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Identifying Five Archetypes of Interaction Design Professionals and their Universal Design Expertise

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Abstract

Systems and services based on ICT (Information and Communications Technology) are now prevalent in our daily lives. Digital transformations have been, and are still being, initiated across private and public sectors. As such, the consequences of digital exclusion are severe – and may block access to key aspects of modern life, such as education, employment, consumerism, and health services. In order to combat this, regions and countries such as the US, Canada, EU, and Scandinavia have all legislated universal design in relation to ICT, in order to ensure as many citizens as possible have the opportunity to access and use digital information and services. However, there has been limited research into how higher educational programs address legislated accessibility responsibilities. This paper looks into the discipline of interaction design (IxD). IxD is the design domain focused on "how human beings relate to other human beings through the mediating influence of products" Buchanan (2001:112). The study presents an analysis of Norwegian higher educational programs within IxD. Based on document analysis, we map the skillsets the study programs state to deliver, and investigate to what degree universal design expertise is included. Our findings indicate the study programs do not deliver adequate training in universal design, in order to fulfill the professional responsibilities related to ICT accessibility. From our findings, we extrapolate five "archetypes" of interaction designers. These personas-like analytical constructs hold slightly different characteristics. For each of the five, we propose universal design expertise fitting key skillsets. We hope our contributions are useful both for the higher education sector and the industry, and will contribute to raised awareness of universal design skills so they can educate interaction designers in their different industry roles with required competences.

Highlights:

- We indicate the current content of interaction design programs in higher education, and document the lacking focus on universal design.
- We identify five different archetypes of interaction designers being educated in such programs. We describe key skillsets and strengths for each archetype.
- We propose universal design expertise for the interaction design profession, and link universal design expertise to archetype skillsets to emphasize relevance.

Keywords:

interaction design, human-computer interaction, universal design, inclusive design, accessibility, educational programs.

1. INTRODUCTION

Universal design guidelines have been continuously strengthened in national and international legislation over the last decades (Hosein, 2004; UN, 2006; US, 2008; European Commission, 2010; Access, 2010; Norwegian Ministry of Children, Equality and Social Inclusion, 2013; EU, 2016a; EU, 2016b; Norwegian Ministry of Local Government and Modernization**,** 2017). This reflects the need to ensure that as many people as possible have similar opportunities to access and use digital information and services with the increase in digitalized services delivered to the public through web and mobile interfaces, including eCommerce, eGovernment and social media (European Commission, 2017). Further, large technical companies (such as Apple) now provide accessibility and design guidelines as well as libraries of components tested for universal design compliance.

The idea of universal design (UD) is to develop products, environments and services that make usage possible for all intended users, to the largest extent possible (Difi, 2017). Technical accessibility is a key aspect in universal design of ICT regulations. Usable accessibility is to a lesser degree emphasized in legislation, though the new EU WAD directive (2018) demands accessibility statements from providers of ICT-solutions, and further the ability for end-users to give feedback.

So far, little attention has been given to studying universal design competencies needed for interaction designers. Further, there has been limited research into the skillsets provided to ICT-professionals through higher education (HE). The readiness of academic training to address universal design as part of interaction design education is thus uncertain.

This study contributes to the articulation of universal design expertise for interaction design professionals, by exploring current educational content in IxD HE programs. Three research questions are addressed:

1. *To what extent, if any, is universal design expertise included in IxD HE study programs?*
2. *What are the abstract archetypes representing interaction design professionals?*
3. *What is the universal design expertise needed by these interaction design professionals?*

The paper aims to shed light on the different skillsets currently highlighted in Norwegian HE IxD programs, including the extent to which universal design competences are included. This should be of interest to industry, students, and educators. Further, we make a theoretical contribution to the field of interaction design by proposing and discussing the needed universal design competence for IxD professionals. Although the empirical data for this study is from a Norwegian context, we believe our findings will be relevant to an international audience, as we extrapolate abstract archetypes of interaction designers from our data, and discuss the necessary universal design expertise in relation to these constructs.

The rest of this paper is organized as follows: Section 2 proves a theoretical framework for the terms “interaction design” (IxD) and “universal design” (UD). Section 3 outlines our methodological approach. Findings are presented in Section 4, followed by a discussion and concluding remarks in Sections 5 and 6. The article closes by calling for further research.

2. THEORETICAL FRAMEWORK

2.1 Interaction Design

Bill Moggridge and Bill Verplank supposedly coined the term “interaction design” in the mid-1980s. A challenge to the interaction design discipline is that an “interaction designer” is not a protected title (Fallman, 2008). Thus, professionals using this “title” may thus have various skillsets and backgrounds (Sørum and Pettersen, 2016). However, Buchanan (2001, p. 112) offers a good definition of the field of IxD, cited by many. He explains that IxD is the design of “action” – focused on how human beings relate to other human beings through the mediating influence of products.

