

DoCS4Design

Doctoral Courses System for Design

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PhD in Design

# A Map & Glossary

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## PhD in Design - A Map and Glossary

First report of the Erasmus+ project DoCS4Design (Doctoral Courses System for Design)

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Preface	1
Introduction	3
Celebrating Diversity	4
Introducing the partner institutes	5
The Map and Glossary	8

<b>I. CONTEXT &amp; HISTORY</b>	<b>10</b>
1.1 What is a 'PhD'?	10
1.2 The European Context	11
1.3 What is a 'PhD in Design'?	14

<b>II. ACTORS AND ORGANISATION</b>	<b>17</b>
2.1 The Candidates	19
<i>Diversity in candidates' backgrounds</i>	20
2.2 The Advisors	22
<i>Guidance in research</i>	22
<i>Requirements for the guiding roles</i>	23
<i>Other teaching roles towards candidates</i>	25
2.3 The Organisers and the Organisation	26
<i>Issue: critical mass and internationalisation</i>	27
2.4 Other actors	28

<b>IV. RESEARCH AND EDUCATION</b>	<b>45</b>
4.1 Research	46
<i>Issue: research topic and available expertise</i>	46
<i>Topics &amp; Methods</i>	46
<i>Research Methodology and Methods</i>	52
<i>PhD in Design Education: Graduate Schools and Courses</i>	53
4.2 Education	53

<b>III. TIME AND ACTIVITIES</b>	<b>30</b>
3.1 At the End: Examination and Further Career	31
<i>Professional career</i>	31
<i>Degree Examination</i>	32
3.2 During the PhD project: Research and Education	35
<i>Duration</i>	35
<i>Process and Timelines</i>	36
<i>Milestones</i>	39
<i>Division of time over research, education, and other duties</i>	40
3.3 At the beginning: Recruiting and Selection	42
<i>The initiative for enrolment</i>	42
<i>Selection</i>	42
<i>Tuition fees, contractual and financial position</i>	43

<b>A-Z</b>	<b>GLOSSARY</b>	<b>62</b>
	<b>APPENDIX</b>	
	Six representations for the PhD in Design	71

<b>V. AFTERWORD</b>	<b>59</b>
Developments, Opportunities, & Next Steps	59

# Preface

This Map and Glossary is one of the results of DoCS4Design, an Erasmus+ project that originated in the idea to exchange experiences regarding the guidance of PhD candidates in the design field. Since 2018, academics from the six participating design schools regularly shared and discussed their approaches and results. In 2020, DoCS4Design started as a three year project in which the six schools work together to collect and disseminate best practices for a PhD in Design curriculum.

This report is called a Map and Glossary to express our intention to give a description of the PhD in Design in the terrain of our practices, and bring together and clarify the often diverse language in which that terrain is described. Originally we intended to give it the form of a map, because many elements of the description depend on each other, but as we progressed we realize that we would not find a fitting compromise between overview and level of detail yet. Hence, the main structure is more linear, in a linear format of several chapters.

In making this Map and Glossary, we collected practices and numbers from the partner programmes. The numbers listed in this document should be taken as indicative, because the underlying data, such as numbers of candidates fluctuate from year to year, or even from week to week, at some of the partners, and are not kept with a single system. For the aim of this document, these rough indications serve the purpose of giving a sense of scale.

Aim of the Map and Glossary is to help those involved in a PhD in Design to develop their own rationale, to build or position their PhD in Design programme within their own university, or bridge to other PhD programmes which have a different structure, process, focus, or aims.

The intention of this Map and Glossary is not to be the definition of a final single or ideal solution, but the opening of a view of the terrain of guiding the PhD in Design, and a light on various words the partners used to find their way in it. Map and Glossary are intended as tools to support exchanging experiences between design schools and the individuals in them, providing information and inspiration for fruitful collaborations and partnerships.

Even though our six design schools carry substantial experience, we are aware that we are a limited North-Atlantic sample of PhD programmes at large, established universities, not representative of all of design, or all of the world. Yet we hope that the description can offer a stepping stone for others in different situations to enter into, or continue their discussion and development of the 21st century PhD education in this wonderful field of design.





# Introduction

This report is called a Map and Glossary.

A Map because it describes the varied terrain of PhD in Design education at six established design schools.

We describe these practices through three lenses:

- the people and roles, **actors and organisation**;
- the process, **time and activities**;
- the content and balance of **research and education**.

These elements are highly interwoven, and each lens benefits from the reader having prior knowledge of the other ones, which is a logical challenge.

***NOTE:** There is a solid 'Chicken-and-Egg' relation between the lenses. Each one is better understood after reading the others first, and some things are needed in two places, e.g., the backgrounds of the candidates concern both actors and timeline; for the sake of brevity, they are addressed in one of them.*

The motivation behind this map is to show the practices, to understand the variety, to highlight examples, in order to help:

- **Candidates** pursuing a PhD to understand their own institution, and to find possible benefits in exchanges and connections;
- **Advisors** that guide the candidates, and others that provide courses for candidates, to understand and contribute to their own institution, and likewise find benefits in exchanges and connections.
- **Organisers** that provide policy and support structures, to learn from existing examples elsewhere, and support the exchanges and connections.



See the **GLOSSARY** for the terms 'candidate', 'advisor', and 'organiser', and the variations used for these.

# Celebrating Diversity

When we explored our practices, it quickly became clear how different everything is: duration, responsibilities, formalities, and opportunities. And language: each institution uses different terms to describe everything. To make sense of it all, the Map uses a single set of chosen terms (e.g., 'candidate') and the **GLOSSARY** unpacks each of these 'privileged' terms into the various forms that are used (e.g., PhD student, candidate, PhD researcher, etc). With the different terms often come nuances in precise meanings, which we cover to a small degree. Aiming for completeness here would not help because the terms are not often clearly grounded in descriptions or regulations, and their usage changes.

These diversities should not be taken as a hurdle to overcome a Babylonian language confusion which blocks us from constructing a unified great single model. The European University Association recommends diversity in research approaches and

topics, and people and their international and interdisciplinary work, in order to cross-pollinate and interdisciplinarily connect, and to make use of broader, larger, mass. Other forms of diversity pertain to the gender, ages, economic, cultural and educational backgrounds of the people involved. Furthermore, diversity between institutes depends on geographic location, and university's research topics and educational focus.

The aim of DoCS4Design is to identify guiding examples and complementarity across, and within institutions, not to define an ideal curriculum, or to pursue standardisation of the PhD, or to create a ranking of practices. The varieties in local, institutional, and national cultures, and their underlying norms and attitudes, is seen as a source of richness through diversity, greater richness through connection and exchange. Understanding these differences can help us (or others) position our discipline in our own

universities, discover solutions we might adapt to our own situation, and find complementary partners for building synergetic collaborations.

Moreover, these diversities do not just exist between our respective institutions, but also within: it helps us realize how much the PhD education is, can be, or should be geared to accommodate the individual competencies of those taking on this intensive path.

## Introducing the partner institutes

The DoCS4Design consortium consists of six institutions doing design research and education, and offering a PhD track. Already within these six there is considerable variety, as the following sections will show. But we do not cover the whole variety of design, or global situations. Notably, all six universities approach design with a connection to engineering, and some to the arts, and all are in Europe or the USA, where international design programmes have been established for a longer time. It should be noted that this is not a full global perspective, as yet lacking upcoming practices in South America, Asia, Australia, and Africa.

The European partners work within the framework developed by the European Union (which included the UK until 2019), the USA partners within a slightly different context. For most of the discussion here we take the EU framework as context, and will indicate differences where helpful. The [next page](#) gives short description of the partner institutes.

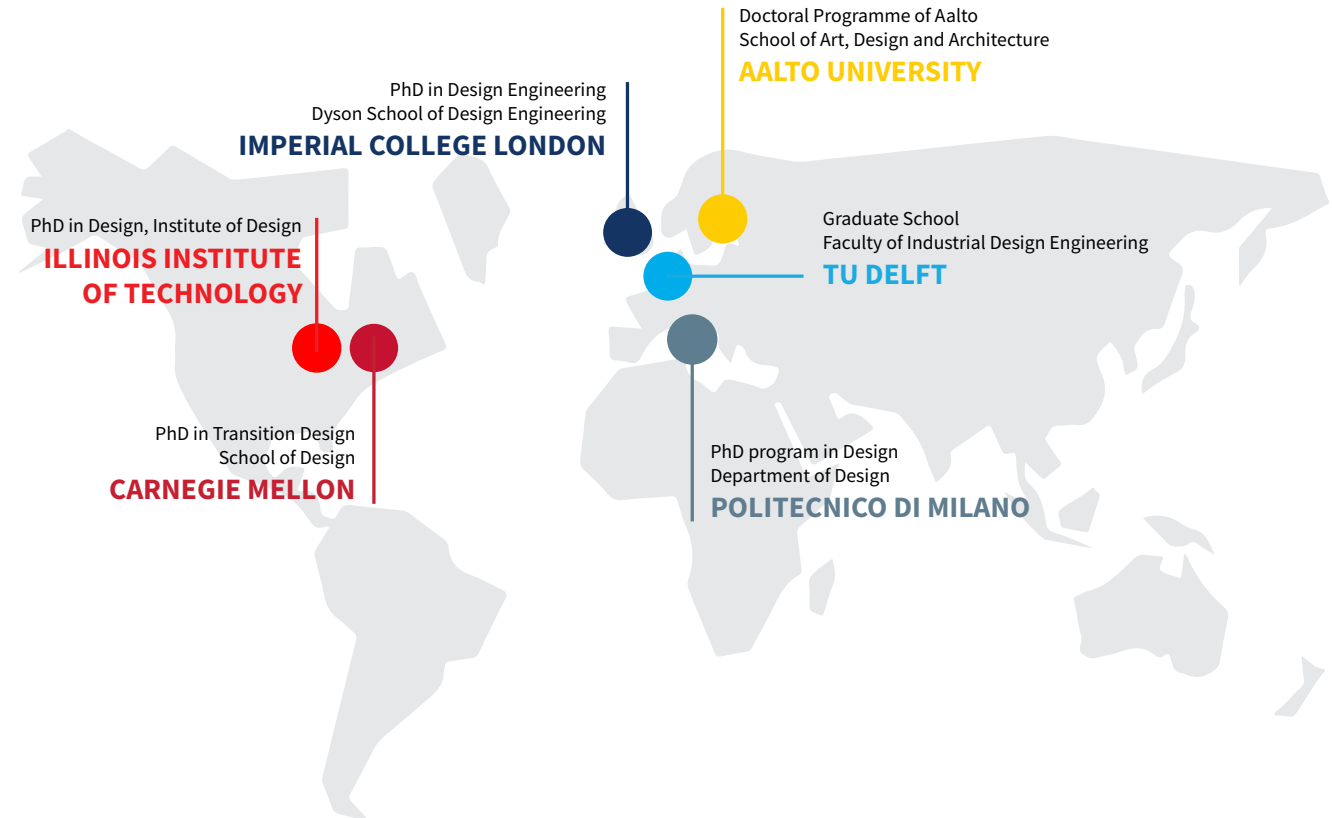


Figure 1 - The six partners of the DoCS4Design consortium: four in Europe and two in the USA.



**Polimi**

**Politecnico di Milano**, university for Architecture, Design and Engineering was founded in 1863. The PhD in Design Program of the **Department of Design** was established in 1990, 11 years before the foundation of the Polimi PhD School. Currently there are 60/70 enrolled candidates in a 3 year programme.

**IIT**

The **Illinois Institute of Technology (IIT) Institute of Design (ID)** in Chicago was founded by László Moholy-Nagy as The New Bauhaus in 1937. ID is known for pioneering human-centered design and systems design. Since 1993 it has a PhD in Design with currently 9 candidates enrolled in a 3 year programme.

**TU Delft**

The **Faculty of Industrial Design Engineering (IDE) at Delft University of Technology** was founded in 1969. The PhD was managed at a university level since the beginning of the 20th century. At IDE, research and the PhD grew rapidly in the 90s and 00s, and a formal Graduate School was set up in 2011. Currently there are 120 PhD in Design candidates enrolled in a 4 year programme.

**Aalto**

**Aalto University** resulted from the merger of Helsinki School of Economics, the Helsinki University of Technology, and the University of Art and Design Helsinki in 2010. In 2000, the University of Art and Design Helsinki started offering doctoral education. Today, there are approximately 50 active doctoral candidates in the 4 year programme offered by Aalto University's Department of Design.

**CMU**

The **School of Design at Carnegie Mellon University (CMU)** in Pittsburgh was founded in 1917. Since 2000 it has a PhD in Design Studies and in Transition Design. The PhD in Transition Design program, plays a critical role in driving sustainable change across a range of complex systems. Together there are currently 20 candidates enrolled in a 4 year programme.

**Imperial**

The **Dyson School of Design Engineering at Imperial College** in London was founded in 2014. It draws together teaching and research in the field, building on decades of design engineering successes across Imperial College and through its collaboration with the Royal College of Art. There are currently 80 candidates for a PhD in Design Engineering enrolled in a 3 to 4 year programme. Many of these PhD projects are in topics like robotics, energy storage technologies and other engineering, technology driven research.

Introduction of the six partners of the DoCS4Design consortium  
We will use these shorthand names when referring to the partners in the running text.

For the Foundation History of the PhD in Design at various universities we distinguish three events, and they occur in different sequences. One event is the moment in time when the university started to award **PhD diplomas**, another one is when institutes founded a Bachelor/Master programme in Design (a **Design school**), and a third is the moment that the institutes started a formal PhD in Design programme, the **Design PhD school**. **Figure 2** depicts these

moments for the partners on a timeline, showing especially activity around the turn of the millennium.

At some universities (TUDelft and Imperial) the PhD already existed university-wide, and the formation of a design-specific organised PhD programme came after 2000. The main pattern, though, is that the PhD in Design at all partner institutions has gained in size and formal positioning over the past three decades.

This development is in line with the establishment of design journals, such as Design Issues (established in 1984), Design Studies (established in 1983), International Journal of Design (established in 1991), and more recently journals such as The Journal of Design, Economics, and Innovation (SheJi, established in 2016) and Journal of Design Thinking (established in 2020).

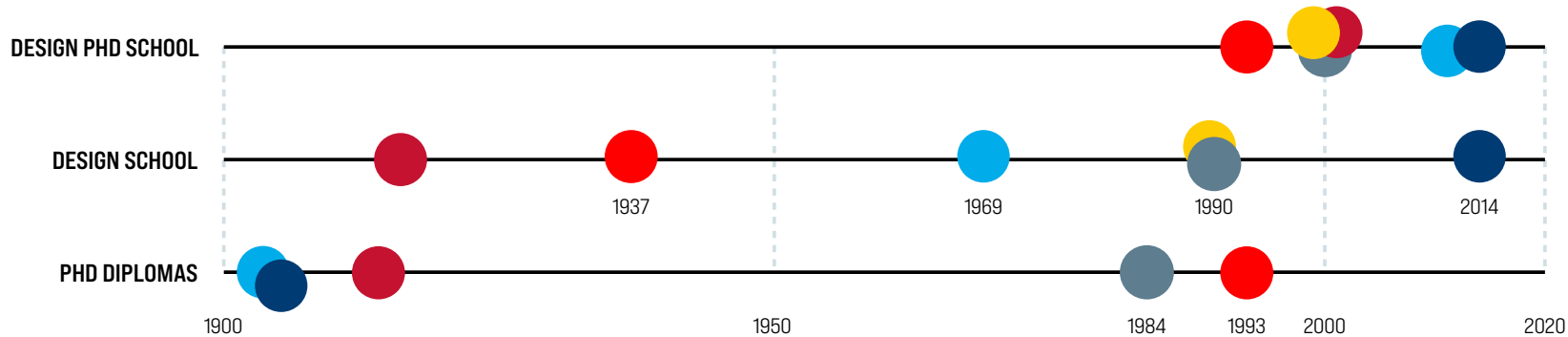


Figure 2 - Foundation timelines: start of awarding PhD diplomas; start of a formal Design School (Bachelor/Master level); start of a Design PhD school (PhD level).

# The Map and Glossary

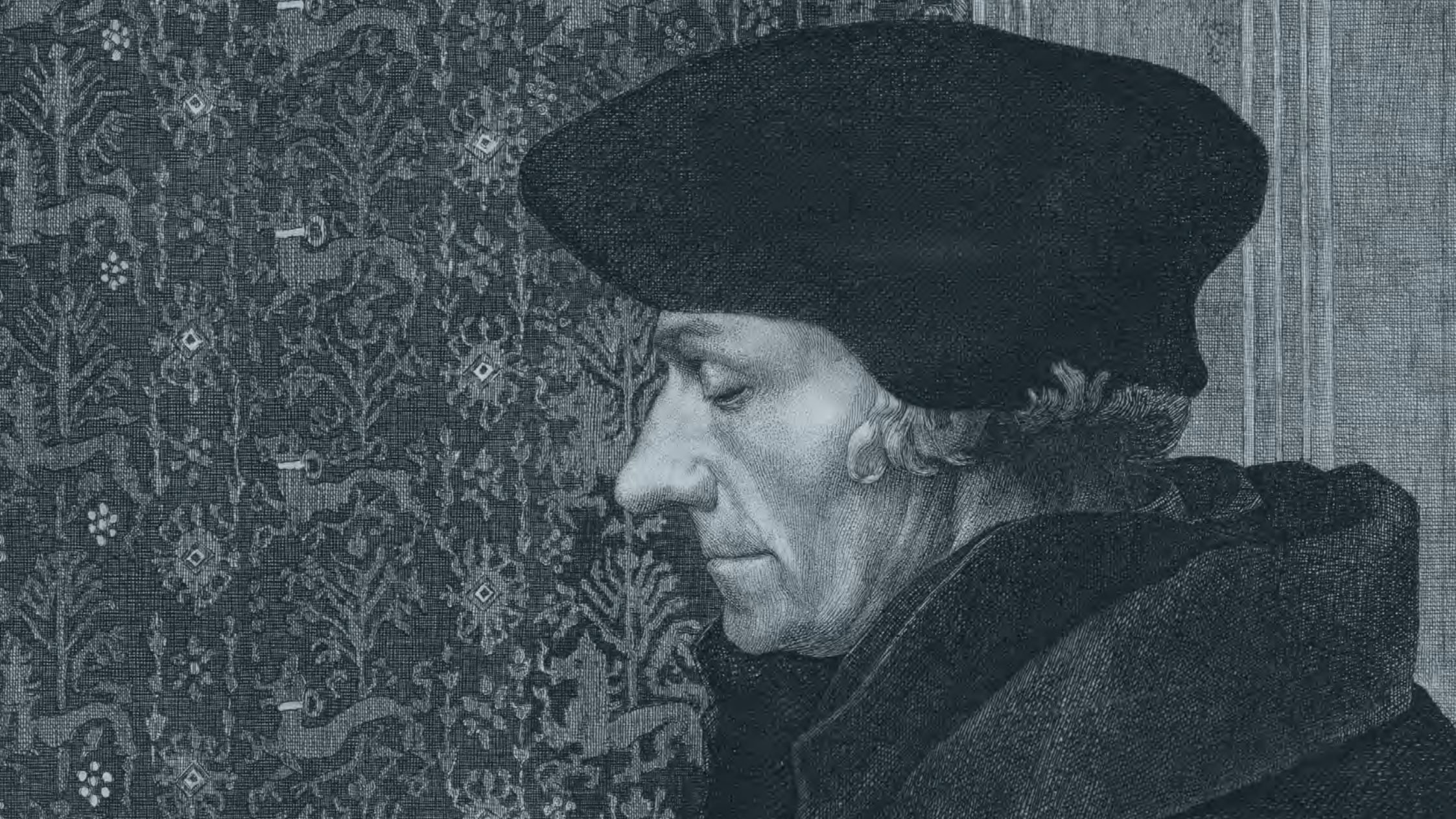
The form of the present document is a Map to describe the way PhD education is organised, and a **GLOSSARY** that covers the terms used in the description. Both are intended to make sense of the variety of practices and idioms used to describe these at the local institutions.

