to be reopened.

The observed case of Team 8 is particularly clear in this respect. During the review, a comment on a critical component leads to a negotiation between the reviewer and the members; the remark made by one of the two professors is perceived as "continuous but not confirmatory," despite an explicit request to fix the problem. Precisely after this passage, the (phenomenal) state of "tension" increases, and its variation becomes perceptible through glances, grimaces, and, above all, through the perceived weight of the subsequent work required to restore that part of the project.

Something similar is observed in Team 10. The initial presentation appears highly programmed and controlled, orderly, well prepared, with a clear distribution of voices, but after the reviewers' final comment - which combines general guidelines and technical clarifications - an immediate shift in the expressions of individual members becomes visible: they grow more serious; posture, gaze, tone of voice, and pace of explanation change. Here too, the perceived "tension" does not coincide with explicit confrontation but rather signals an imminent reorientation of the course of action, marked by the effort of future modification (which encompasses other practices and other scenes within the broader design process) that will follow the review and restructure the course of action. It is also noteworthy that the emotions through which tension becomes perceptible are not a direct result of the reviewer's comment but rather a transformation of previous states in relation to the practices currently unfolding.

Team 5 (subsequently selected for interview) exhibits an even more intense form of the same mechanism: the reviewers' comments do not directly refute the project but instead call it into question in a substantial manner ("not very effective," "not very convincing"), to the point of suggesting that the overall idea pursued up to that moment "does not hold up" from a design perspective.

The interesting point here is twofold. On the one hand, the group's state of tension increases; on the other, the final comments are perceived as relatively vague, that is, they do not provide a clear direction for modification and leave the team with a broader gap to fill. The outcome is so destabilizing that one member is described in the notes as "extremely affected" by the result of the review.

This set of scenes allows for an initial clarification. First, the reviewer's comment does not automatically produce conflictual effects. Rather, it produces a suspension of evidence: what appeared to function must be re-argued, redesigned, and at times redone. The reviewer often acts as an instance that renders a gap in meaning manifest and compels the group (as an embodied and collective instance mediating the design practice) toward renewed schematization and regulation. The substantial difference emerging from the observed cases lies in the quality of the gap opened - and thus in the interfering logics involved: specific

technical comments tend to have a stronger impact on the emotional state, yet they are also more "tractable," as they provide operational footholds; vague comments may appear less aggressive on the surface, but they open up a zone of indeterminacy that is more demanding to govern.
More precisely, one of the most recurrent conflictual effects is not direct confrontation between the team and the reviewers, but the production of a misalignment between the team's expectations and the outcome of the review, manifesting as pathemic intensification, rigidity, and the forced reorganization of priorities.

### 5.3.2 Tools and Provisional Tests

A second recurring node of tension concerns the role of mediating objects and, more specifically, the way they are mobilized when the project enters a phase of uncertainty or contestation. As previously observed, during the review the designed artifact "lives" through supports and representations (CAD models, screens, cross-sections, graphs, equations, sketches, gestures).
In the majority of the teams observed, this node is significant: as soon as problems or uncertainties emerge regarding the configuration of the component or assembly being presented, the negotiation is mediated by a sketch requested by the reviewers. This step is recognizable and immediate, and it becomes clear how the sketch serves to understand a problem without the object being physically present—thus enabling the team to imagine and render a configuration open to discussion. The imaginative effort is high precisely because the work concerns an object that has not yet been realized, and the sketch functions as a local, temporary test, sufficient to move the discussion forward.
The same applies, in a less obvious form, to cases in which negotiation relies on gesture. In the reviews of some teams (e.g., Team 7 and Team 9), members use bodily movements to mimic rotations, translations, amplitudes, and trajectories of components, often in combination with sketches and screenshots of the model. Here, gesture actively participates in constructing the meaning of the mechanical action and in the provisional assessment of its plausibility.
Another dimension concerns technical devices of confirmation/justification (equations, graphs, simulations). In some teams (e.g., Team 4 and Team 6), such devices are used to strengthen the credibility of certain choices or to demonstrate the feasibility of the project without entering into the full detail of the technical reasoning. We have indeed observed how, in certain cases, their use is more persuasive than demonstrative, insofar as it activates a regime of trust between the one who explains and the one who listens.
This node also re-emerges in the interviews, though in a less institutionalized form. In the conversation with the engineer from Group 5, for example, an interesting element appears (in the etymological sense of "sympathetic"): during the review it remains invisible, yet it directly affects the course of action: the 3D parametric modeling software crashes during simulations, generating frustration and delays. This episode is distinctive in that it shows how even the technical tool, often treated as neutral, enters the dynamic of tension as a