Similarly to Buchanan, Jensen (1998 p. 189-190) describes how "interaction" in informatics mainly refers to human-machine interaction, while the concept of "interaction" in media and communication studies refers to the actions of an audience or recipients in relation to media content. This includes the communication between people mediated by a machine (computer mediated communication).. Kolko (2010) also aligns with Buchanan as he states a "simpler way of thinking about Interaction Designers is that they are the shapers of behavior" (p. 12), and views "interactions" as "experiences" (p. 5).

Buchanan (2001) explains how IxD can take on a variety of forms in order to solve how to plan an action, create a concrete form of experience, and evaluate the consequences of an action. He notes that new digital mediums are shaping the discipline, but underscores that IxD may also utilize physical objects, experiences, activities, or services. This is an apt observation. In relation to the development of ICT, the role of interaction designers is typically interpreted as constructing interface level opportunities and actions for tasks and processes that users encounter in software and information systems (Rosenfeld and Morville, 2002; Cooper, Reimann, & Cronin, 2007).

Crampton Smith summarizes IxD as "shaping our everyday life through digital artifacts—for work, for play, and for entertainment" (2007). Lowgren (2013) proposes to define IxD as "shaping digital things (including media) for people's use", which is likely more aligned with how IxD is viewed in industry today. These propositions limit the scope of IxD compared to the established IxD domain definitions, which specifies that IxD is not limited to digital (technological) interfaces.

As such, the academic field of IxD is well aligned in the broad view of the domain of IxD. Further, we are aware of the more limited modern use of the term in relation to the IT-industry, where digital (technological) interfaces are currently in focus. Emerging technologies creating new interactions, such as embedded and ubiquitous computing, are likely to continuously change the field of IxD. We thus believe that limiting IxD is unwise, and draw on Buchanan, Jensen, Kolko and Crampton Smith in our view of IxD as a discipline focused on how to design users' experiences when interacting with various products, over time and in their context of use. As Buchanan (2001) noted, IxD may cover digital, emotional, and physical aspects in the dialogue between users and systems. Thus our use of the term "product" is broad, spanning digital interfaces, physical products, interactive technologies, media channels or services.

2.2 Universal Design Expertise in Interaction Design

Universal design is about designing products and environments for the broadest possible range of users (Bergman et al., 1996; Connell et al., 1997). Adaptations may complement the design, as specified in the UN Convention on the Rights of Persons with Disabilities (UN CRPD): "Universal design shall not exclude assistive devices for particular groups of persons with disabilities where this is needed" (UN, 2006, Article 2). Some regard universal design as a separate discipline, however we argue that this is not a viable approach. Instead, we see universal design needs to be interpreted and applied in the context of each field. For example, universal design is something different in the field of architecture than in the field of informatics.

This view is in line with the legislation and regulations on universal design. Universal design legislation typically demand efforts to ensure that all citizens can make use of digital services regardless of the context of use or their abilities or disabilities (UN, 2006; Hosein, 2004; US, 2008; Access, 2010; Norwegian Ministry of Children, Equality and Social Inclusion, 2017). They are however general, and extended by regulations in different areas. The Academic Network of European Disability experts (ANED, 2013) reports there is specificity of accessibility requirements for some goods and services, in some EU countries. Existing regulations typically focus on the areas of public accommodations (in particular transportation), built environments (including automats and elevators), broadcasting, telecommunications, and ICT, (in particular web-based solutions).

Accessibility is nowadays used interchangeably with universal design, though the overlap between "universal design" and related terms are still debated (including "design for all", "universal access" and "inclusive design"). Accessibility and usability are considered well-established concepts in particular for user interfaces and websites (Petrie and Kheir, 2007:387). Accessibility is defined as: the "usability of a product, service, environment or facility by people with the widest range of capabilities" (ISO, 2010). Usability can be defined as: "the extent to which a system, product or service can be used by specified users to achieve specified goals, with effectiveness, efficiency and satisfaction, in a specified context of use" (ISO, 2010), and plays an important role in designing positive experiences with digital solutions.

Universal design expertise for interaction designers has not yet been established. For the field of IxD, our view is that universal design expertise should be applied to make sure the products and the user interactions with products offer positive experiences to as many users as possible, over time and in their context of use.