The structure of the map is organised along several lenses:

- The lens of **actors and organisation** views at the people involved, and their roles and relations;
- The lens of **activities and process** traces the timeline of doing the the PhD project;
- The lens of **education and research**, two content components in the PhD project, and how these build on each other;
- The lens of **jargon**: the glossary. The glossary lists the jargon used in these descriptions. The terms used vary greatly across the different institutions, often determined at a national or university level. For each term we chose one form, e.g., 'candidate' which we use throughout the map. The glossary lists the various synonyms and variations, and gives a definition and discussion of the term.









# 1.1 What is a 'PhD'?

Basically, **the PhD is defined as a study to become an independent researcher.**

The term 'PhD' stands for Doctor of Philosophy, also abbreviated as DPhil. or Ph.D. (American) and in many countries simply called Doctor (Eastern European nations, successor states of the former Soviet Union, most parts of Africa, Asia, and many Spanish-speaking countries, and Doktor in German-speaking nations). The PhD degree is the result of the so-called third cycle of academic education (Bachelor, Master, PhD).



***NOTE:** As the above paragraph shows, there is great variation in the terms that are used. In the text below we project this variety down by choosing a single variant, usually the one that is used in the main EU documents cited below. See the **GLOSSARY** for a set of definitions and variants. A lot of formal jargon about the roles and elements in PhD programmes, and different schools vary in their use of terms.*

Historically, the PhD degree was a requirement to teach at a university. Later, it also became training for a research job in industry. Currently, the PhD is preparing for a variety of research-related jobs in society, such as researcher, (assistant and associated) professor in universities, and scientists in companies, government, and other institutes. The way PhD training was organised has been quite varied, and still varies from country to country, from discipline to discipline, from university to university.

# 1.2 The European Context

In the European Union, the *Bologna Process* aligned Bachelor and Master education to a uniform structure (1999), but only provided limited directives for the PhD. The European University Association's (EUA) Salzburg conferences (2005, 2010) formulated recommendations in the form of ten principles, followed by eight clues to success). These are summarized in [Table 1](#).

The principles emphasize:

- that the PhD programme should contain both original research and 'transferable skills' training towards a later career;
- that supervision should be organised formally by the institution, and transparent measures for quality control should be undertaken;

- and that the programmes should have sufficient mass, and involve the candidates in interdisciplinary and international activities.

They also emphasize the importance of diversity between programmes, and flexibility towards candidates' individual motivations and research and career directions.

The DoCS4Design project connects to several of these principles: We map how supervision is organised in our different PhD in Design programmes, explore the complementarity and possible connections between the programmes and in general, and seek out how the components of research and education play out, regarding content, dissemination, method, and embedding in the academic Design Research community and beyond.

Many of the Salzburg recommendations and clues already fit well with the current practices at the partners in the DoCS4Design consortium. We will return to those in the later sections. From our discussions other considerations were also brought in: connections to industrial and societal partners is common, as is making use of outcomes from, and engaging with researchers from other disciplines. As in other disciplines, attention to supervision beyond the traditional master-apprentice relationship needed attention.

Sources: European University Association. (2005). Conclusions and recommendations. Bologna seminar on "Doctoral programmes for the European knowledge society. Salzburg, February.  
European University Association. (2010). Salzburg II Recommendations. Salzburg, October.



Conclusions and Recommendations (Salzburg I, 2005)		links to...		Clues to Success (Salzburg II, 2010)
i. <b>The core component of doctoral training is the advancement of knowledge through original research.</b>	4		vi	1. <b>Critical mass and critical diversity</b> <i>are necessary for high quality doctoral education.</i>
ii. <b>Embedding in institutional strategies and policies</b>	3		iv	2. <b>Recruitment, admission and status</b> <i>should be organised to fit the programmes' particular mission and profile.</i>
iii. <b>The importance of diversity</b> <i>of different programmes.</i>	8		ii,v	3. <b>Supervision</b> <i>must be a collective effort with clearly defined and written responsibilities of the parties involved, leaving room for the individual development of the doctoral candidate.</i>
iv. <b>Doctoral candidates as early stage researchers,</b> <i>as professionals, not subordinate interns.</i>	2		i	4. <b>Outcomes</b> <i>of the research must be original and suitable for dissemination within the scientific community.</i>
v. <b>The crucial role of supervision and assessment</b> <i>should be transparently organised.</i>	3,7		viii	5. <b>Career development</b> <i>should be furthered by the programme, flexible towards individual candidates and a wide range of careers.</i>
vi. <b>Achieving critical mass</b> <i>in large universities, or through collaboration</i>	1		v	6. <b>Credits</b> <i>administration should not dominate enthusiasm, curiosity, and creativity.</i>
vii. <b>Duration</b> <i>of 3 or 4 years.</i>			iii,ix	7. <b>Quality and accountability</b> <i>should be supported by appropriate structures and measures.</i>
viii. <b>The promotion of innovative structures</b> <i>for interdisciplinary training, transferable skills.</i>	5			8. <b>Internationalisation</b> <i>strategies, together should serve as a tool that increases the quality in doctoral education and in developing institutional research capacity.</i>
ix. <b>Increasing mobility</b> <i>between programmes/universities.</i>	8			
x. <b>Ensuring appropriate funding</b> <i>of the programmes.</i>				

From Salzburg II summary, inset in section 1. The boldface text is from the document, the italics are added to summarize the text that follows.

From Salzburg II section 2. The boldface text is from the document, the italics are added to summarize the text that follows.

*From Salzburg II summary, inset in section 1. The boldface text is from the document, the italics are added to summarize the text that follows.*

*From Salzburg II section 2. The boldface text is from the document, the italics are added to summarize the text that follows.*

Table 1 - Summaries of Conclusions, Recommendations, and Clues to Success from the European University Association's (EUA) Salzburg conferences (2005, 2010).

Other principles are of current attention. For instance, the requirement of critical mass and internationalisation plays at all schools, but differently. Some design programmes have a large number of candidates, others a few.

- At **Polimi**, **TU Delft**, and **Imperial**, some 5 to 25
- candidates start each year, and many research colleagues are part of the everyday context.
- Other design schools are of smaller size, e.g., at
- **Aalto**, **CMU** and **IIT**, the numbers are under 10 each year, and fewer researchers are connected to the programme.

**Table 2** illustrates these scales with estimates of the regular number of candidates graduating annually, and the number of academic staff involved as advisors (note: the number of candidates fluctuates considerably over the years).

A sufficient scale brings more opportunity for candidates to interact with peers, and a presence of a wider range of topics for which expert guidance is available. Many design programmes in the world are small, both in the number of candidates, and in staff with research expertise. Sometimes, the expertise is limited or absent, leading to low quality supervision or rejection of new candidates. One way smaller

programmes may achieve (access to) scale is to unite, as in the Swedish 'networked PhD' programmes, similar to disciplinary national 'research schools' in some countries. Most often the PhD programme takes place at the institution. Some institutions, e.g., Imperial College, have international programmes, in which the work is split over the institution and an international partner.

<i>number of ... in the programme in a typical year</i>	<b>Aalto</b>	<b>CMU</b>	<b>IIT</b>	<b>Imperial</b>	<b>Polimi</b>	<b>TU Delft</b>
<b>candidates</b>	55	20	10	86	60	120
<b>advisors</b>	25	8	5	39	40	80
<b>organisers</b>	1-2	1	2	4	4	8

Table 2 - Despite the fact that all six PhD programmes are well established, the sizes of the PhD programme communities vary from a dozen to well over two hundred.

# 1.3 What is a 'PhD in Design'?

The above discussion of the PhD holds across all disciplines. This project focuses on the 'PhD in Design'. Already the very label 'PhD in Design' requires clarification, because there is no uniform understanding of what this means. Sometimes, the label occurs on the diploma.

- At **Polimi**, the name of the diploma is 'Doctor in Design';
- whereas at **Aalto** it is Doctor of Arts (DA),
- and at **TU Delft** the diploma does not mention a discipline.
- At **Imperial**, the name of the diploma is "Doctor in Design Engineering Research".
- At the Institute of Design of **IIT**, the final degree is "Doctor of Philosophy of Design".

Moreover, these diploma titles now stand live in a context of a wider spectrum of professional titles, such as EdD (Doctor of Education) and EngD (Doctor in Engineering).

The term 'PhD in Design' can be understood in various ways. It can be seen as an **extension of the Master** in Design (Research for Design), with an emphasis on becoming 'an advanced designer with research skills'. Design techniques may be part of the research doing (Research through Design), or design may be the object of study (Research on Design). Others see the person with a PhD degree as a **transdisciplinary researcher**, whose background may or may not be in design, whose research may or may not be about how design is done, and whose research methods may or may not use design competencies. All partners agree, and sometimes have to emphasize, that the PhD in Design is not 'a design project', but is a research degree.



(See the **GLOSSARY** for  
a comparison of local jargon).

In this project, the 'PhD in Design' is taken to be 'PhD education organised at a university/institute that does design research, and provides design education (Figure 3). The other aspects, such as background of the candidate, research topics and methods, and employment goals, also merit discussion, and will return in the following sections. For example, does a programme aim for an advanced level of design competency, does it require design competency to start, does it require dissemination to the design field, and/or to design practice?

During the first year of DoCS4Design, these three other ingredients were a recurring focus in the discussions between the partners and in a training event involving other staff from our universities. It illustrates that all partners (and, most likely, also PhD programmes at other institutions), are exploring how to balance these disciplinary ingredients within the often university-wide, national, or international settings.

Defining and taking position is recognized as an important challenge, both at the level of programmes, and at the level of individual candidates. It should help to produce high quality research, educate competent design researchers, and have desired (societal) impact. Design is not always well understood, and few outside the programmes have a clear understanding of what a PhD in Design graduate can do, or why one should hire one. In the words of one candidate: *"How do you position yourself in a discipline that is not positioned at all?"*. This question of positioning, of specifying the purpose, the identity, and the form of educational programmes in the PhD in Design, is seen as one of the key discussion topics for the design field in the present decade.

## PhD in design is...

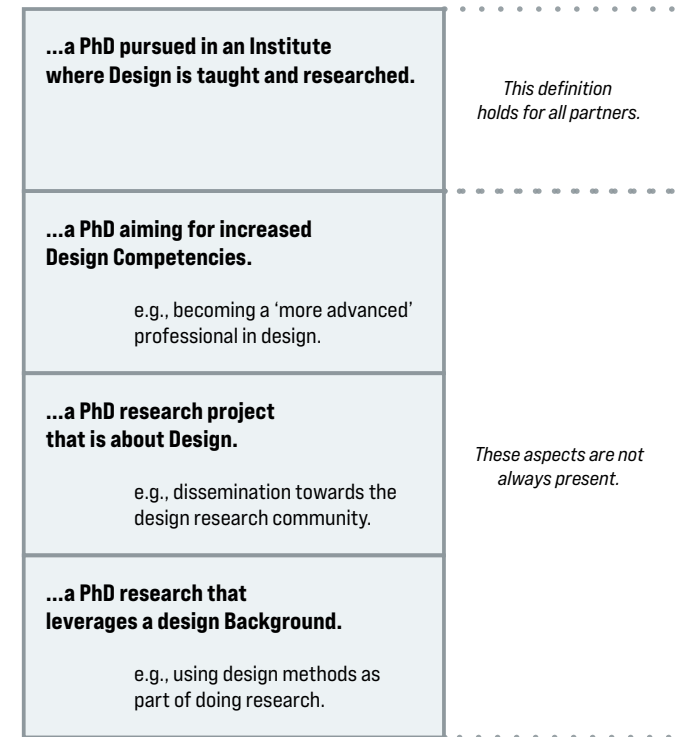


Figure 3 - Ingredients in defining the meaning of 'PhD in Design'





There are a lot of people at play in PhD education. One key person is the **candidate**, the person who is pursuing the PhD. Others are more behind the scenes. The primary relation is between the candidate and the research **advisor** (see **Figure 4**). In some institutions, the advisor needs to have a PhD degree, or be approved for this role by a university body. Some institutions require or provide two advisors instead of one.

- For example, at **CMU** the Primary Advisor does not necessarily have a PhD, but is based in the School of Design. The Secondary Advisor or External Advisor may be from anywhere.
- At **TU Delft**, the first advisor has to be a full professor or an experienced associate professor.

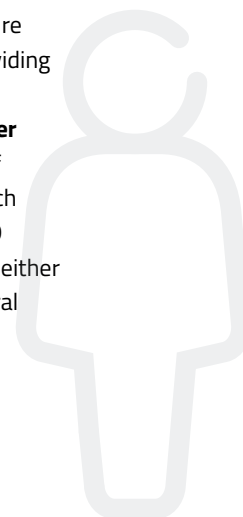


(see **GLOSSARY** for the variety of terms used to indicate the roles)

Over the last decades the emphasis has shifted to making the guidance an activity that is organised and executed by an organisational unit, and to have a team of advisors, e.g., a primary advisor and a daily supervisor attached to each candidate (see **Saltzburg II, Table 1, item 3**).

Also, in curricular elements, there are **teachers** who bring courses, training, on specific skills. Sometimes, these are the same people as the advisors, but teaching courses to a class of candidates; sometimes these teachers are other academics, or brought in from external training agencies. Next, institutions have **organisers**: administrative and counseling support, providing a management structure for the PhD programme ('Graduate School'), and providing access to, and evaluation of courses.

Finally, candidates may interact with a variety of **other** stakeholders: e.g., when their own research is part of a larger research grant provided by a national research agency or an industrial sponsor; and in teaching, PhD candidates may be interacting with master students either in the context of their own research topic, or in general teaching duties at the institute.





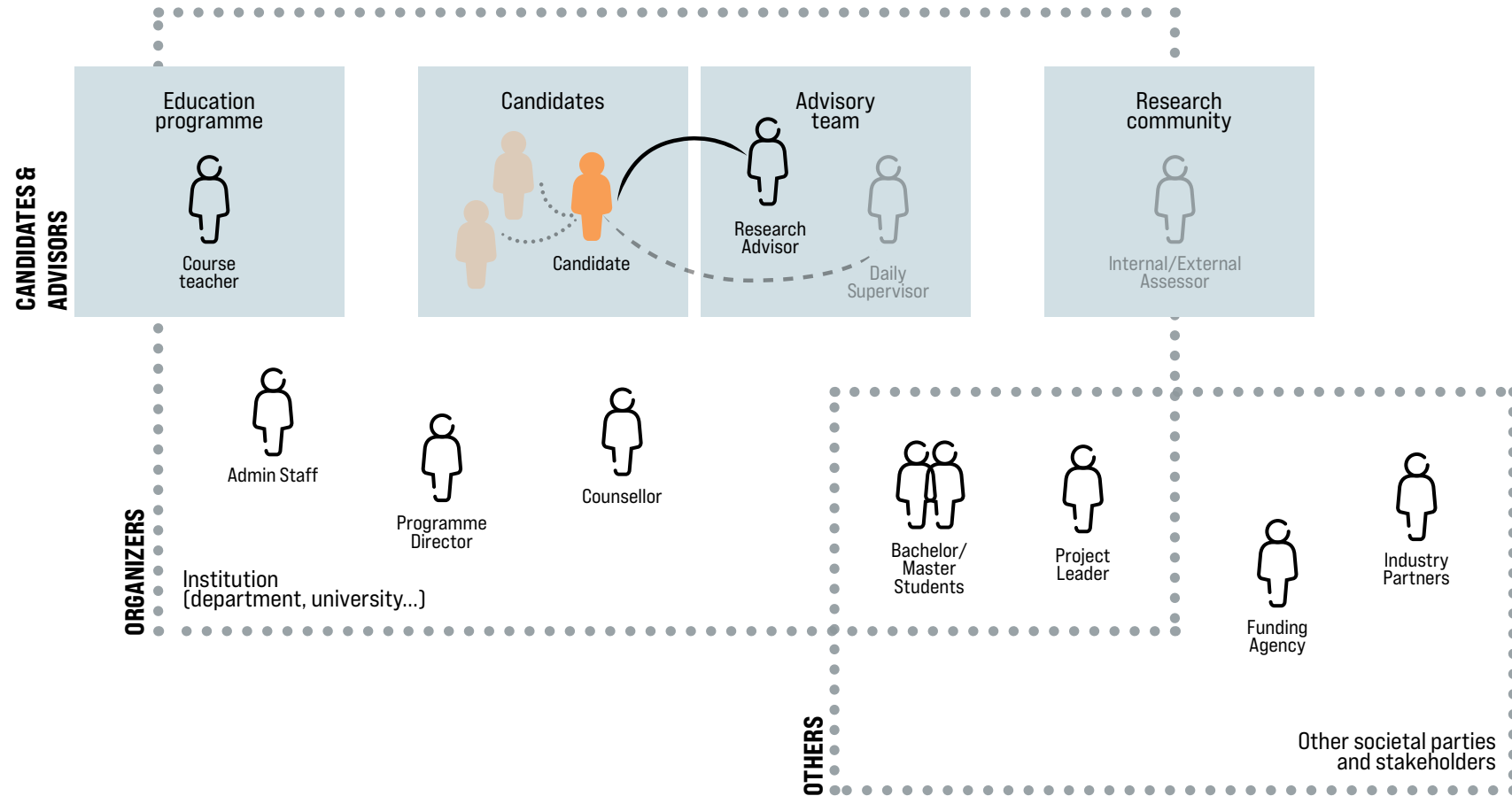


Figure 4 – Four types of actors in the PhD project: candidates, advisors, organisers, and others.