contingency to be accommodated; affect (frustration) accompanies the technical operation and conditions its pace.
From an analytical perspective, this second node allows us to refine the distinction proposed in Chapter 4 between devices and practices in action. Objects (sketches, models, simulations, graphs) are sites where practice is adjusted, persuaded, challenged, and realigned. The evidence requested or provided is never exclusively oriented toward verification; rather, it operates within processes of negotiation and renegotiation. Precisely for this reason, depending on the case, it can become either a resource for clarification or a point of intensification of tension.

### 5.3.3 Endogenous Methodological Misalignments

A third, particularly relevant node concerns misalignments in the team's ways of proceeding. This is the point at which the interviews allow us to more clearly dismantle the stereotypical explanation of conflict as a simple opposition between "design logic" and "engineering logic." Indeed, the data show that some of the most marked conflictual effects emerge among members with the same background, beginning with differences in workflow, decision-making criteria, and styles of managing the design process.
In this regard, I will discuss the specific case of Team 10, the second team selected for interview. When asked about design methods and methodologies, two designers described their approach as systematic, constrained, and rational, guided by "a series of whys" that led to the establishment of constraints. They also reported friction with another designer, whose way of designing was perceived as more open, more instinctive, and less aligned with a shared workflow. They described it as "almost artistic" in a disparaging sense, implicitly invoking the opposition between art, design, and engineering and the status attributed to that opposition. The divergence in their ways of operating led, within this team, to frequent frictions, inconsistencies, slowdowns, and even avoidance behaviors.

This finding is theoretically relevant for at least two reasons. First, it shows that conflictual effects do not necessarily arise from the concurrence of design and engineering, but can instead stem from interference between different regimes for conducting the same practice (in this case, different ways of "doing design"). What enters into tension here are action syntaxes and modal hierarchies (How binding is a constraint? When is a choice considered blocked? Who is entitled to relaunch an alternative?) rather than generic professional backgrounds.
Secondly, the resolution of these tensions often occurs through pragmatic accommodations that do not amount to a convergence of design approaches. The interviews reveal, for example, how in some situations the reviewer's mediation is taken up as an external authority capable of closing the conflict (as one participant put it, "abbassiamo le corna"), or how some members deliberately choose to step aside, even without fully agreeing with the chosen direction, in the name of the principle of contribution and the need to move the work forward.
A particularly interesting feature of this team concerns precisely this principle of contribution, understood as a syntagmatic organizing principle that is collectively agreed upon yet asymmetrically shared among members, according to which each person should

“put their own” into the project, so that the final artifact “speaks” of each in terms of their contributions and design intentions.
More generally, the observed node does not revolve so much around “who is right,” but around the regulatory economy the team manages to construct. It is precisely here that the analysis of practices makes it possible to describe the moment in which, in this specific case, the tension dynamic opens up (through interference between workflows), how it manifests itself through accommodations (frictions, slowdowns, avoidance), and how it is handled through the projection of organizing schemas onto regulation (external authority, strategic renunciation, tacit distribution of decision-making domains), without forcing the collected material into a pre-inscribed dualism

### 5.3.4 Roles, Recognition, and Legitimacy

A fourth recurring node concerns the distribution of roles and, above all, the recognition of one’s position within the practical scene. The interviews clearly reveal that part of the perceived tensions does not directly concern the designed object, but rather the way in which each member succeeds (or fails) in inscribing their contribution into the project and having it acknowledged.
In Team 5, a designer describes herself as a kind of “wild card,” as she takes care of graphics and presentations, contributes to the modeling of certain components, the drafting of the functional diagram, and the technical drawings, yet also expresses a desire to play a more “fundamental” role in other practices. This passage is significant because it highlights a tension of legitimacy internal to the scene: What status does my work have in relation to the parts perceived as more central?
The same designer, in other moments of the interview, recounts having sometimes felt not fully understood at the beginning of the project, but retrospectively interprets the situation as a combination of personal perception, insecurity, and group structure. In some cases, she chose to “let it slide” when the issue did not compromise the overall professional collaboration. This constitutes a clear example of relational accommodation, in which tension is modulated so as to allow the course of action to continue.