Universal Design of Digital Products

Looking into the currently existing regulations, several refer to digital products. Universal design regulations for ICT-solutions typically point to technical accessibility guidelines and standards for digital solutions, such as the WCAG guidelines developed by the WAI section of the World Wide Web Consortium (W3C, 1997). Accessibility is commonly regarded as the basis for ensuring universal design of ICT: "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect" (W3C, 1997). However, there is increasing consensus on guidelines and standards not being enough to ensure universal design (Rømen & Svanæs, 2011; Power et. al 2012). For ICT-solutions, the term "accessibility" is sometimes split into "technical accessibility" and "usable accessibility" (Paddison & Englefield, 2003; Petrie & Kheir, 2007). The split emphasizes the importance of considering usability aspects (ease of use) for a wide range of users in universal design.

Some technical strategies ensure the necessary flexibility to achieve universal design of ICT. Through dialogue independency the presentation layer of a system is separated from semantic and syntactic layers (i.e. the logic of and interaction to/from the system) (Dong, 2007). This enables the users to choose, adapt, modify, specify, or design interfaces and/or interaction styles for themselves to match their own needs (Hartson & Hix, 1989). Further, multi-modality allows different interactions forms for input and output; e.g. selecting speech recognition, computer mouse, or keyboard as input, and audio or visual output. These strategies are commonly used as best practice for usability as well as accessibility aspects.

Universal Design of Physical Products & Services

The 7 principles for universal design, developed by The Center for Universal design, is an important set of guidelines for product design (Weightman & McDonagh, 2003). They are: 1) perceptible information, 2) low physical effort, 3) size and 4) space for approach and use, 5) tolerance for error, 6) flexibility and 7) equitable, simple and intuitive use. The principles highlight physical and ergonomic aspects of accessibility.

There are no clear accessibility regulations for physical, manufactured products. For services, only digital "touchpoints" (user-service interaction points) are covered through ICT regulations. However, based on ANED (2013) report and the UN CRPD Article 9 calling for legislation, a new EU directive is proposed on accessibility of products and services (EU, 2016b). The proposal is an Annex to the European Accessibility Act (EAA) by the European Commission (2015). A set of accessibility guidelines for the design and production of products and services is proposed. Compared to the universal design principles, they appear measurable and tailored to specific types of products and services. They extend user interface and functionality design, e.g. including packaging and instructions for use where relevant. Accessibility is described as achieved by the removal and prevention of barriers, preferably through a universal design or "design for all" approaches (§25).

Combining Guidelines & User-Centered Approaches

The use of guidelines is recognized as a good, cheap basis for integrating the needs of people with varying abilities into design at an early phase, and both the principles for universal design and WCAG guidelines are extensively used. Still, guidelines are as critiqued for not being able to cover all case-specific possible usage issues. To increase the capability of professionals to detect usage problems beyond guidelines (and determine if guideline is counterproductive), recommendations are adding awareness of user diversity, knowledge of user needs and increasing designer (or developer) empathy for users. For example, Ferri, Bardzell, and Bardzell (2017) make a case for complementing assistive technology focus with an empathic design approach for anti-ageist design.

Most design approaches suggested for ensuring universal design are user-centered; extending the notion of the "user" to encompass disabled, "edge-case" (representing a challenge or situation that occurs at an extreme setting or condition) and other marginalized user groups. User Centered Design (UCD) – also called Human Centered Design (HCD) – is commonly used in IxD, and defined as an "approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques" (ISO, 2010 p. 2). The starting point for universal design initiatives is typically to recognize human diversity, with the aim of creating solutions that stretch to the edges in the scatterplot of human needs.

In order to ensure universal design of an end-result, universal design expertise must be embedded into discipline-specific approaches. Efforts in this regard are being made. Newell, Gregor, Morgan, Pullin & Macaulay (2011) suggests an edge-case inclusive and sensitive user-centered design strategy, fostering relationship between designers and users. Santana et al. (2017) notes how traditional service design is not oriented towards addressing the needs of people with disabilities. By considering "edge-case" users in the design and evaluation of touchpoints and user experience journeys, one move towards ensuring universal design of services (Bue & Begnum, 2018).

One can also reflect on universal design of products by separating 1) basic material (digital or physical, also spatial), 2) user-product interactions, and 3) product content (or end-aim). When all "layers" are accessible and usable for all users (or as many as possible), universal design is achieved. This way of approaching universal design is in use in the IT-industry (e.g. by Funka Nu Inc.) to ensure universal design of web solutions. Here, layer 1 covers technical accessibility (including compliance with assistive technologies, in addition to following current coding and accessibility standards). Level 2 refers to the usability and accessibility of the user interactions and the user interface design (including understandability, navigational structure, digital ergonomics, and visual design), and level 3 audits the digitalized content (text, video, images, audio and multimedia content). Standards and guidelines are important for ensuring good universal design on some of the aspects reflected by these product layers, while utilizing inclusive user-centered design approaches (including user testing with disabled users and assistive technologies) is recommended to ensure universal design overall.