## 2.1 The Candidates



**The candidates** (PhD candidate or student, see **GLOSSARY**) are the persons pursuing the PhD degree.

The PhD research component is individual research, sometimes embedded in a larger project. The social embedding of candidates with their peers varies: Most candidates do their PhD work **on-site** at the institution. In some places, they are in a single class with peer candidates in the first year, in others they are mostly working on their own, or embedded in a research group. At most of the DoCS4Design partners, candidates start simultaneously in September or November, which forms a natural peer group, often receiving joint education.

Besides these **on-site** candidates, there sometimes are **external** candidates, who do not reside at the institution, only visiting for consultation with the advisors or specific courses or events. These can be candidates who work part-time on a PhD within another company or institution. Where on-site candidates are often part of a research group and community of peers, external candidates require special efforts and events to set up interactions with peer candidates.

The employment status of the candidates can vary. Sometimes, they are on a research contract with the university, or they come with a personal grant. These differences may affect their obligations, and put constraints on the topic of their research.

- At **TU Delft** and **Imperial**, candidates start at any time of the year, typically within a grant-sponsored project, see **section 3 Time and Activities**.
- At **Aalto**, candidates typically start in September and form a cohort with other candidates in the School of Arts, Design and Architecture. Occasionally, where candidates are attached to funded research projects, they may start at other times in the year.
- At **Imperial**, candidates funded by a Centre for Doctoral Training (e.g., AI in Healthcare) work in cohorts, taking courses and doing assessments together during the first year. After that, all candidates are working on their own projects while embedded in a research group.
- At **IIT**, candidates are affiliated to their primary advisor and funding varies on a case by case basis. In the first year candidates take courses as a cohort. In the second and third year candidates spend most of their time doing fieldwork and experiments, while working on sponsored projects under the supervision of their advising committee.



## Diversity in candidates' backgrounds

In the eight 'clues of success' (EUA, 2010) diversity is recommended on various levels: diversity of research and in terms of international exchange and collaboration (strategies to increase the quality in doctoral education and in developing institutional research capacity).

Another aspect is the diversity of the candidates and in terms of their educational and cultural backgrounds, age (generation), formal position (contract), gender, professional experience (as a designer, researcher or other) and economical status. The educational backgrounds of the candidates vary within an institute. Most candidates have a master degree, which is usually required, or at least a bachelor degree. Some candidates enter the PhD programme straight after their master, others have professional experience. In some programmes, it is an admission requirement that those degrees are design degrees, in others it is not.

From the inventory of the consortium partners, it stands out that in most of the PhD in Design programmes the majority of candidates are female,

often in contrast with the gender balance in other disciplines at those universities. At the moment of this inventory, at Aalto and IIT the majority of candidates is female, while at Imperial is male. The others lie in-between.

The age when starting indicates that most candidates begin the PhD immediately after their master.

- At **IIT** most candidates make a return to academia after several years of design practice.
- At **Aalto**, more international students join the Masters programme after professional experience than home students.

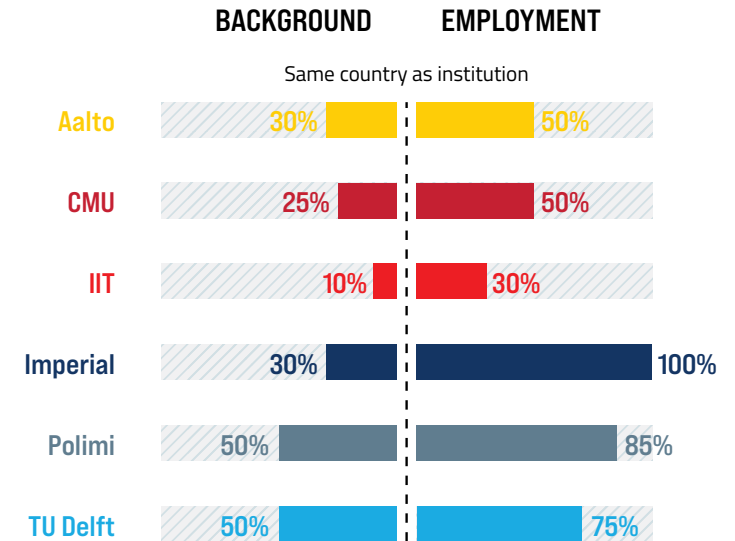


Figure 5- The part of the candidates that came from the same country as the institution, and made their next career step in that country.



	<i>Aalto</i>	<i>CMU</i>	<i>IIT</i>	<i>Imperial</i>	<i>Polimi</i>	<i>TU Delft</i>
<i>% female*</i>	72 %	60 %	70 %	42 %	62 %	55 %
<i>% Master in Design</i>	90 %	40 %	100 %	30-40%	50 %	60 %
<i>% Master in other country</i>	40 %	40 %	80 %	26 %	50 %	30 %
<i>% with prior Professional experience</i>	20 %	100 %	90 %	20 %	20 %	10 %
<i>Total number of candidates starting per year</i>	8	3-5	2-3	20	15-20	30
<i>Age when starting</i>	28-35	26-50	28-32	26-35 (a few in their 40s)	27-34	26-30 (also several older)
<i>% full time &amp; in-house</i>	70 %	75 %	95 %	95 %	97 %	60 %

Table 3 - A rough indication of the current diversity of candidates (who are now doing their PhD in Design) in terms of sexes, educational backgrounds, age, and location.

\*The authors are aware that diversity and gender covers more.

## 2.2 The Advisors

Candidates are **guided by a variety of academic actors**. The general term used here is advisors.



*Related roles and terms are teacher, tutor, and supervisor (see the **GLOSSARY**).*

### Guidance in research

A required part of every PhD programme is the 'original research', in which the candidate conducts a research project, individually, under guidance of one or more advisors, experienced academics. Historically, the PhD followed a master-apprentice model of tuition. The central role of guiding the candidate lays with a single **advisor** (also called supervisor (EU), promotor, chair). The strength of this role was such that in German the term Doktorvater and Doktermutter are sometimes used to refer to this primary advisor.

Over the last decades, the responsibility for advising has shifted from a solo advisor to an advisory committee, with responsibilities divided over a primary advisor and one or more **co-advisors** (also called co-promotor, mentor, supervisor, daily supervisor). The advisors coach candidates on research, on writing the thesis, and towards their future career, academic and societal network. Often they decide when the research work is sufficiently complete for the final assessment or examination. Furthermore, there are internal/external **assessors** (sometimes a committee, including 'opponents'). The qualifications (professor, associate professor, assistant professor) and respon-

sibilities (promotor, chair, assessor) for these roles differ between institutes.

In some places, the advisor is also the Principal Investigator in a funded project, and the candidate is hired to contribute to that project with the research. These differences are connected to the expertise of the advisor on the topic of the candidate's research, balancing multiple interests (the advisor being also the managerial supervisor of the employee-candidate, and the advisor and student having responsibilities towards the outcomes promised in the project's funded proposal).

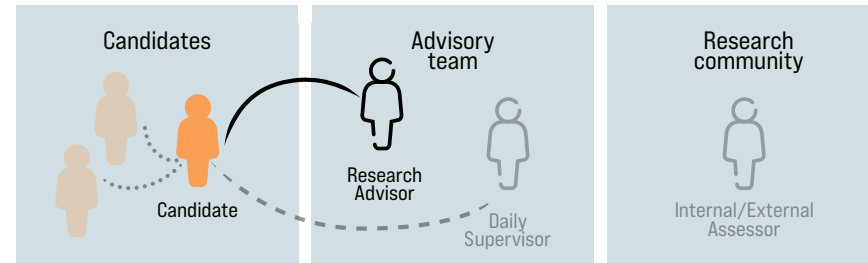


Figure 6 - Candidates are guided by the advisory team



## Requirements for the guiding roles

In line with Salzburg II, item 3 (**Table 1**), there is a shift from one to one Master–Apprentice learning to formalised structures of supervision, involving multiple advisory roles and institutional structure and support. Part of this is the number of advisors, and requirements put on those who can take on that role.

There is considerable variation within the partners regarding:

1. Number of advisors per candidate;
2. Their affiliation with and position in the institute, and;
3. Specific approvals.

For some schools the general degree and advising requirements are defined by the university but most degree-specific policies and regulations are established at the school level by the faculty and Dean.

- For **CMU** the minimum is one advisor (called Primary Advisor) who should be based in the school of design, and a maximum of four advisors in total per candidate. The secondary advisors (also called external advisor) may be from elsewhere.
- At **TU Delft** two advisors are currently required, three are permitted; the primary advisor (or ‘promotor’) has to be a full professor or an experienced associate professor that has been approved to act as advisor; the second advisor can be a full, associate, or assistant professor. A third advisor is sometimes added to bring in senior expertise from another university. Next to these, the IDE faculty appoints an independent academic as ‘PhD mentor’; each of these helps about a dozen PhD candidates and their advisory teams through the (new) process steps, formal documentation, availability of graduate school courses, especially during the first year of the PhD.
- At **Aalto**, a supervisor is appointed who is typically a full or associate professor – certainly someone with experience of bringing a PhD to completion. An advisor is appointed, usually. In a small minority of cases, the supervisor also undertakes an advisor role. However, this is discouraged. A third advisor, sometimes external, is occasionally appointed.
- At **IIT**, a total of 4 advisors are required for completion of the program. Three should be from the home program, in this case from the Institute of Design and one from the university. There is also an option of adding an external advisor from outside the university.
- At **Polimi**, a supervisor is appointed who is typically a full, associate or assistant professor – certainly someone with experience of bringing a PhD to completion. 2 external reviewers from outside the university are appointed for the thesis completion. The “Regulations on PhD programs of the Politecnico di Milano” is strongly based on the Italian Ministerial Decree.

See **Figure 7** for some examples.



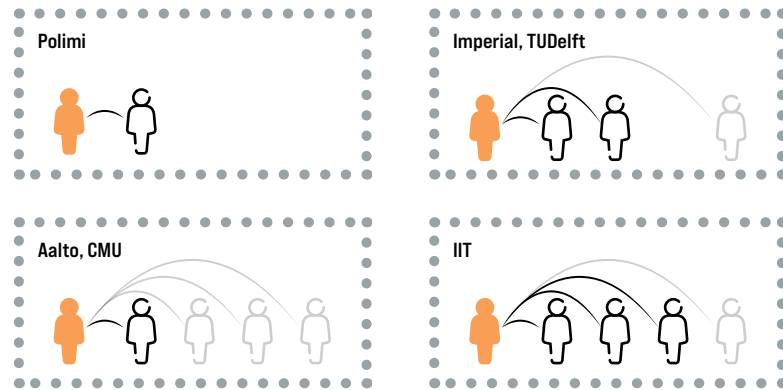


Figure 7 - The rules for appointment of advisory teams vary regarding how many advisors come within the institution/department or from outside. See [Table 4](#) for an overview.

There is also variation in the moment when the link between candidate and advisor is made, sometimes before enrollment in the school, sometimes after a year of doctoral education. See [chapter 3](#).

Institutes	Number of internal advisors	Position in institute	Degree held by advisor	External advisors
<b>Aalto</b>	1-3	Primary advisor from Aalto and department, others possible from elsewhere.	PhD (primary advisor), with or without PhD (secondary advisor)	allowed
<b>CMU</b>	1-4	Primary advisor from CMU School of Design, others from elsewhere.	PhD/Master	allowed
<b>IIT</b>	4	All full time, 3 from IIT School of Design, 1 from another department of IIT University.	PhD/Master	allowed
<b>Imperial</b>	Minimum of 2	Senior member (senior lecturer/reader or associate professor equivalent by the Board of doctorates) of academic staff from Imperial.	PhD	allowed
<b>Polimi</b>	1-2	Assistant Professor, Associate Professor or Full Professor. While the principal supervisor must be a member of the Design Department, the other can be a member of any other Polimi Departments.	PhD/Master	allowed
<b>TU Delft</b>	2	Full professor or associate professor (awarded the 'ius promovendi') as primary advisor and a secondary advisor (associate or assistant professor) from TU Delft or elsewhere.	PhD	1 (optional)

Table 4 - Overview of the different criteria for the individual supervision of candidates.



## Other teaching roles towards candidates

Whereas the advisor role is tightly connected to the research and thesis project of the candidate, various others provide support in teaching PhD level courses. In the education programme, these teachers train the candidates in courses to provide disciplinary knowledge and general skills, e.g., about design theory, research methods). Some of these teachers are advisors themselves, others are specialists, or general trainers (e.g., academic writing, project management).

- At **TU Delft**, courses in transferable skills and some research methods courses for PhD candidates are offered university-wide. Disciplinary courses are managed by the IDE faculty. The quality control for courses and instructors is under development (for the accredited BSc and MSc programmes, strict criteria are available and assessed).
- At **Imperial**, candidates funded by a Centre for Doctoral Training must complete courses specific to the CDT's theme (e.g AI and health). For the majority of candidates no courses are required. Training on generic skills like communication are offered centrally by the Centre for Academic English and the library.
- At **Aalto**, candidates enrol in the Department of Design, School of Arts, Design and Architecture and University-wide doctoral and Masters level courses as appropriate to their research. These are devised through the Personal Study Plan.

These are divided between General Research Studies and Research Field Studies (15–25 ECTS each). There are certain compulsory components such as doing research, doctoral research seminar and research ethics.

- At **IIT**, PhD courses are all managed by PhD Faculty at the Institute of Design with the exception of the required course on Statistics offered by the university. In addition, PhD Candidates can take master or PhD level courses across the university as electives.
- At **Polimi**, candidates enrol in the PhD program in Design doctoral courses (25 ECTS) focused on research methodologies and practices. Additionally, candidates enrol in the Polimi PhD School courses (10/15 ECTS) as appropriate to their research.



## 2.3 The Organisers and the Organisation

The PhD programme is organised at a certain level of the **academic institution**, often a department or the university as a whole, and regulated at several levels, including the international and national levels (e.g., national disciplinary Research Schools). The organisation devises policy and its implementation, and provides central support facilities, including administration, an offer of education, the appointment of advisors and examiners.

### **Organisational support**

Within the universities, there is often a central policy regarding rules of examination, requirements for supervision, administrative support, Human Resource management and personal counselling, quality assurance, general facilities such as library access, and general courses, such as academic writing, or research statistics.

- For example, the central University Graduate School at **TU Delft** provides psychological counselling services for PhD candidates, a set of 'transferable skill courses' on creative writing, career orientation, project management, and formally appoints supervisory teams and evaluation committees. The design school provides disciplinary courses, and coordinates events for candidates and advisors.
- At **Imperial**, several parts of the organisation are involved: the college provides courses, the faculty of engineering organises networking events for candidates, the department handles conflict resolution and milestone progression, and the research groups offer a working context around the supervisors.
- At **Aalto**, the central Doctoral Education Services as part of Learning Services provides overall support. Doctoral regulations and administration are handled within the six schools - in the case of Design, in the School of Arts, Design and Architecture. This is where formal procedures such as admissions, approval of supervisors and advisors, defence arrangements are processed. These, however, exist in the context of the University framework. Within the Department of Design, most candidates are located in one of seven research groups.
- At **IIT**, the Graduate Office is responsible for overall policies, regulations, and students records. The Institute of Design is responsible for most everything else regarding the PhD Student experience, including admissions, advising, courses, employment, and exams.



## Issue: critical mass and internationalisation

Since these responsibilities differ greatly between schools it is important for newcomers to map and check the division of support and related responsibilities.

### ***Evaluation of the Phd Education programme***

PhD programmes are regularly evaluated by national bodies.

- In the USA, **CMU** and **IIT** are reviewed every 4–7 years by the Middle States Commission on Higher Education Accreditation.
- The programmes of **Polimi** and **TU Delft** are reviewed every 5 years in the course of research assessments under the auspices of national bodies. These assessments are coupled more tightly to the research of the institutes rather than their Bachelor/Master education.

EU Policy in the Salzburg recommendations (2005, item vi **Table 1**) emphasizes that doctoral programmes should seek to achieve critical mass, which might be achieved in various forms of regional or (inter)national collaborations. Next to the size of the engaged community, a coherent research topic/agenda is emphasized. Critical mass is seen as the way to give candidates access to a variety of experts and advisors, but also for them to gain interdisciplinary and international experience and network. Examples that are mentioned are national research schools around a disciplinary focus that have been around in the sciences for a longer time.

- **IIT** has a small number of candidates and staff, but an internationally well-known programme.
- **Aalto** does not have any joint programmes. However, it does occasionally offer PhD events, such as a Summer School as part of the Nordes (Nordic Design Research) network.
- **Imperial** leverages industrial and institutional partnerships such as multi-institution Doctoral Training Programmes to offer candidates support.



## 2.4 Other actors

**Several other actors** may play a role in the work of the candidate, besides the institutional ones mentioned above. Examples are colleagues and managers in a research project (if the PhD research is part of a funded research project), master and bachelor students (if the candidate performs teaching activities), industrial or other societal parties (if the candidate's research takes place in interaction with other organisations).

In addition, there are organizational structures, with roles such as counsellor or an association for the PhD candidates to deal with conflict of interests, for example, between candidate and advisors and to deal with personal problems, for example, psychologists and PhD candidate associations.

- For example, in Delft PromooD is a university-wide union of PhD candidates that promotes the interests of all PhD candidates at [TUDelft](#). Every new PhD candidate receives a handbook with a very thorough introduction to the PhD programme and it covers various subjects that are helpful for people moving to Delft or the Netherlands for the first time. Topics range from how to find a doctor or a house to applying for grants.
- [Aalto](#) provides counselling support and conflict resolution via Learning and Education Support. An introductory week for all new School of Arts, Design and Architecture candidates takes place in September where various other infrastructural supports are introduced.
- [Imperial](#) has an administrative role of post-graduate tutor whose job it is to look after the wellbeing of all students. There are also counselling services and hardship funds among other support structures.
- [IIT](#) has an orientation week in August prior to the beginning of the academic year for master and PhD candidates. It covers all aspects regarding new candidates: healthcare, immigration, tuition, curriculum, advising, career services, students association, social life, and moving to Chicago. Orientation is coordinated by the Institute of Design in coordination with other university services and departments.

When candidates work in the context of a larger project, or perform teaching duties, several other actors come into play. These can provide a relevant societal network, opportunities to learn transferable skills and training in aspects for a future career (e.g., in teaching or in the domain of the research project). This can also lead to conflicts of interest when imposed workload detracts from the PhD work. For instance, when the advisor is also the project leader, and the candidate is employed as a researcher in the project.