On the opposite side, the interview with the Team 10 engineer reveals an almost mirror configuration. In this case, the participant emphasizes how the group relies on her for the technical dimension and how, if she did not perform that task, “no one else would,” since it requires specific competences in which other members feel lacking. Here, the role is strongly recognized; yet for precisely this reason, it becomes a point of pressure and asymmetrical accountability.
The same interviews also bring to light tensions related to the management and organization of the group. Some members implicitly refuse to assume the role of “manager” who distributes tasks to others and experience as burdensome the need to carry out their own work while simultaneously organizing that of the group. In this case, the conflict revolves around the definition of who should take on the metapraxic function of coordination.
This node shows that a significant share of conflictual effects arises when the practical scene produces asymmetries of visibility, centrality, or burden among members. In Fontanillian

terms, it concerns the redistribution of instances and connections between operator, objective, and strategic horizon (e.g., who is authorized to decide? who is required to justify? who is overlooked? who absorbs the cost of integration?). Disciplinary labels are insufficient here as well; it is often the position actually occupied within the course of action that generates the tension node.

### 5.3.5 Axiological Trade-offs

A fifth recurring node concerns trade-offs between different value criteria and the way in which such trade-offs generate blockages and reorientations. Compromises are, of course, foundational and necessary within relational dynamics; however, the interest here lies not merely in highlighting their recurrence, but in describing how compromise emerges as the outcome of a tense dynamic in which multiple strategic horizons - such as technical feasibility, innovation, coherence of use, quality of presentation, laboratory requirements, available time, and costs- compete with one another.

In interviews with members of Team 10, for example, several signs of this axiological plurality appear. On the one hand, they recount at times heated discussions about how users should interact with the product, described as long and unproductive debates. On the other, they recall a very negative review after which the group had to consider starting over from scratch, with a direct impact on the timeline and the delay already accumulated.

In other passages, however, it becomes clear that regulation does not occur solely through external imposition. It can take the form of a pause, a suspension of debate, followed by the construction of an “acceptable” compromise based on criteria of cost and logic, sometimes accepting the sacrifice of certain aspects in order to preserve the overall coherence of the project within the laboratory’s constraints.

Noteworthy is the rereading of the review by a designer from Team 5 - the same one who appeared extremely distressed following the reviewer’s comment. While acknowledging perplexity and skepticism regarding some decisions, she admits to having interpreted the reviewers’ feedback as useful and even positive, since, in her view, it enabled a shift of focus after a phase in which the team had concentrated primarily on the engineering demonstration (simulations, fluid dynamics, functionality) and less on the communicative dimension of the project (an aspect the reviewers had asked to be emphasized more strongly). Here, the feedback takes the form of a device for realignment between value axes, moving beyond the status of mere judgment. Other members of the same team, however, interpreted the very same comment in a diametrically opposite way.

This constellation of episodes shows that the observed conflicts cannot be reduced to a single opposition (e.g., “aesthetics vs. technique”), but rather stem from variable combinations of axiological orientations that become dominant at different moments in the process. Practice does not pursue a single, transparent objective; instead, it continually produces locally optimized configurations that allow the course of action to continue without fully eliminating the heterogeneity that generated them (Fontanille, 2010).

### 5.3.6 Extra-project Factors

A sixth node, decisive for the overall interpretation of the research, concerns what we might call extra-project factors: personal histories, linguistic conditions, relocations, pre-existing relational structures, and character incompatibilities are among those observed. The interviews clearly show that these elements, reasonably considered background noise when analyzing a linear syntax of design practice and consequently neutralized,never remain outside the design process. Rather, they enter the practical scene and contribute to modulating the tension dynamic and its effects.

A particularly eloquent passage is the account of a designer describing a previous project experience marked by tension with a teammate, in which linguistic difficulties functioned as a genuine blockage, contributing to making the design process "quite tense" and negatively affecting both interpersonal relationships and the project itself. In this case, tension cannot be attributed solely to professional roles; instead, it results from a combination of barriers that had little to do directly with design activity.

Another noteworthy passage concerns the same designer's statement that "a year ago she wasn't the person she is now," and that in the same situation today she would likely have reacted differently. This detail is important because it introduces a temporality of relational competence. The project evolves in the unfolding of practice, just as the practitioners who embody it evolve, with consequences for how tension is perceived, expressed, and regulated.

If conflictual effects can be amplified or attenuated by extra-project factors, then it becomes even less tenable to attribute them mechanically to a presumed ontological incompatibility between design and engineering. More accurately, the tense dynamic of interdisciplinary design is always situated and takes shape in the intertwining of professional practices, actual roles, various devices, and personal experiences. In precisely these terms, we previously specified that praxis logic, understood as the internal functioning of a practice that expresses the way in which the elements composing a scene relate to one another, does not coincide exclusively with professional role. Different modes of action, not directly linked or reducible to a professional sphere, can naturally influence how practices are conducted, and the principles and pressures that regulate them will structure different compositions of practice.

It may seem counterintuitive or even destabilizing, especially if the analytical focus is meant to remain on the design stage, to acknowledge the capacity of extra-project factors to strongly direct the course of a scene. Yet the ethnographic material shows that the frequency and weight of their influence vary from case to case. The distribution observed was indeed variable: in a few rare instances, planning was strongly affected by extra-project causes (for example, in one group, personal circumstances led to the systematic absence of certain members, generating a redistribution of tasks and increasing the burden on each individual); in many other cases, these factors were confined to specific moments or emerged through direct narrative, yet were managed through a prioritization of project-related events. In all cases analyzed, however, no team was exempt from the presence of these dynamics.

To affirm this does not mean dissolving the analysis into an "it depends on everything," but rather recognizing that the meaning of practice emerges from concrete accommodations within a far more complex scene, and that the affective level participates in this emergence as a structuring component of the course of action.

### 5.3.7 Initial Reconstruction of Results

Through ethnography and interviews, conflictual effects emerge recurrently under at least six conditions:

1. when a review opens a gap in meaning and forces a reorientation of the project;
2. when objects (sketches, models, simulations, graphs) fail to quickly stabilize shared evidence or, conversely, become sites of friction themselves;
3. when team members operate according to non-aligned workflows and decision-making criteria;
4. when the distribution of roles produces asymmetries of burden, centrality, or recognition;
5. when axiological and modal pressures (feasibility, innovation, communicability, time, costs, course requirements) enter into competition;
6. when extra-project factors (language, personal histories, stress, personalities) evidently interfere with the conduct of action.

The most theoretically relevant point is that none of these conditions can be reduced to the simple designer-versus-engineer dichotomy. On the contrary, the research shows that tension is often generated within the concrete practical configuration itself, and that disciplinary affiliations become operational only when mobilized within that configuration. This is why, in the examples presented, we find both cases of effective understanding between different profiles and marked friction between members sharing the same background.
We can therefore conclude that the empirical results do not disprove the thesis hypothesis. Rather, they show that tensions between design and engineering practices do exist, yet they rarely manifest as a “pure” clash between two professional essences. More often, they emerge as local effects of a tense dynamic that traverses a much denser scene, involving a plurality of actors, objects, strategies, affects, and values that co-construct the project in progress.

## 5.4 Interpretative Synthesis

At this point, it is possible to respond to the question that guided the research: what renders the tensive dynamic of interdisciplinary design empirically observable, and in what sense the conflictual effects that emerge in the observed scenes can be interpreted as products of this dynamic.
The research conducted obviously does not provide a complete map of collaboration between designers and engineers. What it allows, in a far more circumscribed manner, is to show how tension becomes legible within practices in action when the course of action encounters discontinuities, resistances, relaunches, redefinitions, and is compelled to produce accommodations in order to continue. The framework discussed in the previous chapters (§4) is thus confirmed with regard to how methods and methodologies can orient, program, and render a process circulable and teachable, yet do not fully exhaust its meaning, which is constructed in the situated regulation of occurrences (Fontanille, 2010).