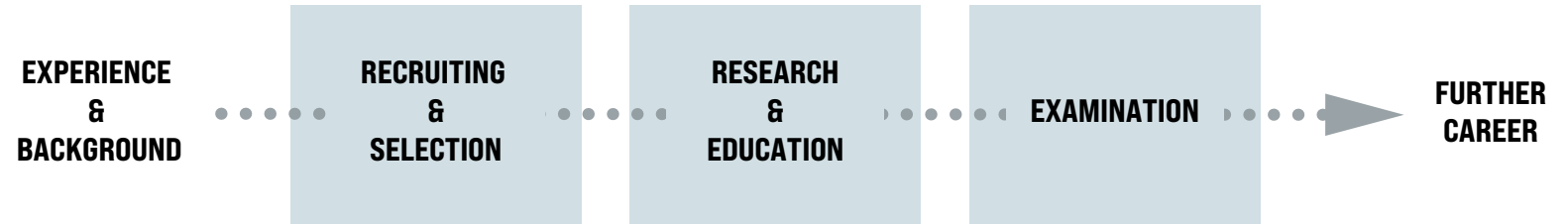


Figure 8 Timeline of the PhD in Design

Another lens looks along the timeline of PhD education at the phases, activities and (intermediate) results with which the organisation, advisors and candidates engage. It is organised and represented chronologically, as the journey of the candidate, starting with his or her (design) background, and proceeding with the way the PhD project gets started, how the 3 or 4 years of research and education take place, what happens at the end, and what the next steps of the candidate are. Because what happens in one phase is largely motivated by what one should deliver to the next one, we describe it in reverse chronological order: first at the *end*, then *during*, and finally at the *beginning* of a PhD in Design.

# 3.1 At the End: Examination and Further Career

## Professional career

The PhD is an education to become an independent researcher, and is a preparation for a variety of later jobs. Originally, for academic teaching, later also for (industrial and academic) research positions, and increasingly for different types of jobs in society.

PhD Programmes emphasize the aims of developing the candidate to become 'an independent researcher' with sufficient generic skills ('transferable') demanded by society, such as professional communication, project management, interdisciplinary collaboration, and - more recently- entrepreneurial skills. Data about the further careers of PhD alumni is limited. Most DoCS4Design partners estimate that between 40% and 70% of the graduated candidates continue in academia. This is higher than for many other disciplines, and may be related to the fact that design is growing as an academic discipline world-

wide, with relatively many positions available. The midway split between academic and other functions signals the need for flexibility in the education components, where for some the typical academic skills of teaching, proposal-writing, and building an academic network, may be more relevant, while for others other industrial/societal networks and design

skills are more in the focus. Many graduated PhDs remain in the country of their studies for some time for a while (estimates range from 1 in 4 upwards). See **Figure 9**. Some maintain a personal link to their former advisors, but most often there is not a PhD alumni network.

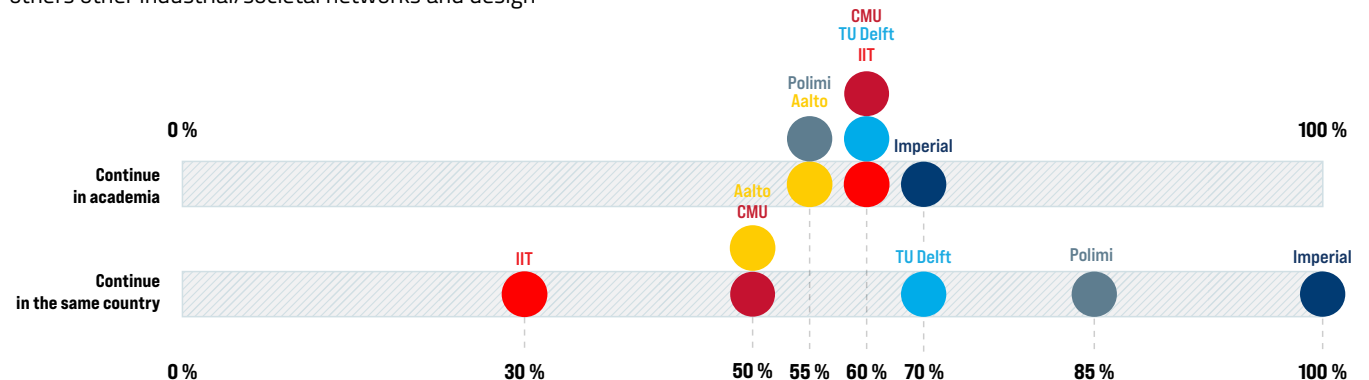


Figure 9 - Jobs after the PhD. Many graduates remain in the country for their next job; just above half remain in academia.



## Degree Examination

At the completion of the PhD, the candidate takes part in a final examination. Part of this is an evaluation of the written PhD thesis, often in a (public or private) defence of the work by a committee of assessors, from within and outside the institution. Course requirements usually have been completed earlier in the programme.

The terminology in this area is particularly under scrutiny. At some places, terms like 'thesis' and 'dissertation' are used as synonyms, in others the dissertation refers to a larger set of documentation of the research, including but not limited to the thesis.

Regarding **the deliverables**, at each of the partners, the candidate produces a thesis. It is a common practice that one or more journal and/or conference papers are produced and submitted for review by the time of the exam. Also, there are varying practices and expectations, sometimes rules, regarding the public dissemination in the form of journal articles, conference papers, the form of the thesis, and/or exhibitions of work. The role of societal impact, designed artefacts, exhibitions, and evidence of impact on industrial practice or design education is weighed

differently, occurs regularly, but nowhere explicitly required for all theses.

- At **Polimi**, the PhD thesis is a written dissertation, shared with the exam committee, archived, but not published. It is made available in the Polimi online repository; the author decides whether the thesis is open access only for the Polimi community, for anyone or not open access.
- **TU Delft** follows the Dutch tradition where the thesis is a published book of 100-300 pages openly available to the public (and occasionally available as a commercial book) before the final exam (defence) takes place, and accompanied by a list of 10 provocative 'propositions' about the candidate's research and wider matters of academic and societal import. Often, the research chapters of the thesis are based on 3-4 published journal articles and conference papers, but how many and which form of dissemination is used is left to the expert judgement of advisors and assessors. Next to that, all theses are publicly available in the university's research repository.
- At **CMU** an exhibition and workshop are a regular part of this. In recent years, there is a rising interest in design research to give designed artefacts (sometimes referred to as 'research prototypes') a special position.
- At **Aalto**, nearly all PhDs in Design are either by monograph or by articles. Practical work may be documented in these. There is the possibility of presenting practical work, e.g. through exhibition, which is evaluated separately prior to the written part. However, in Design, this is rarer than other departments in the School.
- **Imperial** requires all candidates to produce a thesis which is generally made available to the public. While a PhD by Publication is not allowed, it is common for candidates to adapt several papers to be chapters of the thesis.

- **IIT** requires a PhD thesis as a written dissertation of approximately 100-200 pages which is published and available to the public through the university library. The dissertation has to be reviewed by the 4 members of the advisory committee, then presented and discussed in public during the required final oral exam. The oral defence and dissertation are the two requirements for completion and graduation of the PhD degree.
- At **CMU**, the terminology and deliverables are currently under discussion. There is a desire to shift from mainly written document towards a more encompassing 'body of work', and from 'defence' to a less adversarial mode of engagement with the academic community.

**NOTE:** The DoCS4Design deliverable #Wunderlibrary will explore and publish a variety of theses and prototypes from across the partners.

<i>Institutes</i>	<i>Final work(s) form of the main deliverable</i>	<i>Publications form and required/typical numbers</i>	<i>Examination assessors involved</i>	<i>Examination private or public</i>	<i>Specific practices and rituals</i>
<b>Aalto</b>	A published thesis open to the public	Presented as a monograph or minimum three peer-reviewed articles and extended introduction.	2-3 external assessors in two phases	Public	Examination by public defence with external opponent.
<b>CMU</b>	A written dissertation and oral defence	Suggested 1 or 2 academic articles beyond the thesis but this is not required.	1 external assessor and the full advisory committee	Public	Oral defence open to the public, followed by a close section with the advisory committee to discuss the written dissertation.
<b>IIT</b>	A written dissertation and oral defence	Suggested 1 or 2 academic articles beyond the thesis but this is not required	3 or 4 assessors	Public	Oral defence open to the public followed by a close section with the advisory committee to discuss the written dissertation.
<b>Imperial</b>	A published thesis open to the public	Often 2-3 though no explicit requirement beyond the thesis	1 internal assessor, 1 external assessor	Private	Annual showcases
<b>Polimi</b>	A written dissertation	Minimum two peer-reviewed papers.	2 assessors	Public	Examination by public defence with external opponent.
<b>TU Delft</b>	A published book of 100-300 pages openly available to the public	often 3 - reviewed journal / conference papers	4 independent assessors	Public	Laymen's talk prior to the defence, paranympths supporting the PhD candidate, a list of propositions about the thesis.

Table 5 - Overview of the different deliverables and examinations per candidate.

In some places, the graduation or diploma award is (sometimes highly ceremonial) public presentation and defence against an independent committee of assessors, involving family and friends of the candidate. In others it is a closed viva with one or two assessors, more like an exam. In some it is a major public and social event, in others it is a private meeting with a few people.

In the former, the manuscript for the thesis has gone through a review round before it is approved for the exam; in the latter, sometimes required improvements are determined at the exam.

A ceremony is typically a cultural ritual to complete a cycle. In public defences, as common in the Netherlands and Scandinavia, cultural symbols and a protocol that prescribes clothing, and a specific course of events with a beadle, two paranympths that support the candidate, list of propositions, a debate with a committee composed of internal and external opponents, promotor and co-promotor and a chair enhance the values the values propagated with a doctor's degree. This is also the moment that the candidate receives his/her diploma, in a form that represents the institute's identity. In Delft this is a large document with a wax seal, stored in a large red tube.



Figure 10 - Ceremonial diploma award at TUDelft

## 3.2 During the PhD project: Research and Education

### Duration

The Salzburg I (2005) recommendations indicate that, as a rule (Table 1, item vii), the duration of the PhD programme is three or four years. On top of these substantial differences in total time, there is also variation in the amount of time candidates have for research and education, and at what point their research project begins. With all DocS4D partners, three or four years is the intended duration, but all report that this duration is not always met, and is a substantial transition from earlier PhD culture, when durations of 10 years were not uncommon.

At many universities, realizing the intended duration has become a major policy goal, and has led to strengthening and formalizing PhD education as an institutional responsibility organized more towards the organisation that has been established for bachelor and master programmes: quality management procedures and teaching components. This is a matter of concern across disciplines at many of the universities. Many advisors see the completion of the result and the thesis-as-planned as key. But at the same time there is a move towards more focus on assessing the learning goals. In many universities only recently recognize or emphasize the need for regulation and to deal with, for example, failing advisors, or delays due to pregnancy leave and unexpected circumstances beyond the control of the candidate. The recent situations regarding COVID-19 have brought those aspects again to the focus of discussion.







## Process and Timelines

The first year of the programme usually takes a special position. It often involves a substantial part of courses and training, sometimes orientation on a research topic and finding an advisor. In some programmes, there is a formal evaluation at a go/no go meeting after one year or a broad examination (based on the courses attended in the first year), followed by an assessment of a (by the candidate developed) research proposal. For the proposal, some schools provide a formal format (template).

Individual research by the candidate is part of each programme, but the amount of time and timing varies.

- At **CMU** PhD candidates do not produce their research proposal until the end of the first year, so not during their master or design practice. Proposals are based on what the candidate drives as a person and the energy that comes from this drive. Proposals are written within the community in a co-design process so everybody is part of it and the candidate does not stand alone. The ethos is what makes it work.
- **Polimi** structures the curriculum on the base of ECTS and allows exchange of courses between schools, see the Education section.

Timing of education varies across disciplines and universities in general. In some institutes, the research project spans the entire duration programme. In others, the first year is education and orientation, and the research starts after one year. Education may take place at the beginning of the PhD period, or scattered over the years, but 'with a bias for the front'.

- At **Aalto**, students must complete 40 ECTS credits of theoretical studies (general research studies and research field studies) and a doctoral thesis. The doctoral degree generally lasts four years. Candidates who complete their education component within 18/24 months are awarded a small incentive grant.
- In **Delft**, the required courses are supposed to be completed in the first two years, so as to be effective support for the research. Some transferable skills courses are intended for the final stage to support candidates at finding jobs after the PhD.
- **Imperial** has a Graduate School which delivers doctoral courses across college. A total of 4 modules need to be completed: two before the Early Stage Assessment (12 months) and a further two before the Late Stage Review (18-24 months).
- **IIT** has a total of 5 PhD required courses that candidates take during their first 3 semesters. Candidates start research credits in their first semester although the majority of the research credits are taken between the third and fifth semesters.

With most of the partners, education and research run in parallel, with an emphasis on education and solidifying the research plan in the first year, and about a year for writing the final thesis in the last.

Two models are common: synchronous and asynchronous learning programmes. In the **synchronous** model, candidates start at the same time, and, after a period of coursework, are then linked to an advisor for their individual research project.

In the **asynchronous** model, candidates come into the programme at different times; they usually start on

their research project from the beginning, and courses are taken along with the research.

- In *Polimi*, candidates apply to the programme with a specific research topic; if selected, he/she connects to an advisor from day.
- In *IIT*, candidates define their research questions during the admissions process and are only selected if already connected to a primary advisor.

Synchronicity has an impact on the way the community of candidates is formed. In a synchronous model, a 'class of peers' is established at the start, and courses start with a more homogeneous population. In asynchronous models, the stages of candidates are more diffuse, and the amount of in-house experience of candidates on a twice-a-year course can vary by six months.

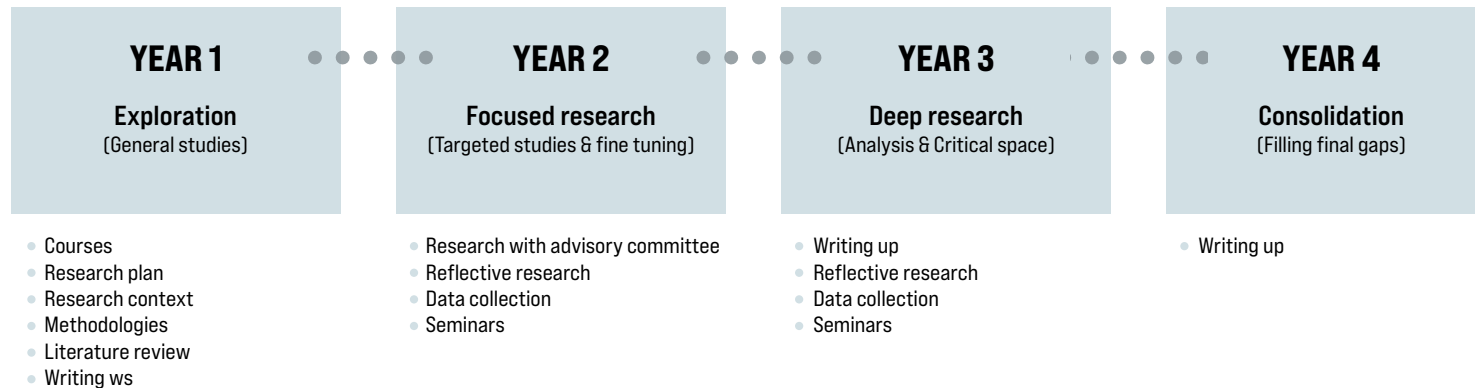


Figure 11 - Possible structure of a PhD in Design programme.



- In **Delft** the traditional way to the PhD is that the candidate is hired for a 4-year grant project, and can then register with the Graduate School. The project can start at any moment of the year, and the Principal Investigator of the project often is one of the advisors. Although the majority of PhD candidates start either in September or January, it could be difficult for candidates to find their peers, and because many courses could be taken at various moments, the candidates in the courses would vary greatly and would experience some course content as too early or too late. As of 2020, the course structure was adjusted, and new candidates would take the basic entry courses at the first opportunity, supporting a semester-based 'class of peers' as exists in the synchronous models.
- At **Aalto** and **Polimi**, most candidates join a Research Group within the Department of Design, ensuring some vertical integration between them, post-docs and other faculty members. With the single intake in September (November at Polimi), however, there is also the opportunity to build peer relationships within the Department and across to others in the School

among that intake. Otherwise, there is less hard emphasis on annual cohorts than, perhaps, in other institutions in this consortium.

- At **Imperial**, PhD candidates can apply on a rolling basis as and when funding is available. While this means they can start any time of the year, the majority of candidates start in October with the start of the Academic year. Graduate School modules are offered throughout the year which makes it easy to begin any time and milestones are based on when the candidate begins making the structure flexible. There is an annual research showcase in June/July which provides some anchor to all candidates.
- At **IIT**, PhD candidates usually start the program in August at the start of the academic year. They take classes together while working individually on their research under the supervision of their primary advisor. They also join several social events to connect with the other candidates and advisors, helping build a community of design researchers.

Related to this, the moment when candidate and advisor are coupled varies from before the start to during the first year.

- At **CMU**, advising starts at the end of the first year (out of four years total).
- **Aalto** and **Polimi** try to establish the supervisor and advisor teams from the outset. However, there are occasional changes along the way.
- At **TU Delft**, finding an advisor is a condition that takes place before the candidate is admitted to the PhD programme.
- At **Imperial**, prospective PhD candidates are required to contact potential supervisors before funding may be secured. A supervisor is arranged before the candidates begin the programme.
- At **IIT**, the admission of a candidate is conditioned on the approval of a research proposal by an advisor, which happens at least 6 months before the start of the program.



## Milestones

Some institutes have clearly defined milestones whereas others have no intermediate deadlines and deliverables defined.

- At **IIT** candidates get one Qualifying Exam at the beginning of the second year before formally beginning their research project; also, at the beginning of the third year, the candidates must pass a Comprehensive Exam in order to formally apply for the final examination and completion of the thesis.
- **TU Delft** has a structure with several required, documented meetings in the first year, a go/no-go assessment by a committee after one year, and annual progress reports.
- **Polimi** has no 'qualifying exam', but yearly assessments with internal commissions nominated by the PhD Board and composed by assistant/associate/full professors of the Department of Design.

- **Imperial** has four milestones. A research plan at week 12, the Early Stage Assessment around 12 months, a Late Stage review at 18-24 months and the Viva. The Early Stage Assessment often acts as an important go/no-go milestone.

Next to that, funded programmes often impose reporting moments, and personal grants often require statements of progress by the advisory team.

## Division of time over research, education, and other duties

How activities are divided varies from programme to programme, and between candidates in the same programme. These activities entail, for example, education (following courses), doing research, visiting seminars and conferences, including project work and teaching that does not directly contribute to the research outcomes. Teaching is usually a small part of the whole workload.

In the PhD programme also courses and activities are incorporated to train transferable skills that help the new doctor in design to find an appropriate job, see **Research and Education**.

- The required doctoral education courses at the **TU Delft** is 45 days in total within a programme of 4 years;
- **Polimi** requires an equivalent of 45 ECTS, which is 160 days in total.
- **IIT** requires a total of 70 days of required course work.

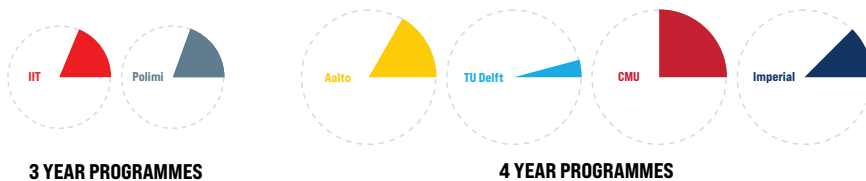


Figure 12- A comparison of workload in the programmes. The coloured sector represents the amount of time scheduled for formal education, the rest is the time allotted to project duties and teaching.