The first result that emerges clearly is that the review effectively functioned as a privileged practical scene for observing these dynamics, insofar as it places the project in a position to be publicly re-problematized, exposing it to evaluative demands, testing its provisional consistency, and compelling the team to reposition itself with respect to criteria, constraints, and priorities. For these purposes, the review functioned as a device of re-segmentation of the course of action, a threshold that both separates and connects a before (what the team has stabilized) and an after (what must be negotiated).

The second result concerns the relationship between the tension dynamic and conflictual effects. The collected materials confirm that the moments perceived as "tension" by participants (frictions, arguments, changes in tone, stiffening, blockages, feelings of heaviness or frustration) do not coincide with the tension dynamic itself, but rather constitute its phenomenal traces. The distinction introduced earlier (§3) thus finds fairly clear empirical support here. In reviews, for example, the observable effect may be minimal (a glance, a grimace, a change in tone of voice), while the transformation triggered is in fact much deeper, involving the reopening of part of the project, the redistribution of tasks within the team, possible shifts in criteria guiding the practices, recalibration of axiological weights, or returns to previous decisions. Conversely, interviews recount episodes of very heated discussions that, from the standpoint of the design process, lead to relatively rapid and localized accommodations. In both cases, what proved analytically relevant was not so much a description of the apparent intensity of the conflict, but rather the regulatory work that enables the course of action to proceed.

The third finding, perhaps the most important, is that the observed conflictual effects cannot be satisfactorily explained as a simple opposition between individual design and engineering practices. The data instead reveal a more complex and, precisely for this reason, more nuanced situation: tensions emerge where different value criteria, non-aligned praxic logics, asymmetrically distributed roles, more or less effective mediating objects, time constraints, reviewers' expectations, and extra-project factors intertwine. In some cases, this intertwining actually takes on a form that participants interpret as a difference between "more engineering" and "more design" approaches; in other cases, however, marked misalignments arise even within the same disciplinary affiliation. Empirically, the existence of tensions between design and engineering practices is not denied. These tensions operate as praxic logics that become relevant only within a situated configuration of actors, objects, values, and strategies.

This point also allows us to clarify a possible objection. Arguing that conflict does not depend solely on disciplinary opposition does not mean dissolving the analysis into a generic dependence on any single factor. On the contrary, it is possible to identify recurring conditions under which conflictual effects tend to intensify, such as the emergence of instability triggered by comments; the insufficient (or excessively persuasive) effectiveness of evidence mediated through sketches, models, and simulations; misalignments in the way work is conducted; asymmetries of recognition and responsibility; competition between value axes; and interference from extra-project factors. These typical conditions constitute an initial

empirical framework for understanding how the tensive dynamic materializes within the observed practical design scene.

Another element that emerged concerns the role of mediating objects. All the observed reviews consistently show that sketches, CAD models, graphics, simulations, gestures, and presentations - usually considered representational supports or tools for presenting the project - actively regulate the course of action. They make it possible to question what is not yet present as a finished object, to transform intuitions into proposals, and to produce sufficient local evidence to make provisional decisions. At the same time, they can become sites of tension when they fail to clarify adequately, when they do not function as expected, or when their interpretation remains ambiguous. We can affirm that devices are part of the operational syntax of practices and directly participate in the construction (and management) of tension.
An equally important remark concerns the affective level. The observed or narrated emotional states do not appear as mere psychological reactions to a pre-existing process but as components that affect the regulation of the course of action itself. It is possible to directly observe how the pathemic level constitutes one of the ways in which practice organizes, deforms, stabilizes, and reorients itself, particularly when the transformation of affective states is embedded within the path toward resolution.

That said, it is also useful to clarify the limitations of the research - repeatedly emphasized so many times that it became a form of ritualistic caution - as they are integral to the meaning of the findings. First, focusing on the review privileges a highly interactive and evaluative scene but leaves out large portions of ordinary work (daily micro-decisions, moments of asynchronous work, informal exchanges, silent practices) that could reveal other forms of tension. Second, the interviews are retrospective and therefore inevitably reorganize events into narrative form. What emerges is already the result of a metasemiotic practice of selection, hierarchization, and interpretation of an emerging pattern, both by participants and by the researcher.
The reconstructed scenario of the review has proven to be an empirical and descriptive framework capable of supporting the argument that the conflictual effects observed in interdisciplinary design are better understood as local outcomes of tensive dynamics that traverse heterogeneous practices rather than as automatic consequences of opposing disciplinary identities. From this perspective, conflict changes its status, becoming a privileged indicator of points at which the course of action has had to (or has not yet succeeded in) producing a sufficiently shared accommodation.

## 6. Conclusions

This thesis originated from a question that was simple only in appearance, emerging from the experience of the Design Engineering course: where do those moments of friction, misunderstanding, and suspension that recur in shared design between designers and engineers actually come from, and how do they impact the project itself?
Over the course of the research, this question gradually shifted from a formulation centered on disciplinary differences to a more precise one, one that involved a direct semiotic translation from disciplines to practices, oriented toward observing the unfolding scenes and the tensive dynamics that traverse them.
First, it was shown that tensions between design and engineering exist, but they should not be understood as the effect of an ontological opposition between the two disciplines. The tensive effects activated by this dynamic are inevitable and constitutive conditions of the course of action. In a sense, regardless of its development, it is we (or others) who decide and evaluate whether what occurred can be considered positive or negative, without presupposing an internal charge even before these moments unfold. As introduced at the beginning, all these scenes may at times appear problematic and demanding, yet over time they can be reinterpreted as foundational moments in the professional path of a planner, engineer, or designer.
We have also had the opportunity to observe the unconditional recurrence of these effects beyond the actual role of practitioners. What we identify as tensions emerge from local effects of situated practical configurations in which actors, roles, criteria of validity, temporal constraints, expectations, and affective states are intertwined.
These effects become visible as more or less evident phenomenal traces that we must grasp, and they reveal a deeper regulatory work that concerns the overall progression of the course of action.

The semiotics of practices has made it possible to describe these phenomena without reducing them to individual psychologies, standardizations, or pre-given situations, and without resorting to explanations drawn from other disciplines. The adoption of the notion of tensive dynamics (and of the related resolution sequence) has enabled the collected episodes to be read as significant passages in the construction of the project. From this perspective, even what is commonly treated as noise or contingency within instructional practices and objects becomes analytically relevant, insofar as it participates in the regulation of the scene.
Pauses, gazes, stiffening, hesitations, changes in tone, but also relief and rapid realignments now emerge as an essential part of the design process.
What has been argued in this thesis therefore calls for a shift in perspective. If conflict is interpreted solely as a relational failure or as incompatibility between designers and engineers, the risk is that of seeking generic solutions (more methodological alignment, more coordination, more control) without interrogating the concrete scene in which friction arises. If, instead, it is understood as an indicator of points where the course of action has not yet produced a sufficiently shared accommodation, then it becomes possible to intervene more specifically, perhaps by clarifying criteria, redistributing responsibilities, reformulating

evidence, working on the translatability between different registers (technical, formal, communicative), and acknowledging the structuring role of the affective level.

The question of the role of the design engineer, as well as the professional role of individual designers or engineers, remains open - an explicit intention generated by unexpected contingencies. The work carried out allows us to better frame its relevance. If tensions do not mechanically depend on disciplinary affiliations, then the value of a “hybrid” figure cannot be taken for granted. More precisely, the design engineer can be hypothesized as a facilitating actant to the extent that, within a situated scene, he or she effectively manages to translate between heterogeneous criteria, forms of evidence, and priorities. In this sense, their effectiveness should be observed as the practical effect of a specific configuration of action.

In closing, the conceptual contribution of this thesis does not consist in having identified a formula for eliminating tensions, but rather in having attempted to describe them in a less reductive way, showing how they participate in the construction of the project, of the design object, and of the designers involved.

To conclude, I return to the idea that nothing ever stops acting, and to how, emerging from the scenes analyzed, these have continued to transform and change over time, each time shifting the meaning of all their constituent elements. This thesis is already circulating as a text-object in other scenes and practices, whether in the context of the final evaluation or in future rereadings, carrying with it (at least for me) all the wonderful moments experienced during these university years.

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