For example, some candidates need to spend more time on teaching in master courses than others. Teaching can contribute to the candidate's development, especially for those who plan an academic career. Also, some teaching activities such as mentoring master graduation projects can add to their work if it is on topic. On the other hand, high teaching workload can come at the expense of progress for the student.

- At IDE in **Delft**, policy limits the amount of teaching tasks that candidates can be asked to do to 10% of their time (160 hours) in any year, with a strong preference for tasks that contribute to the candidate's research and professional development. Some funding agencies prohibit the candidate from being given teaching tasks.
- At **Polimi** candidates are allowed to be involved in teaching activities for a maximum of 40 hours per year.
- Currently, at **Aalto**, candidates funded within the department do a max 5% teaching, although this is under review.
- At **Imperial**, candidates have the option to engage in teaching support as a graduate teaching assistant. Graduate Teaching Assistants should normally teach fewer than 6 hours per week and teaching must not exceed 10 hours in any week.
- At **IIT**, candidates have the option, if they are qualified, to either be the instructor or teaching assistant to master and undergraduate design courses. They can dedicate from 10 to 20 hours a week for teaching.

**Other obligations**

When candidates are embedded in research groups, taking part in academic (co-reviewing articles) and social tasks (organizing a team activity) can be part of the formative experiences. Usually this is managed at the level of the individual candidate, advisor or research group.

<i>Institutes</i>	<i>Time division</i>	<i>Education receiving</i>	<i>Research own project</i>	<i>Other duties e.g. teaching</i>	<i>notes</i>
<b>Aalto</b>	Uniform programme of total of 40 (but may be more) ECTS, divided over 2 years out of 4.	Courses offered by school or department level.	Most of the time.	Currently max 5%.	year1=23+/16 ECTS; year2=21+/9 ECTS (by school/dept)
<b>CMU</b>	One year of courses, two years of research project, one year thesis.	Courses offered by school or department level.	Most of candidates' time across all years.	Teaching Fellows teach one full course per semester .	About 50% of our PhD researchers are Teaching Fellows; the other 50% are self-funded and not required to teach.
<b>IIT</b>	9 CR education in year one, 48 CR research & thesis across 3 years.	Courses offered by the Institute of Design PhD programme.	Most of candidates' time across all years.	Optional teaching support of no more than 10 hrs/week.	-
<b>Imperial</b>	1 semester courses in year 1, 2.5 years research, 1 year thesis.	Courses offered at university, with network universities and supervisor level.	Most of candidates' time across all years.	Optional teaching support of no more than 10 hrs/week and 6 hrs/week average.	-
<b>Polimi</b>	Uniform programme of total of 35 ECTS for courses, divided over 3 years.	Courses offered by Polimi PhD school and Design PhD programme.	Most of the time.	6 months of internship abroad (10 ECTS) that may be replaced with 2 additional courses. Also, 40 hours/year max as teaching assistant (national regulation).	-
<b>TU Delft</b>	Mostly individually chosen courses, at least 15 GSC in three categories (transferable, disciplinary, research).	Courses at university, faculty, advisor level.	Most of the candidate's time in each of the 4 years.	Max 10% teaching, of time in a year; tasks in the embedded research project or group.	-

60 ECTS is one year full-time study load

1 GSC (Graduate School Credit) = 1 day of work + preparation

1 Credit (CR) is equivalent to a total of 45 hours of study per semester

Table 6 - Variety in ways in which courses for candidates are organised and quantified at the partner institutions.



# 3.3 At the beginning: Recruiting and Selection

## The initiative for enrolment

The initiative for enrolment in the PhD Programme lies either with the institution ("apply here with proof of funding") or with the candidate ("register here when you are hired on a project"). Most institutions have an admissions office, where interested people can apply for admission to the PhD programme.

## Selection

Besides the financial and degree rules, some programmes have a **selection process**, either as part of the admission process, or as part of the research hiring process. The **selection criteria** depend on the research topic and approach. They also include requirements to prior education (often a master diploma) and English language proficiency. The process may involve a screening by a selection committee, judging academic skills, or a competitive selection in the case of multiple applications for the same position.

- *Aalto*, *CMU*, *IIT*, *Polimi*, and *Imperial*, the application to the program requires the candidate to provide a CV, research-plan, motivation letter. All these, except Polimi, also require a portfolio of earlier work.

- In *TU Delft* and *Imperial*, candidates are registered with the Graduate School after being accepted by their advisor, often in a regular job application requiring some of the above elements.

Most programmes conduct an interview with the candidate, the European ones require an explicit proof of English Language skill (typically a TOEFL or IELTS test), and some require proof that the candidate has sufficient funds to pursue the PhD project.

The DocS4D partners all use the English language for research reporting and for procedures. It is an open question if this holds for other programmes worldwide. Likely there are programmes using multiple language versions, or only using the local language.



## Tuition fees, contractual and financial position

The institution may require tuition fees, bench fees, and proof that the candidate has sufficient funds to pursue the studies. Some candidates are self-funded, some hold a scholarship or grant from a national or other institution. Some prospective candidates contact the institute with or without a proposal and funding. Some partners have scholarship programmes to support the funding of candidates. In some institutions, there is a fixed number of positions in the programme, in others candidates are hired for temporary research positions, and the number of candidates fluctuates with those positions.

The fees candidates need to pay or that need to be covered through funding differ considerably, from 0 up to 38,000 euros per year. It is not clear how other costs, such as travel expenses of conferences, extra training, research materials, and the printing costs of the thesis are covered.

The legal and **financial position** of candidates varies significantly. Some are employees of the institution during their PhD project, others have the status of registered student. Yet others conduct the research as part of their job in an industrial position, and follow the PhD programme part-time, coming in for courses and advisor meetings only. Self-funded candidates are more independent - and have less obligations such as a minimum of teaching hours - than candidates who are funded and have an internal position within the institute.

- For **Aalto** it is difficult to give percentages. There are approximately 50 candidates. Some come with grants from their home countries. In Finland, many doctoral candidates get short-term grants from foundations (1-4 years). Some get several, short-term grants from different foundations. The department funds several candidates (up to 10 or 12 per year) either at the start of their studies for up to a year while they apply for grants elsewhere and, often, towards the end of their studies to help bring them to completion. It is rare that a student is funded by the department throughout their 4 years of study.

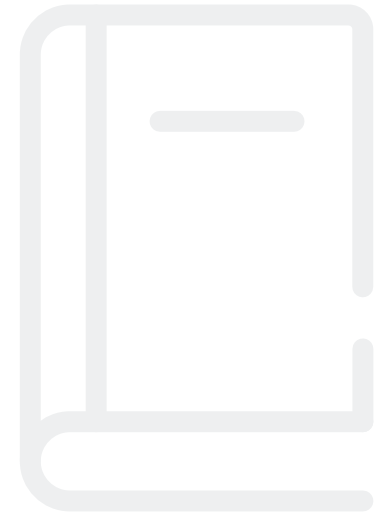
The 'typical' PhD works full time, but several schools also have a number of candidates who work part time, often employed in industry.



# RESEARCH AND EDUCATION 4

Research and Education are the two main elements of content in the programmes.

**Table 6** on page 41 shows how the amount of time spent on them can vary. In this section we explore research topics that candidates are working on, the research domains and themes schools are targeting, and the competences educated in courses for candidates. In addition, the section gives an overview of the possible constraints that need to be taken into account by the organisers of PhD education, the teachers, as well as the candidates, whether or not laid down in written rules.



# 4.1 Research

## Issue: research topic and available expertise

All PhD programmes require candidates to give evidence of becoming an independent researcher by **conducting original research**. One driver behind the requirement for critical mass ([Salzburg I, item vi; II, item 1](#)) is the concern that the candidate has access to the relevant expertise and academic/societal network, preferably in the persons of the advisors. Absence of such expertise may be an important limitation to the freedom for candidates to define their research questions.

In some cases this expertise question is addressed from (before) the start, e.g., when the candidate was hired by the advisor on his/her project, which is often the case with funded grant projects in Delft. All partners indicate that in most cases, they can make an in-house advisory team with the required expertise. Most encourage candidates to fit into the research strategy of the school, which has the obvious benefit of research expertise being present.

- Several schools ([CMU](#), [Polimi](#), [Aalto](#)) indicate that it may be the secondary advisor that is a domain expert. At Imperial College, staff are not forced to take on candidates on topics for which they do not have expertise and there is often collaboration with external partners which adds additional support.
- At [TUDelft](#), sometimes a third, external advisor is added to the team, especially in the case of interdisciplinary research collaborations.
- At [IIT](#) the primary advisor should be the expert on the research area while working with the other committee members bringing complementary areas of expertise to the research.

## Topics & Methods

Many factors influence the topic of the research.

For some candidates, the PhD comes with the research project for which he or she was hired, and the project brief or grant topic was more or less established. For others, it is the candidate's responsibility to come up with a research topic, either during his or her first year, or in his or her application, or in negotiation with available advisors. The topic may have to fit within the research agenda of the institution, or have a specific relevance for design, or make use of expertise, methods, or facilities at the institution. Even if the candidate is free to choose, the available expertise in the institution, or its partners, can be a limiting factor.

The degree of independence and autonomy in terms of freedom with regard to the chosen subject of study varies per individual. In a sponsored project, the contract and agreements with funding partners may steer the object of study. In some cases the candidate's research contributes to a research group, in other cases the research assignment is more loosely defined. Especially in the more art related institutes the curiosity of the candidate is leading. A certain degree of freedom is important to connect with the intrinsic motivation of the candidate.



### *How are research topics chosen?*

The way in which candidates choose their subject of study varies greatly. Some candidates bring their own subject, while others work on a study that is part of an already started project, research group, lab, or fits the research agenda of the institute. The possibility is usually related to the financing. Someone who works on his or her own time and finances or is supported by a personal grant, for example, will usually have more freedom. Though, research topics proposed by the applicants are usually discussed, negotiated, defined, and pre-approved prior to final submission of the application. Candidates who apply for an advertised project vacancy are expected to become a good match between their personal interest and competences and the advisor's area of interest and expertise. However, the research culture also plays a role.

In some schools a lot of value is attached to autonomous learning and signature design with a low hierarchical structure, whereas in other schools, research teamwork and contribution to the established research structure is stimulated.

In sum, identified factors that both constrain and drive the research topics are:

- The expertise and interest of the candidate;
- The expertise and interest of the advisor(s);
- The available committed industrial and other societal parties;
- The opportunities to gain operational funding for carrying out the studies;
- The research agenda of the institute/department/group;
- A larger project in which the candidate is embedded;
- The agenda and financial support of funding institutes, such as governments and companies and;
- The research culture.

How these factors play out varies across institutions, groups, projects, and individual candidates. Yet all partners indicate that the candidate has considerable freedom in determining the research topic, goal, and questions within the constraints. One recurring theme in the discussions is the large influence of **external funding** and institutional agendas, especially in those programmes where candidates come in on already defined projects, which on the one hand can limit curiosity-driven research, on the other hand can provide a context with willing collaborators. A second, connected, theme is the increasing attention towards desired societal impact of research, next to scientific impact. These shifts occur both at institutional levels, but also at the level of individual (PhD) researchers.





### ***What topics are addressed?***

The topics of study are extremely diverse and can be categorised in various ways. The common criterion is that generated knowledge and/or impact of a PhD research should contribute to the particular discipline. For example, a research project on emotions in game design could be considered as a PhD in psychology or a PhD in (Game) Design, depending on its focus, or on the institution. But because research is becoming increasingly integrative and multifaceted, the disciplinary lenses or application areas found within a PhD programme (or even within a single candidate's project) can be difficult to separate.

- In **Delft**, the PhD diploma does not mention a discipline, and there is a range of different topics connected to the IDE research agenda, which is currently organized on intersections of societal challenges (application areas) and disciplinary perspectives. PhD projects provide contributions to academic design research, design practice, application areas, and design education. Often a PhD project can have contributions to more of these. However, there is no explicit policy on which of those are required.
- At **Aalto**, the Department of Design's research foci are Design for Sustainability, Collaborative and Human-Centred Design and Practice-Based Design Research. Research is clustered around the expertise of seven research groups, and doctoral candidates develop their research project to fit along with one of these.
- At **Imperial**, research is broadly grouped around four themes: AI and Data, Sustainability, Health and Wellbeing and Mobility, but other areas are also possible (e.g Additive Manufacturing). Research groups around the interests of each academic provide a more narrow specification and may exist outside of these themes.
- At **Polimi**, research is broadly grouped around seven themes: Advanced Manufacturing, New Innovation Paradigms, Cultural and Creative Industries, Digital transformation and Services, Digital transformation and Products, Cultural Heritage, Design for sustainability. Research groups around the interests of each academic/research lab provide a more narrow specification.
- At **IIT**, research is clustered around the expertise of a PhD advisor within the Institute of Design. Candidates explore a sub-topic within the advisor's research agenda.
- **CMU**'s research is structured by its programme on Transition Design. Within this theme the candidate has a lot of freedom to develop a research proposal that attunes with own interests and drive, see **section 3.2**.



Some identified ways to categorise research topics and whether or not put together in a matrix are:

### 1. Contribution to the body of knowledge in the design discipline about

e.g.

- Designing (design processes), Designers (people who design), Design outcomes (products, prototypes, ...)
- Design education
- Theory, methods, and tools

### 2. Contribution of design to application areas/domains

e.g.

- Design for: Advanced Manufacturing, Design for new business & manufacturing, Design for Social & Public sector innovation, and Design for cultural & creative industries;
- Healthcare, Mobility, Living

### 3. Perspectives or societal goals, to create impact

e.g.

- Well-being, Sustainability, Ecology
- United Nation Grand Challenges

From an inventory of topics, approaches, and outcomes from the work of individual PhD candidates, shared and discussed in several DoCS4Design meetings, six categories were identified, each representing a specific type of research regarding approach and used method and the aimed outcome, some more theory driven and others more impact driven, see [Table 7](#).

For each category examples were made; a summary of work in an easy to read A4 format. Examples can be found in the appendix. This is a first iteration that may not cover the entire variety of PhD's in Design.

This set was used to raise discussion in a workshop with the six partners and some of their staff members, and appeared to be useful for different reasons:

- To explain to both an early-stage candidate and to colleagues from other disciplines how a design thesis looks like.
- To have a starting point for starting an informed discussion with PhD candidates and co-supervisors.
- To show how boundaries can be set in a PhD in Design.
- To understand what kind of infrastructure is needed; kind of expertise for supervision, courses, facilities.
- To understand what is required more, for example, for a PhD in Design that aims to have societal impact on a short term.

*Theory driven*

*Impact driven*


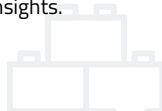




<i>Regarding Approach and Method</i>		
1. <b>In control</b> , the result is scientific knowledge, a result from a systematic approach that focuses on validation of a hypothesis. 	2. <b>Learning through design</b> , the researcher follows a Research through Design approach and the result consists of one or more demonstrators (designed artefacts) that lead to insights. 	3. <b>Experience matters</b> , the researcher uses his/her own working experiences and the result is based on case studies that are developed over a long period of time. 
<i>Regarding Aimed outcome</i>		
4. <b>Free as a bird</b> , the result is a product, service or other designed result that is exhibited in a final and public exhibition. 	5. <b>Supporting designers</b> , the result contributes to the process of design (designing), for example a new method, tool or technique, or a reflection on a methodology. 	6. <b>Making a difference</b> , the result is a design that contributes to societal issues and is recognized by the public opinion. 

Table 7 - Six representations for the PhD in Design

### How do schools define their research portfolio and/or strategy?

Similar to the candidates' individual topics the research portfolios are very diverse.

- **Aalto** organises their portfolio mostly around seven departmental research groups, each led by a professor, whereas
- **IIT** and **Imperial** College indicate a number of design areas and application fields.
- **TU Delft** has a general research strategy formulated by the departments, but specific topics arise from granted project proposals, either within chosen application areas Health, Sustainability, Mobility, or disciplinary perspectives.
- **Polimi** distinguishes a number of application fields and possible design elements. But in none of them is there a prescribing guidance on what the research should be about, academic freedom, and upcoming opportunities allow for considerable variation.

But none of them contain a prescribing guidance on what the research should be about, academic freedom, and upcoming opportunities allow for considerable variation.

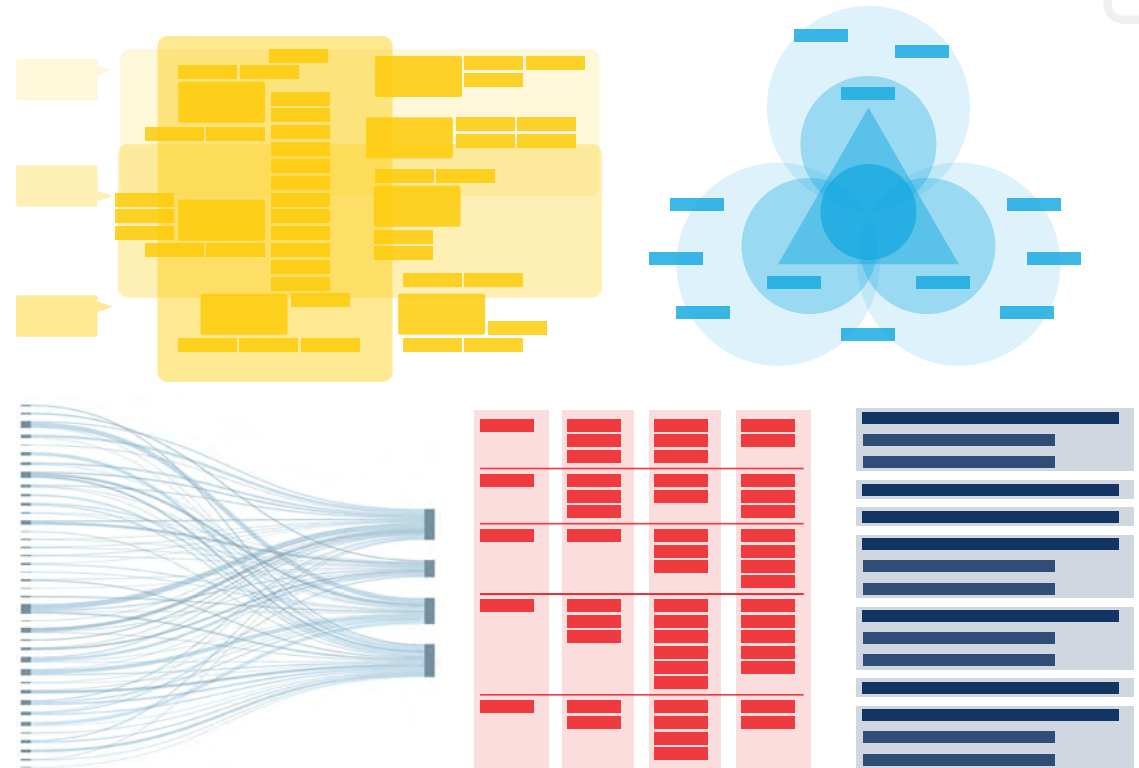


Figure 13 - Various representations of the research portfolios

## Research Methodology and Methods

Research in Design PhDs make use of a variety of methods from application areas and disciplines from the sciences, engineering, humanities, and design itself.

Design research is positioned between fundamental research (as occurring in many scientific disciplines) and applied research (as occurring in industry). Within design research, the approaches and formats vary between these two opposites, and research methods from various other disciplines (e.g., social sciences, engineering) are adopted and adapted.

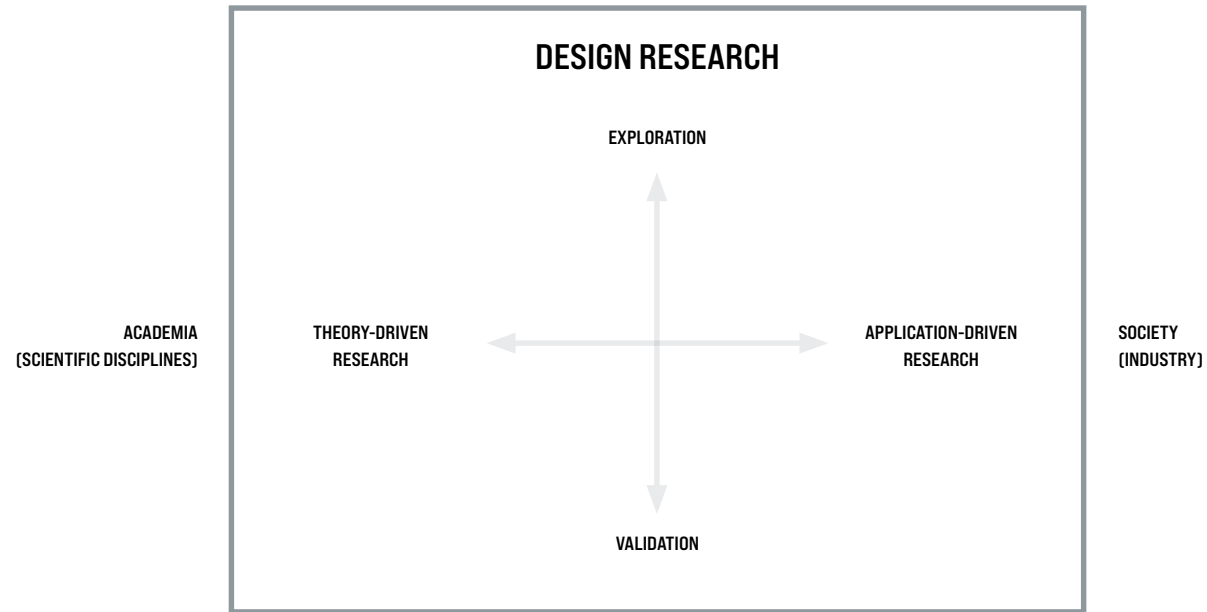


Figure 14 - The landscape of research approaches in a PhD in Design

# 4.2 Education

## PhD in Design Education: Graduate Schools and Courses

Most schools use the name 'PhD in Design', some Graduate School, and others Doctoral Programme, then the name of the institute indicates the domain (design, art, industrial design, architecture...). Head of the curriculum - here called Graduate School - is a director or coordinator with most of the time a full-time professor position.

### How it started

The first Graduate Schools in Design started around 1990 (e.g. Aalto, Polimi, IIT) followed by others around 2010 (Delft, Imperial, CMU). At most of these institutions, other disciplines already had established Graduate schools, or national Research Schools across universities. The Graduate School curricula are specifically developed for the design discipline.

An exception is the Delft Graduate School's curriculum and regulation that is developed for all disciplines in the university. This is also expressed in the Delft PhD diploma that does not

mention a discipline. However, as with the other schools, a substantial part of the courses are organized at the design school, and some of its practices spread to other disciplines.

### Content/Competences

Programmes offer courses in *four different categories*:

- **Discipline specific courses**, such as Research through Design, Design History, and design methodology;
- **Topic specific courses**, that are courses to deepen the candidate's understanding about a certain area of expertise;
- **Generic courses** for doing research, such as academic writing and research ethics, and philosophy of science; and
- **Transferable skills course**, that are courses to train competencies for professional practice, such as networking and project management.

### PhD researcher's propositions (= answers to research questions)



### What are research questions?

What is your topic?

What is the context?

What do you want to achieve?

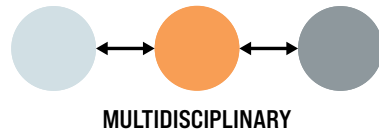
What is the nature of your question? (e.g. descriptive, explorative, explanatory...?)

Are there potential relationships you want to explore?



Figure 15 - Slides from course material





In addition, there are credits (time) allocated for individual work (e.g. thesis, prototype, design).

- At **TU Delft**, there is a university-wide competence model for PhD education, which distinguishes three themes: research skills, disciplinary skills, and transferable skills. Within each of these, a candidate has to obtain 15 credits (one credit representing one day of work plus preparations). Courses in each theme can be obtained from different sources, but typically the university offers transferable skills, the design school offers disciplinary skills for its PhD candidates, and research skills are obtained in part on the job, and in part in specialized courses.
- **Imperial** requires 4 courses with general knowledge needed for a PhD in Design.
- At **IIT**, all candidates receive training in a common shared research methodology deemed especially relevant for the PhD in Design: participatory action research. Also, conducting pilot studies is an element of research practice that is taught to and required of all candidates.

In general, the scope is broad in the addressed topics (theories rooted in different disciplines) and time (historical perspective) aiming to make candidates understand the habitat in which they join. Most schools provide a set of required courses from master programs or specifically developed for the PhD curriculum, but there is also room to select from master courses within or sometimes also outside one's own institute.

Also, issues of disciplinarity are in the focus of attention. Design is a young academic discipline, and those pursuing a PhD degree in it typically build on/ relate to a mix of other, established disciplines for knowledge or research methodology. Issues include cross-disciplinarity (often to an established discipline in technology, humanity, or the social sciences), **multi-, inter-, and transdisciplinarity** in combining relations to several of these. And finally there is a growing field of research methodology that is particular to design (e.g., 'Research through Design').



### *Transferability between institutions*

#### **Credits for courses**

Universities acknowledge each other's PhD degrees, but at course level, exchanges are not formally arranged, rather in an explorative state. In Europe BSc and MSc courses in accredited programmes are expressed in ECTS (European Credit Transfer and Accumulation System). Polimi and Aalto use the ECTS also as its official unit for courses, see also page 40.

- **Polimi's** courses are awarded in units of ECTS (an EU exchange currency for study workload used in the Bachelor-Master programmes; 60 ECTS is 1 full year of study). Polimi offers a 3 years program with a 45 ECTS study load. In a first year mid term review with international examination board candidates are reviewed for admission. There are 5 main courses: Design research methodologies; Design research planning; Design research prototyping (embedded in an international Summer School); and two freely selected among the PhD school offer. In addition there is Scientific production, that is a writing course, leading to at least two scientific papers on the chosen research topic.

A six months of internship abroad (10 ECTS)- that can also (partly) be replaced by courses - enhances the exchange of experiences between schools.

- **TU Delft** uses ECTS only for formally accredited programmes (BSc and MSc). A separate unit Graduate School Credits GSC is used to express the nascent nature of the new education, and to accommodate courses offered by non-universities. One GSC represents one study day plus preparation. Translations from ECTS or external courses are judged by the education coordinator of the programme.
- At **Aalto**, ECTS is used both for formally accredited courses and for Individual Study Attainment. This is where courses, conferences, or other research activities are undertaken outside the accredited courses at Aalto or at other universities. An equivalent number of ECTS is agreed with the supervisor and registered. See **Educational formats** on page 56.

- PhD candidates are in an environment where they cannot know everything, and that could make them insecure. To avoid that, **CMU** nurtures a culture in which people feel comfortable with what they do not know, which contributes to the exchange of knowledge and learning. CMU creates a culture of freedom of not knowing by admitting and celebrating it.

Some standardization is helpful for the exchange of candidates and teachers between institutes. There is limited experience with exchange of credits, as different schools use a different system. Though, institutes have experience with exchanges in summer schools and incidental workshops and courses, often judged on a case-by-base basis.



### **Educational formats**

As mentioned in **Process and Timelines**, individual candidates join in the program in some situations together as a cohort, and in other situations candidates start any time (synchronous versus asynchronous learning). An advantage of the latter is that there is a lot of flexibility and autonomy, a drawback, however, is that the candidates do not always form a community for peer learning.

Depending on the learning goals and topics and the possibilities within the institute different formats are chosen. Here are some of them listed.

- **Seminars:** These are group sessions of 5 to 20 candidates that support critical thinking through dialogue and discussion. Candidates prepare for the session by reading a paper or book chapter about a specific theory, phenomenon, or another topic.
- **Courses:** There are practice-led and thematic courses with learning activities such as weekly lectures, assignments, group discussion, peer feedback session and so on. They can be internal and offline in studios or online with experts and/or candidates outside the institute, and real time or self-paced.
- **Workshops:** These are short – half a day, one, or two days – training sessions, usually for a generic and delineated topic, for example, about research questions.
- **Summer/Winter courses:** The format for these courses is intensive learning, for example, during one week, candidates work on an assignment full-time. Typically, the course has an international character with candidates from different institutes and with input from external (international) recognised speakers (key note lectures).
- **Conferences:** Candidates are encouraged to write a paper, and attend and present at one or more conferences.
- **Exams:** The formats for examination vary. There are, for example, the ‘qualified exam’ in which after one year, candidates are tested on their scientific competence, and the pre-examination by an external committee.

- At **TU Delft** and **Aalto**, these are considered ‘learning on the job’ activities which fit under the category of ‘research skills’ training.

Diversity in learning formats – be it individual or in a peer-reviewed group, offline in class or online at your own pace, with international exchange –, a varied offering fits in well with teaching a diverse group of candidates, with different personal interests and capabilities, educational backgrounds, and research topics. Moreover, not to mention the diversity of advisors and teachers who support the learning process.



Some schools also have general practices that do not fall under the course structure, but allow candidates to develop skills that contribute to their identity and skills as researchers in design.

- Candidates at **Aalto** analyse past PhD theses with respect to their form, positioning, academic traditions, method, data, analysis, and argumentation, allowing them to compare various ways of design research. Sharing summaries of this analysis with their peers, they also practice the presentation of academic knowledge.
- **Imperial** strives to cultivate „discipline envy”; an active endeavour to find aspects of other disciplines that researchers wish would be part of their work. Asking others who are not sharing the same view, mode of thinking and/or working contributes to awareness and respect, as well as understanding how the various disciplines relate to each other.
- **TU Delft**'s research builds on a broad range of traditions from (social) sciences, engineering, humanities, and design; candidates can have backgrounds in any of these. In the introductory research course, taught by a broad sample of researchers across the school, candidates are confronted by this variety of traditions and encouraged to explore their place in it.

PhD courses typically are different from those in Master or Bachelor programmes. There is often more emphasis on formative engagement rather than summative testing. PhD education programmes are less standardized and usually not accredited. In our review we got an overview of workload and learning goals for the candidates, but little insight as yet about the didactics of the courses, or of advising. These considerations, such as the training of advisors for their responsibility in guiding the candidate in both research and competence development, merit further attention.



# 5

## Developments, Opportunities, & Next Steps

The chapters in this Map were made to establish a language to talk about our PhD education programmes. The focus of this endeavour was to select terms for descriptions through three lenses (Actors and Organisation; Time and Activities; Research and Education), and give a sense of the variety in language, situation, and practices at the six programmes that participate in DoCS4Design.

The map is supposed to give guidance to cross the terrain of practices. It is meant not as a definitive statement or ideal, but as a stepping stone to support everyone who acts on this terrain with an overview that can help them to identify opportunities, make connections, and plot a route.

We see several directions in which next steps can be taken, based on the limitations of the map:

1. The map only covers six programmes, from established universities in Europe and the USA. As it stands we hope these can inspire and inform others to learn from these examples. A broader sampling of conditions and practices from universities outside of this region and from other flavours of design can further extend the overview.
2. The map gives examples of practices at each programme, but provides little analysis of the pros and cons of the practices, or the reasons why these practices grew at these institutions. It identifies some questions, such as 'what is the goal of a PhD in Design, how is the research driven by available expertise of individual advisors, institutional research agendas, and agencies funding research. A further exchange of practices and sharing and co-developing educational renewal, a topic already on the agenda of design conferences and initiatives, is a logical next step.



3. The map juxtaposes conditions and practices at individual institutions, but does not discuss the opportunities of collaborations between programmes. These might be giving connections to current candidates, access to complementary expertises, joint courses and exchanges. In the runup to DoCS4Design we already identified some examples:

- **Polimi's** Summer School with the Design Research Prototyping course as main ingredient is an opportunity for both PhD candidates and supervisors from various institutes to exchange knowledge and build on their network. Together they work on a specific topic. Some examples are: Design RtD Experiments - exploding and materializing the boundaries of experimental knowledge (2019); Designing in Transitional Times - Experiments for future(s) imagination (2020); and More than Human Futures - Reframing design knowledge prototyping for human-non-human ecologies (2021). The aim is to discuss an idea of design research that moves away from an exclusive positivist vision.

- In 2019 and 2020 **TU Delft** ran an online seminar course in which candidates from the six partner programmes discussed recent literature on 'Research through Design', relating it to their own projects. One aim of the course was to raise the candidate's understanding of design-based research methods, and support them in positioning their own research. Another to explore cross-institutional courses. A third to provide an opportunity for network building to candidates.

4. The lens about actors and organisation has focused most on the candidates (also because most descriptions of practices focus on these). Attention for the advisors, their expectations, dealing with stress and wellbeing, preparation for this educational task, was found to be one that requires further attention, at which several institutions have ideas, wishes, and some experience, but less than with the candidate's perspective.

The map and glossary are also a momentary glance. At all the institutions, and elsewhere, programmes are changing, and looking for new ways to engage societal parties, better equip the candidates for new jobs in a rapidly changing world. Societal partners, and future employers of PhDs are beginning to recognize the value of research-trained designers, but much is still unclear. Programmes such as the International Training Networks ('Marie Skłodowska Curie' programmes) provide new mechanisms for joint supervision and training around thematic topics. The New European Bauhaus policy of the EU is aiming for further interdisciplinarity and actions towards sustainability. The field of design itself is changing, and the formats of modern education are likewise in development, often towards more interdisciplinarity and international connections (a development that is likely to have quickened under Corona pressures).



## GLOSSARY



Institution  
 Graduate School  
 Asynchronous versus synchronous  
 Time > duration  
 Time > division of  
 Time > rhythm  
 Time > pace of  
 Competencies (supervisors)  
 Course formats  
 Bachelor and Master  
 Teaching (by learner)  
 Constraints  
 Project leader  
 Administrator  
 Counsellor  
 Internal vs external candidates  
 Director  
 Candidate  
 Advisor  
 Adjunct advisor  
 Educators  
 Assessor  
 Teacher  
 (research) Group  
 Parties/partners  
 Sponsor  
 Research methods  
 Topic  
 Institutional research agenda  
 Transferable skills  
 Competencies-future (PhD candidate)  
 Disciplinary  
 Interdisciplinary  
 Multidisciplinary  
 Transdisciplinary  
 Recruiting  
 Selecting  
 Dissertation  
 Graduating  
 Examination  
 Thesis  
 Deliverables  
 Publishing  
 Monograph  
 Diploma  
 Doctor of Philosophy Degree  
 Professional Doctoral Degree  
 Salzburg agreement  
 Bologna Declaration  
 Accreditation  
 Credits  
 Policy  
 Third cycle  
 Language requirements  
 Scholarship  
 Funding

These are the common terms in the DoCS4D partner institutions for the main roles that are used in this document. See from next page for the alternatives that we have already listed, and their definitions.

	<i>Aalto</i>	<i>CMU</i>	<i>IIT</i>	<i>Imperial</i>	<i>Polimi</i>	<i>TU Delft</i>
<i>Candidate</i>	Doctoral student	PhD Researcher	PhD Student	PhD Student / PhD Candidate	PhD student / PhD candidate	PhD student
<i>Degree</i>	Doctor of Arts (DA)	Doctor of Philosophy (PhD in Transition Design)	Doctor of Philosophy (PhD in Design)	Doctor of Philosophy (PhD); a discipline is not named	Doctor in Design.	Doctor of Philosophy (PhD); a discipline is not named
<i>Advisor</i>	Supervising professor	Primary Advisor	Primary Advisor	Supervisor	Supervisor	Promotor
<i>Co-advisor</i>	Advisor	Secondary Advisor, and/or External Advisor	Secondary Advisor	Co-supervisor, second supervisor, assistant supervisor	Co-supervisor	Copromotor, daily supervisor
<i>Assessor</i>	Opponent, pre-examiner	External Examiner	External Advisor	External examiner	External reviewer	Committee member, opponent
<i>Other specific roles</i>	Doctoral programme committee member	Director of Doctoral Studies	Director of PhD Program in Design	Director of Postgraduate Studies	Coordinator and Vice-coordinator of PhD Program in Design	Graduate School director

Table 8 - The various terms used in the DoCS4D partner institutions



For the important terms, one is chosen out of the various synonyms and variations. The discussion positions the different terms and explains their nuances in meaning.

<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Accreditation</b>	Certification	Officially recognized, accepted, or approved by a third-party, called an accreditation body.
<b>Adjunct advisor</b>	Co-supervisor, adjunct professor, adjunct lecturer	A subordinate compared to the advisor that supports the candidate in his or her research.
<b>Administrator</b>	Officer, manager	Person who is responsible for the organisational aspects of the PhD education, such as registration of completed courses, and finance.
<b>Advisor</b>	Promotor, co-promotor, mentor, supervisor, daily supervisor, chair, Doktorvater/Doktormutter EU: supervisor	A person who guides the candidate in research. The position (professor, associate professor, assistant professor) of the specific role (advisor, propotor, chair) differs between institutes.
<b>Assessor</b>	Committee member, examiner, evaluator, opponent, external reviewer	Independent evaluator of the candidate's work.
<b>Bachelor and Master</b>	First and second cycle education	Since the Bologna Declaration (in 1999), the European Union adopted a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years.
<b>Bologna Declaration</b>	Joint Declaration of the European Ministers of Education	In 1999 29 European countries adopted a system of easily readable and comparable degrees, also through the implementation of the Diploma Supplement, in order to promote European citizens employability and the international competitiveness of the European higher education system.

<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Candidate</b>	PhD student, PhD candidate, PhD researcher, promovendus, EU: doctoral candidate, High-residency/Low-residency	The person who is pursuing the doctoral degree.
<b>Competencies (supervisors)</b>	Capabilities, proficiencies, knowledge & skills	Knowledge and skills that are aimed for by the Institute, regarding both research and professional competencies.
<b>Competencies-future (PhD candidate)</b>	Capabilities, proficiencies, knowledge & skills	Knowledge and skills that are aimed for by the PhD programme, regarding both research and professional competencies. Usually in an appointment procedure articulated in selection criteria.
<b>Constraints</b>	Criteria, regulation, rules	
<b>Contract</b>	Agreement, legal position of the candidate	There are various contracts, basically the candidate has an employee status (paid or not paid) or a student status (paying a fee).
<b>Counsellor</b>	Harassment Counsellor, study advisor	Independent person in the institute that supports the interest of a single person.
<b>Course formats</b>	Schedule, planning, structure	A course format refers to the layout of a course, including course names, activities, time, duration (studyload) and sometimes other details, such as milestones.
<b>Credits</b>	ECs, ECTS, hours, study workload	European Credit Transfer and Accumulation System (ECTS), 1 EC represents about 25 to 30 hours of work.
<b>Curriculum</b>	Educational programme	A document with a vision, manifest, learning goals, mandatory and optional courses with a minimum of credits (ECs) to be completed.
<b>Deliverables</b>	Output, results, products	Work that should be handed in for examination. Some examples are: monograph/thesis, journal papers, prototypes, and design exhibitions.



<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Diploma</b>	Certificate, bullae	Document bearing record of graduation from or of a degree conferred by an educational institution. Usually with symbolic features, in a form that represents the institute's identity.
<b>Director</b>	Programme coordinator	Person who is responsible for the functioning of the Graduate School.
<b>Disciplinary</b>	See also multi-, inter-, transdisciplinary	Relating to a particular field of study.
<b>Dissertation</b>	Monograph, thesis, project, body of work	A dissertation is a long formal piece of writing on a particular subject, especially for a university degree. A thesis/monograph refers specifically to a book. In the PhD in Design the deliverables can also feature a product or prototype, usually shown in an exhibition.
<b>Doctor of Philosophy Degree</b>	PhD, DPhil, doctor, Dr.phil.	A Doctor of Philosophy (Latin philosophiae doctor or doctor philosophiae) is the most common degree at the highest academic level (third cycle) awarded following a course of study. Universities sometimes award specific types, such as the Doctor of Musical Arts (D.M.A.) for music performers and the Doctor of Education (Ed.D.).
<b>Educators</b>	Teachers, tutors, see 'advisors'	The general term used in this project. A person who guides the candidate in research. The position (professor, associate professor, assistant professor) of the specific role (advisor, propotor, chair) differs between institutes.
<b>Examination</b>	Defence, defense, evaluation, assessment, exam, ceremony	A final and formal assessment of a candidate's knowledge or proficiency at the end of the PhD track (third cycle). Sometimes, a cultural ritual (ceremony) to complete the third cycle. For example, with cultural symbols, such as dress codes, a beadle, paranymphs, list of propositions, a debate with a committee composed of internal and external opponents, promotor and co-promotor and a chair. This is also the moment that the candidate receives his/her diploma, in a form that represents the institute's identity.
<b>Funding</b>	Sponsoring, scholarship	Financial support for candidate's costs, tuition, and for research materials.

<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Graduate School</b>	PhD curriculum, Doctoral school, Research school, PhD School PhD Programme Doctoral Programme	Organisation in its own institution that organizes PhD processes, doctoral education, policy execution, quality control, educator training. Organised community of researchers across institutions, often national, uniting research in a field/topic. 'RS might be organized around a particular discipline, research subject, or interdisciplinary research area. They strive to create a research network for doctoral candidates, possibly involving cooperation across institutions.' ((EUA 2007, p.9).
<b>Graduating</b>	Finish	To receive a degree or diploma on completing a study.
<b>(research) Group</b>	Team, lab, section	Research group in which the candidate is embedded.
<b>Institution</b>	Department, group, university, faculty	The organisation that offers or supports the PhD programme, makes and implements policy, is responsible.
<b>Institutional research agenda</b>	Research agenda	Identified research priorities, outlining a clear framework for making decisions about future research directions.
<b>Interdisciplinary</b>	See also multi-, trans-, disciplinary	Interdisciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole.
<b>Internal vs external candidates</b>	Resident vs executive PhD researchers	Internal candidates reside at the institution on a full-time basis; externals conduct their research elsewhere, and only come in for consultations with advisors or courses.
<b>Language requirements</b>	Communication (written, speech)	Entry requirements for the sake of a common language, usually English proficiency.
<b>Monograph</b>	Thesis, dissertation, project	Final work that has been published. A monograph refers to a book.

<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Multidisciplinary</b>	See also inter-, trans-, disciplinary	Multidisciplinarity draws on knowledge from different disciplines but stays within their boundaries.
<b>Parties/partners</b>	NGO, company, societal parties, industry	A dissertation is a long formal piece of writing on a particular subject, especially for a university degree. In the PhD in Design the result can also be a product, usually published in an exhibition. Parties outside the university playing a role in research or education activities of the candidate.
<b>Policy</b>	Programme, blue-print	An overall plan embracing the general goals and acceptable procedures of an organisational body.
<b>Professional Doctoral Degree</b>	PDEng, DBA, EdD, DNP, DrPH, 博士 (boshi in Chinese)	The degree focuses on applying research to practical problems, formulating solutions to complex issues, and designing effective professional practices within your field. Examples are Doctor of Business Administration (DBA), Doctor of Education (EdD), Doctor of Nursing Practice (DNP), and Doctor of Public Health (DrPH). The PDEng is a two years practical oriented professional doctorate in engineering which is better suited to the direct needs of industry, whereas the PhD is focused on scientific research.
<b>Project leader</b>	Project coordinator	Person in charge of the research project or program in which the candidate performs a role.
<b>Publishing</b>	Disseminate, report, distribute, research output	There are different forms in which outcomes from research are published, see deliverables. Each institute has its own requirements regarding form, numbers, and quality.
<b>Recruiting</b>	Select, enroll	There are various ways in which candidates are recruited...
<b>Research methods</b>	Research approach, methodology	

<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Salzburg agreement</b>	Bologna Seminar	The main outcome was to reach agreement on the establishment of a set of ten basic principles that should underpin further considerations of the key role of doctoral programmes and research training in the Bologna Process.
<b>Scholarship</b>	Personal grant	Funding for candidate
<b>Selecting</b>	Recruiting	Who determines intake, what criteria
<b>Sponsor</b>	Fund	Grant-giving institution, profit as well as non-profit organisations.
Asynchronous versus <b>Synchronous</b>	A/Synchronous registration, A/Synchronous learning	Synchronous = happens at the same time. Asynchronous = doesn't happen at the same time. With synchronous learning, participants can receive immediate feedback. With asynchronous learning, the participants can learn at their own pace. Synchronous registration is when a group of candidates start at the same time.
<b>Teacher</b>	Educator, coach, tutor, professor, and can also be a role for the candidate, supervisor	Someone who provides (general) courses to candidates.
<b>Teaching</b> (by candidate)	Tutoring, coaching, lecturing	The candidate is (also) performing teaching duties/activities as part of his or her education or as part of his or her contract. Sometimes this is treated as a learning, sometimes as a required chore.
(PhD) <b>Thesis</b>	Dissertation	Written report handed in by candidate and evaluated by committee for awarding the degree. See under <b>Dissertation</b> .
<b>Third cycle</b>	Third phase, PhD education	According to the Bologna Declaration the first cycle results into a Bachelor degree, the second cycle into a Master degree, and the third cycle into a Doctoral degree.

<i>(Chosen) Term</i>	<i>Alternative terms</i>	<i>Discussion (definitions)</i>
<b>Time &gt; division of</b>	Division of time	Amount of time available per week for research, education, other activities (like teaching).
<b>Time &gt; duration</b>	Duration of time, Tempo, speed	Minimum and maximum time for research, education, other activities (like teaching).
<b>Time &gt; pace of</b>	Speed	Pace of time is used to refer to the speed at which activities and events occur.
<b>Time &gt; rhythm</b>	Plan, schedule, structure	Plan, schedule, or arrange when (something) should happen or be done.
<b>Topic</b>	Theme, subject, focus or foci	Subject of the research of the candidate
<b>Transferable skills</b>	Generic skills, professional skills	Transferable skills are abilities that are relevant and helpful across different areas of life: socially, professionally and at school. They are generic, which means that they are helpful across disciplines, such as working in teams, critical thinking, communication and presentation, networking. The Salzburg agreement explicitly mentions the importance of transferable skills.
<b>Transdisciplinary</b>	See also multi-, inter-, disciplinary	Transdisciplinarity integrates various sciences in a single context, and transcends their traditional boundaries.

DoCS4Design

Doctoral Courses System for Design

# Six representations for a PhD in Design



Co-funded by the  
Erasmus+ Programme  
of the European Union

2021

**A''**  
Aalto University  
School of Arts, Design  
and Architecture

**Carnegie  
Mellon  
University**

**IIT Institute of Design**

**Imperial College  
London**

 **POLITECNICO  
MILANO 1863**  
DIPARTIMENTO DI DESIGN

**TU Delft**



Six **representations for a PhD in Design**, developed in the DoCS4Design project, an ErasmusPlus funded project (Map & Glossary, 2021)


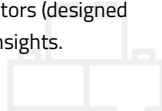
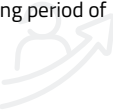

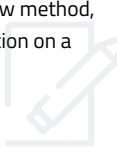

For each category examples were made; a summary of work in an easy to read A4 format. This is a first iteration that may not cover the entire variety of PhD's in Design.

This set was used to raise discussion in a workshop with the six partners and some of their staff members, and appeared to be useful for different reasons:

- To explain to both an early-stage candidate and to colleagues from other disciplines how a design thesis looks like.
- To have a starting point for starting an informed discussion with PhD candidates and co-supervisors.
- To show how boundaries can be set in a PhD in Design.
- To understand what kind of infrastructure is needed; kind of expertise for supervision, courses, facilities.
- To understand what is required more, for example, for a PhD in Design that aims to have societal impact on a short term.

*Theory driven*

*Impact driven*

<i>Regarding Approach and Method</i>		
1. <b>In control</b> , the result is scientific knowledge, a result from a systematic approach that focuses on validation of a hypothesis. 	2. <b>Learning through design</b> , the researcher follows a Research through Design approach and the result consists of one or more demonstrators (designed artefacts) that lead to insights. 	3. <b>Experience matters</b> , the researcher uses his/her own working experiences and the result is based on case studies that are developed over a long period of time. 
<i>Regarding Aimed outcome</i>		
4. <b>Free as a bird</b> , the result is a product, service or other designed result that is exhibited in a final and public exhibition. 	5. <b>Supporting designers</b> , the result contributes to the process of design (designing), for example a new method, tool or technique, or a reflection on a methodology. 	6. <b>Making a difference</b> , the result is a design that contributes to societal issues and is recognized by the public opinion. 

# Representation 1: In control

The result is scientific knowledge, a result from a systematic approach that focuses on validation of a hypothesis.

## 1. Title and Author of the work

The beauty of unity-in-variety: Studies on the multisensory aesthetic appreciation of product design by Ruben Post

## 2. Place and year

TUD 2016

## 3. Research aim - Describe in a few sentences.

To demonstrate how unity and variety relate to each other and to aesthetic appreciation.

## 4. Research questions - Give the main question(s).

How can the principle of Unity in Variety explain how and why we aesthetically appreciate perceiving product designs by vision and touch?

## 5. Approach - A short description of the overall approach.

The Unity in Variety principle was empirically investigated through twelve studies and multiple pilot studies, mostly quantitative in nature.

## 6. Results - A short paragraph.

The result is a validated hypothesis, that is that unity and variety, despite being negatively correlated, positively influence aesthetic appreciation of product designs with 'unity' as the dominant factor.

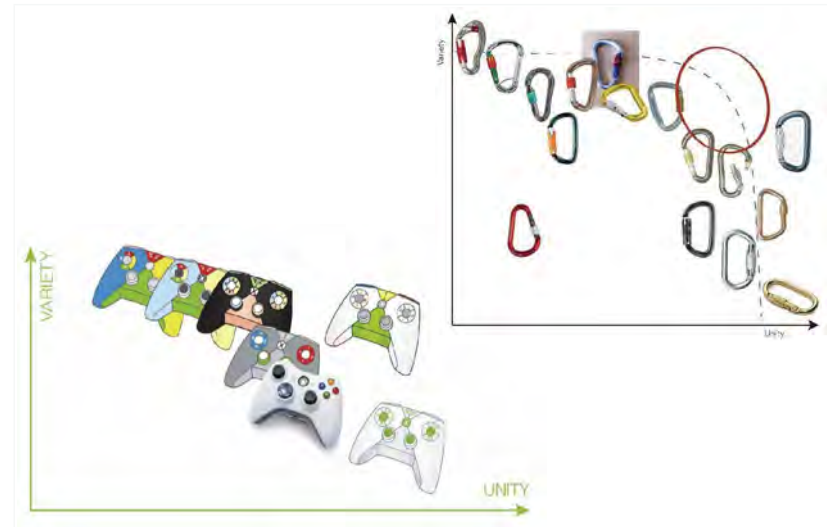
Some publications:

Post, R.A.G., Blijlevens, J., Hekkert, P. (2014). Aesthetic appreciation of Tactile Unity-in-Variety in Product Designs. In Proceedings of the 23rd Biennial Congress of the International Association of Empirical Aesthetics (pp. 358-360), New York, United States of America, 22-24 August 2014.

Post, R. A. G., Blijlevens, J., Hekkert, P. (2013). The influence of unity-in-variety on aesthetic appreciation of car interiors. In Proceedings of the 5th International IASDR Conference (pp. 2942-2947). Tokyo, Japan, 26-30 August 2013. <http://design-cu.jp/iasdr2013/papers/1630-1b.pdf>

Post, R. A. G., Blijlevens, J., Hekkert, P. (2013). Unity-in-variety in product design aesthetics, In Proceedings of TeaP 2013, Pabst science publishers, pp 217.

## 7. Illustrations - Diagram, photos, other.. And link to the work



Examples made by students to illustrate how products can be mapped within their category according to their unity and variety balance.' (Post, 2016, p.167)

## 8. Why is this an example for this category? - Two perspectives

### Background PhD student

The PhD candidate started his PhD just after successfully finishing a master in Cognitive Neuroscience at an Institute for Interdisciplinary Studies.

### Content

The project is clearly based on the hypothesis that there is a relationship between the unity in variety balance and aesthetic appreciation.

## Representation 2: Learning through Design

The researcher follows a Research through Design approach and the result consists of one or more demonstrators (designed artefacts) that lead to insights.

### 1. Title and Author of the work

HUMAN RESOURCE DESIGN.  
Steering human-centred innovation within private organisations. by Martina Rossi

### 2. Place and year

Polimi 2020

### 3. Research aim - Describe in a few sentences.

To offer a guiding design framework for academics and practitioners who want to develop projects in the field of human resource management and organisational transformation.

### 4. Research questions - Give the main question(s).

- How can service design support and enhance effective collaborative practices aimed at organisational change within private companies?
- How these collaborative design practices should be articulated and conducted?
- To which extent the role of the service designer is meaningful and relevant to collaborative design practices within private organisations? Within this context, what are the skills and attributes needed for this professional figure?

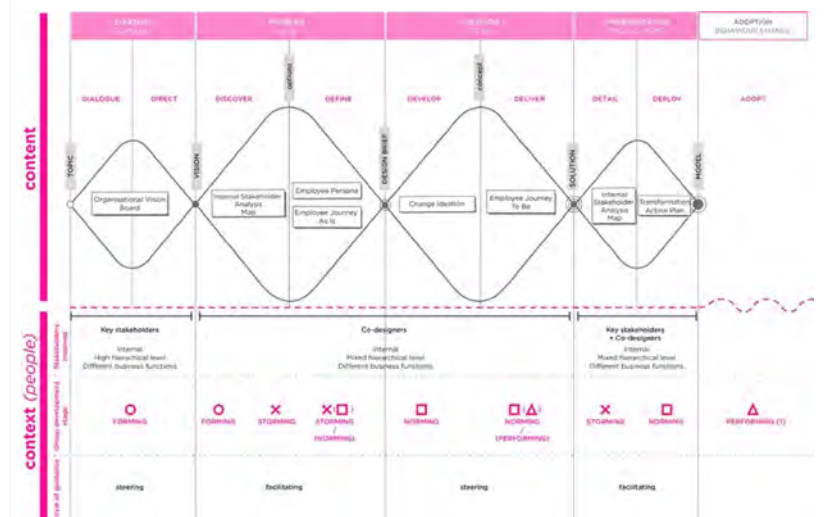
### 5. Approach - A short description of the overall approach.

Findings were mainly derived from field testing of various components of the framework. Specifically, the framework was applied and tested within three representative projects.

### 6. Results - A short paragraph.

A framework, guidelines and a set of tools addressed to both content level (the topic of the project) and context level (team development and dynamics).  
Publications: a book edited by Springer Nature, a chapter in a book edited by Franco Angeli and an article on Strategic Design Research Journal. Several publications in conference proceedings.  
The framework is also being adapted to the educational field and it's actually under testing in the Master of Product Service System Design of the School of Design of Politecnico di Milano.

### 7. Illustrations - Diagram, photos, other.. And link to the work



### 8. Why is this an example for this category? - Two perspectives

#### Background PhD student

The student is a trained service designer and she applied her design skills to learn through the research. She also took advantage of her professional experience to find suitable projects for her experiments.

#### Content

Insights are generated through the making.

## Representation 2: Learning through Design

The researcher follows a Research through Design approach and the result consists of one or more demonstrators (designed artefacts) that lead to insights.

### 1. Title and Author of the work

For Inspiration Only by Ianus Keller

### 2. Place and year

TUD 2005

### 3. Research aim - Describe in a few sentences.

To support designers with collage making.

### 4. Research questions - Give the main question(s).

- How do designers interact with their collections of visual material?
- How can new tools support this interaction?

### 5. Approach - A short description of the overall approach.

Answers were found through the design of a product (Cabinet) and two case studies in which the product has been used by design practitioners.

### 6. Results - A short paragraph.

Cabinet is a tool that helps designers collect and organize the visual material for inspiration. It does this by making the interaction with digital material more physical (designers can drag digital images on a table as if they are real objects) and by offering a fluent way to add physical material to the digital collection (anything placed on the table is digitized and projected in place, and can be added to the collection).

The result is knowledge about how designers use visuals in their daily work.  
Journal publications (Design Studies, Codesign, Int J. Design Computation).  
Demonstrations of prototypes at HCI conferences and education.

### 7. Illustrations - Diagram, photos, other.. And link to the work



For more information visit the [Cabinet website at the ID-StudioLab](#)

### 8. Why is this an example for this category? - Two perspectives

#### Background PhD student

The student was educated as a designer (at TUDelft) and used his own design skills and experiences to learn through designing.

#### Content

Insights are generated through the making.

## Representation 2: Learning through Design

The researcher follows a Research through Design approach and the result consists of one or more demonstrators (designed artefacts) that lead to insights.

### 1. Title and Author of the work

Making Sense Through Hands. Design and Craft Practice Analysed as Embodied Cognition by Camilla Groth

### 2. Place and year

Aalto University, Espoo, Finland, 2017

### 3. Research aim - Describe in a few sentences.

To examine what embodied cognition theory could mean for design and craft practice through empirically-based research and practice. The thesis was part of the Handling Mind project conducted with other Finnish universities to connect areas of neuroscience, psychology, design and educational research.

### 4. Research questions - Give the main question(s).

Main question: How do design and craft practitioners think through their hands?

Sub-questions:

- How do experts in tactile knowing use their enhanced tactile sense in a making situation?
- What methods may be used in the study of embodied and experiential knowledge in crafts?
- What is the role of emotions in connection to tactile experiences in a craft practice? How do design students use embodied knowing in material exploration?

### 5. Approach - A short description of the overall approach.

Through three case studies, notions of body-based knowing, especially related to haptic experiences were studied. The first case involved ceramic workshops with deafblind makers, conducted at the IIRIS Service and Activity Centre for the visually impaired in Helsinki and the Tampere Resource Centre for the Deaf-blind. The second case involved a practice-led self-study on tactile augmentation in ceramic craft practice. The third case examined Masters' students' use of their embodied knowing during a design and material exploration process.

### 6. Results - A short paragraph.

Theoretical and practical implications:

- 1) Embodied cognition theory lends itself well to informing design and craft related practice.
- 2) Design processes include embodied knowledge even in the cognitive and immaterial stage of creating mental images of the intended physical designs.
- 3) Making may be seen as a way of negotiating meaning through interaction between the embodied mind and the material environment, thus it may affect intrapersonal growth and provide a useful platform in educational settings.
- 4) Design and craft research benefit from a combination of research approaches that aid in investigating both representational and non-representational aspects of the practice.

The practice-led research setting was found to be an efficient way of studying experiential knowledge as it includes the practitioner's perspective, thus allowing for sensory experiences and emotions to be studied in action. The use of video documentation was found to be especially useful in both the effective study and dissemination of experiential data and research results due to its multimodal potential.

### 7. Illustrations - Diagram, photos, other.. And link to the work



<https://aaltodoc.aalto.fi/handle/123456789/24839>

### 8. Why is this an example for this category? - Two perspectives

#### Background PhD student

Groth has a BA and MA in ceramics and glass, and worked for many years creating ceramics for projects with industry and cultural organizations. At Aalto, Groth was part of the Empirica research group which emphasises practice-based research through art, design and craft.

#### Content

Groth conducted a series of practice-led experiments through workshops and seminars about making ceramics. One was self-guided/ auto-biographical and two were with groups of other makers. The emphasis was on the process rather than the designed artefacts.

# Representation 3: Experience Matters

The researcher uses his/her own working experiences and the result is based on case studies that are developed over a long period of time.

## 1. Title and Author of the work

The Design of Data Sonification.  
Design processes, protocols and tools grounded in anomaly detection.

## 2. Place and year

Polimi 2021

## 3. Research aim - Describe in a few sentences.

To introduce a designerly approach to the field of data sonification i.e. the representation of data through sound. The field is traditionally the domain of computer science, from one side, and art, from the other side, which has historically created a tension between different approaches that might have contributed to the scarce success of this data representation method. The author investigates how design can bridge between the different approaches and contribute to the transition of data sonification from a niche field to a widely adopted method to represent, understand and communicate complex phenomena.

## 4. Research questions - Give the main question(s).

- Why is sonification, despite gaining momentum, not yet widely adopted as a data representation method?
- Can a designerly approach to sonification make the difference? How can we evaluate if this approach helps create 'better' (more effective and engaging) sonification?
- Can we frame a design methodology to approach sonification from prototype to testing?

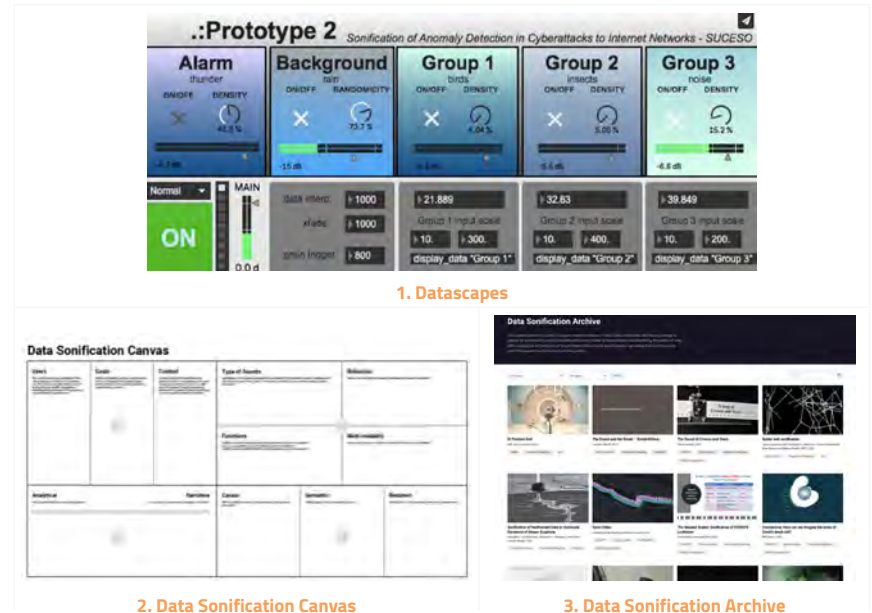
## 5. Approach - A short description of the overall approach.

The answers to the research questions were found through interviews with sonification experts, workshops with designers expert in data visualization, and the design and development, over a two-year period, of two 'design actions': two sonification applications for the real-time monitoring of cyber-attacks in the context of digital and digital-physical networks.

## 6. Results - A short paragraph.

- Interviews to experts and workshops with designers lead to the formalisation of a design tool, the "Data Sonification Canvas", which is meant to support designers in integrating sound to their data visualisation methods
- From the two Design Actions, a fully working prototype ('Datascape') for the real-time monitoring of cyber-attacks to digital and physical infrastructure was designed, and it is currently being developed as a potential commercial application.
- A web project, the Data Sonification Archive, was launched as an online observatory on data sonification projects in order to gather insights on the long term on how sonification is used, by whom, and with which goals.

## 7. Illustrations - Diagram, photos, other.. And link to the work



1. Datascape

2. Data Sonification Canvas

3. Data Sonification Archive

## 8. Why is this an example for this category? - Two perspectives

### Background PhD student

The PhD candidate is a professional sound designer who worked for more than a decade in the sound branding and sonic interaction design industry.

### Content

Results are obtained through the conceptualisation, design and development of a real-world application of sonification, and tested with real domain experts in a real work environment.



# Representation 5: Supporting Designers

IIT Institute of Design

The result contributes to the process of design (designing), for example a new method, tool or technique, or a reflection on a methodology.

## 1. Title and Author of the work

Anatomy of Infrastructure  
Authors: Andre Nogueira, Carlos Teixeira, Weslynn Ashton

## 2. Place and year

IIT Institute of Design  
2017-19

## 3. Research aim - Describe in a few sentences.

TDesigners are known for their abilities to create interventions (products, services, infrastructures and systems) with product-technology features capable of promoting new experiences among actors. While these interventions are often oriented towards impacting social systems, they embed new affordances into the socio-ecological context, and generate new interactions not only among humans, but also between humans and non-humans' actors. As the field increasingly engages in complex socio-ecological challenges, new methodologies are required to incorporate considerations of the dynamic, non-linear interactions among actors shaping these challenges.

## 4. Research questions - Give the main question(s).

We explored novel approaches to ethnography and prototyping of infrastructures in order to (1) uncover the logics shaping these interactions, and (2) iterate interventions to increase the fitness in socio-ecological systems. We assumed design practices as iterative processes in which participants continuously gathered information about context through prototyping.

## 5. Approach - A short description of the overall approach.

We applied some tools of this new methodology in 'The Future of Farmers Market' project, a partnership between IIT-Institute of Design, a graduate design school in Chicago, and the Plant Chicago, a non-profit organization located on the south side of Chicago with a mission to cultivate local circular economies through education, research, and incubation. Plant Chicago recently began working to develop collective activities with co-located businesses at The Plant, an industrial facility on the south side of Chicago that serves as a community building space for local food and beverage businesses. The project focused on multi-systems integration as a strategy for developing circular economies, and considered farmers' markets as critical paths for advancing transitions in the local context.

## 6. Results - A short paragraph.

By applying new tools, participants uncovered four main challenges among farmers' markets: data application, access to best practices, materials & nutrient management, and rules & regulations. Once these patterns were situated within the system's anatomy, participants were able to agree on four actionable properties that market managers should intervene to advance local circular economy practices in Chicago: collaboration, education, facilitation, coordination. The framework developed during this project was presented as a poster in conferences and incorporated into course work at the master design program, and used in research for industry sponsored projects.

## 7. Illustrations - Diagram, photos, other.. And link to the work



## 8. Why is this an example for this category? - Two perspectives

### Background PhD student

The PhD Student worked with two of his advisors during a period of 3 years to develop and test a new framework.

### Content

The framework was developed to interpret products and services as infrastructures in large, complex, and dynamic socio-ecological-technical systems.

# Representation 5: Supporting Designers

The result contributes to the process of design (designing), for example a new method, tool or technique, or a reflection on a methodology.

## 1. Title and Author of the work

Creativity 4.0. A method to explore the influences of the digital transition on human creativity within the design process by Carmen Bruno

## 2. Place and year

Polimi 2020

## 3. Research aim - Describe in a few sentences.

Explore Digital Creativity domain to identify the main positive and negative influences that the current scenario of digital transition is bringing on human creativity to inform and thus empower the creative design process for innovation.

## 4. Research questions - Give the main question(s).

- What are the ingredients that influence the human creative abilities?
- What are the positive and negative influences of the digital transition on the human creative abilities?
- How is the creativity within the design process influenced?

## 5. Approach - A short description of the overall approach.

Mainly transdisciplinary literature analysis (design, psychology, sociology and computer science), case-based analysis, qualitative expert interviews through card sort method in the context of digital creativity

## 6. Results - A short paragraph.

Creativity 4.0 Model (Fig. 1): the theoretical model explains the complex and multidimensional nature of creativity in the digital transition. It allows to identify digital influences on the human creative abilities. Creativity 4.0 Framework (Fig. 2) the framework deconstructs the design process in step, activities and factors of creativity (cognitive, emotional, motivational, social). It allows to map digital influences to provide a deep understanding of the changes on creativity within the design process. The framework allows also to make a wiser and consciously use of the digital opportunities addressed to human creative enhancement for innovation.

The research path contributes to formalize a human-centred method (Fig. 3), where the Creativity 4.0 Model and Framework become the fundamental tools to continuously identify digital influences on creativity and map them on the creative design process.

Dissemination: 5 Conference presentation, 2 journal publication, 1 book chapter, 1 book.

The model and framework has been adopted as a theoretical core knowledge of an Erasmus+ proposal "Digital Creativity for Developing Digital Maturity Future skills" that has been selected for fund (started in Sept. 2020).

## 7. Illustrations - Diagram, photos, other. And link to the work



Fig 1. Creativity 4.0 model



Fig 3. Creativity 4.0 human centred method

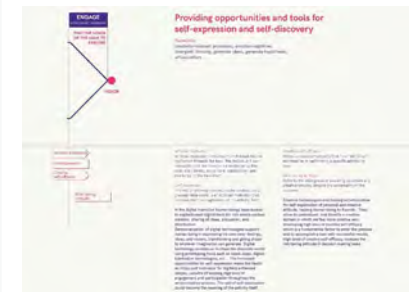


Fig 2. Creativity 4.0 Framework

## 8. Why is this an example for this category? - Two perspectives

### Background PhD student

Product designer educated in Polimi, the research topic stems from her experience and interest in developing methods and tools for empowering the creative process for innovation in different fields.

### Content

The framework can be adopted to i) design new tools to augment creativity (also digitally) in the steps of the design process ii) design training activities for empowering the factors of creativity in the design process iii) to study the influences of a specific digital technology on creativity within the design process

## Representation 6: Making a difference

The result is a design that contributes to societal issues and is recognized by the public opinion.

IIT Institute of Design

### 1. Title and Author of the work

The Future of Farmers Markets: Advancing the local circular economy.  
Author: Andre Nogueira

### 2. Place and year

IIT Institute of Design  
April 2018

### 3. Research aim - Describe in a few sentences.

To experiment with codesign practices and prototype interventions that advance the development of local circular economies.

### 4. Research questions - Give the main question(s).

What are the barriers to, and opportunities for, implementing codesign practices to advance the circular economy

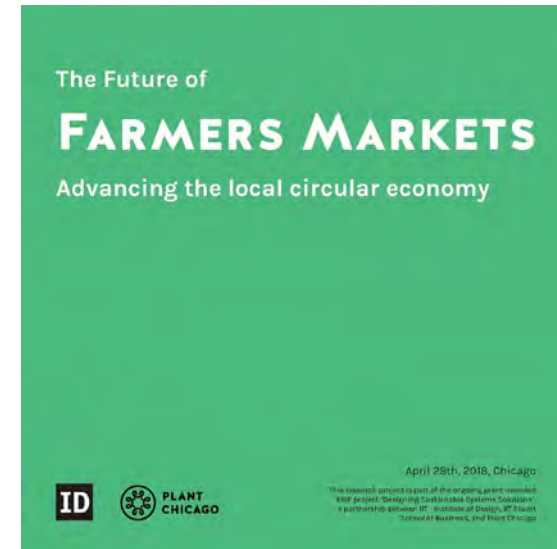
### 5. Approach - A short description of the overall approach.

The researcher visited different farmers' markets, grocery stores, restaurants, urban farms, community center and research institutions, and engaged with local vendors, farmers market managers, customers, and peer organizations to conduct the research. Then interviewed participants about their personal and professional experiences in farmers' markets, and the infrastructure supporting their activities. Next, utilized well-known design methods such as POEMS (people, objects, environment, messages and services), the five stages of human experiences (entice, enter, engage, exit, extend), user journey maps, value webs, and activity systems, as tools to ground our research in the context, and structure our findings. Lastly, hosted a workshop with farmers' market managers and other representatives of circulareconomy initiatives to validate some of the interpretations being made, as well as to explore potential principles that could inform alternative paths to increase impact.

### 6. Results - A short paragraph.

When situating codesign and prototyping practices in a specific context it enables the understanding and redesign of the infrastructural elements that conditions the performance and impact of such choices. By using case studies the researcher developed generalizable findings applicable to codesign practices. The study was part of a larger research project involving a total of 3 case studies, each study involving different levels of complexities.

### 7. Illustrations - Diagram, photos, other.. And link to the work



### 8. Why is this an example for this category? - Two perspectives

#### Background PhD student

The PhD student was in his second year and applied and received a grant for advancing practices of local circular economies.

#### Content

The PhD Student used this grant for developing a case study for experimenting with codesign methods for system transformation using participatory action research methods.

# Representation 6: Making a difference

The result is a design that contributes to societal issues and is recognized by the public opinion.

## 1. Title and Author of the work

Making Sustainability. How Fab Labs Address Environmental Issues  
Cindy Kohtala

## 2. Place and year

Aalto University,  
Espoo, Finland, 2017

## 3. Research aim - Describe in a few sentences.

To examine the environmental sustainability issues in peer production and how they are addressed in Fab Labs.

## 4. Research questions - Give the main question(s).

- How do actors in the social world of a Fab Lab address environmental sustainability, in their future-oriented vision and strategy work and in their everyday operations?
- What are the environmental (often socio-environmental) issues in the maker movement and distributed production, and how are they discussed and tackled in Fab Labs?

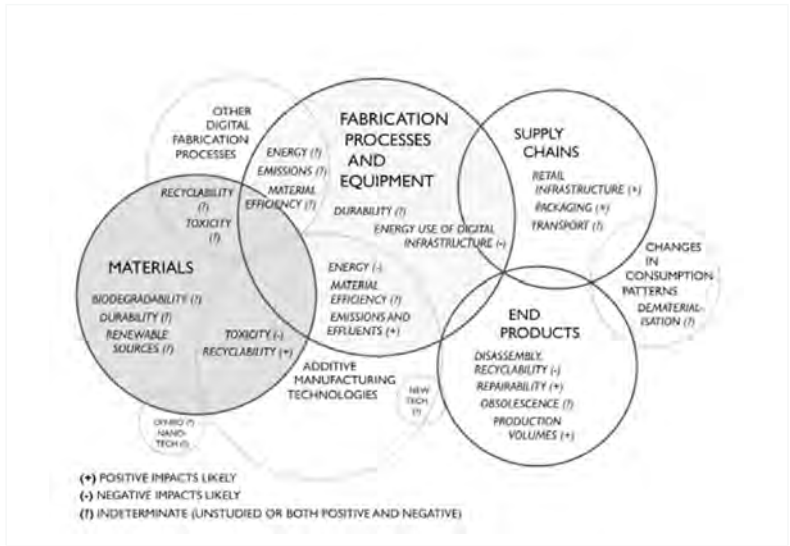
## 5. Approach - A short description of the overall approach.

- Primarily through ethnographic research methods and Symbolic Interactionist analysis, the thesis examines daily practices and discourses in selected Fab Labs and how sustainability is represented in these communities.
- Informed by STS, Design Research and the field of Design-for-Sustainability

## 6. Results - A short paragraph.

- Key finding: conflict actors encounter between setting ambitions, promoting particular ideologies and espousing sustainability-oriented values, and realizing and enacting these values in the mundane and constraining routines of everyday practice.
- Details the current landscape of research literature on distributed production, who is studying these environmental issues and how, and the potential opportunities and threats in this new mode of production.
- Contributes to research on peer production communities, social shaping of technology and sustainable design.
- Wider implications may indicate how increasing digitalization and citizen involvement in production will transform design and production and the sustainability implications therein

## 7. Illustrations - Diagram, photos, other.. And link to the work



<https://aaltodoc.aalto.fi/handle/123456789/21755>

## 8. Why is this an example for this category? - Two perspectives

Background PhD student

Content

Kohtala has a BA and MA in design. She is active in various maker communities and urban activism projects.

Project contributes knowledge about current maker practices and their sustainability implications, which has value for the peer communities studied as well as technology developers and policy makers.