Knowledge of User Needs

On the topic of user knowledge, users to be included in universal design strategies are often those representing main bodily disabilities, such as visual, motor, hearing, and cognitive impairments. On visual impairments, one must separate between blind users and users with reduced vision. In addition, those suffering from color-blindness are often considered; usually focused on the main types of green/red and blue/yellow distinction. For blind users, guide dog needs must also be considered. In order to facilitate empathy, persons with motor impairments are often split into those with permanent disabilities and those with injuries. Wheel-chair users receive a lot of attention, and their needs largely cover what is need by persons with strollers or walking aids. Further, persons with reading- and writing difficulties (including dyslexia) is a large user group. Finally, elderly are typically considered.

Sometimes, we see that quite "young" elderly users are receiving focus in digital design. However, Slettemeås (2014) points to the fact that based on statistics, it typically the older elderly users (e.g. above 80 years) that are in danger of digital exclusion. He also identifies that non-western first-immigration non-native speakers and persons outside of the job marked (e.g. unemployed or on disability leave) are in danger of digital exclusion. Depending on the type of product designed, one needs to consider additional user groups, apart from disabled users. Further, the context of use and likely emotional states should be considered. For example, anxiety aspects may be important to consider if designing products used in stressful or high-pressure situation. We also see designers becoming more aware of usage aspects related to fatigue.

In current universal design legislation, the "right-based" and "social-gap" views on disabilities are evident. The right-based model, states disabilities should not affect a person's opportunities for participating in the society, nor the access to products, goods, and services. The social disability model focuses on the societal responsibility to remove attitudes, physical and social barriers that exclude from participation. The stance is disabilities are mainly socially created, rising from the gap between user capabilities and the product or contextual demands. This is called the "gap-model" on disability. The gap-model also fit the social-adapted model, which acknowledges individual disabilities as somewhat limiting in themselves, but holds that socially created disabilities is the main issue, and the bio-psychosocial model used by WHO (ICF 2002, p. 10), which also defines a disability by the interaction between bodily functions and specific social contexts. Note that many more disability models exist, however the gap-model is particularly useful for (interaction) designers, as it integrates user capabilities, product aspects, emotions, actions and contexts of use.

Continuous Expansions on UD Regulations

Universal design legislations and regulations are continuously updated. On the area of ICT, the EU Web Accessibility Directive (WAD) went into force September 23rd 2018 (EU 2016a). WAD regulates universal design criteria for websites and mobile applications in public sectors. WAD refers to the EN 301 549 standard, which was recently updated to include the new version 2.1 of the Web Content Accessibility Guidelines (WCAG) from the Web Accessibility Initiative (WAI). As such, EU now adheres to a newer WCAG version than comparable regulations. In addition, WAD legislates user feedback opportunities and inclusion specifications (explaining which user groups are excluded from usage, if any, and providing reasons why) from solution providers. We now await local updates from non-EU countries. For example, the Norwegian universal design of ICT regulations are currently being re-written in accordance with WAD, and we do not yet know if both public and private sectors will be covered by stricter WCAG criteria, user inclusion specification and user feedback options.

Regarding the proposed EAA Annex directive on products and services, in addition to design and development criteria, the current version suggests that all "economic operators" should be responsible for the accessibility compliance of products and services, in relation to their respective roles in the supply chain (EU, 2016b, at 9). "Economic operators" cover, in addition to procurers, distributors, and service providers, "any natural or legal person who manufactures a product or has a product designed, or manufactured" — which includes interaction designers. In line with this, there is an increased need to determine relevant universal design expertise for interaction designers, and make sure we include these competences in our educational programs and teach students how to apply universal design expertise to IxD work.

2.3 Summary of Theoretical Framework

Based on related research, universal design is seen as a professional add-on expertise that should be integrated into professional activities. IxD is a discipline focused on how to design users' experiences when interacting with various products, over time and in their context of use. As such, universal design in the context of IxD is viewed as focused on how to make sure user interactions with various products offer positive experiences to as many users as possible, over time and in their context of use.

We treat the terms "universal design" and "accessibility" as overlapping; however both accessibility aspects related to spatial, physical, and technical issues, and aspects related to understandability, operability and visibility (sometimes referred to as "usable accessibility" in the case of digital products) must be ensured. It can be useful to separate products into different layers for ensuring universal design, separating basic material, user interaction, and content accessibility. Depending on the professional role of the interaction designer, he or she must understand the universal design aspects relevant for the design of users' experiences on either of these product layers, over time and in their context of use.

Depending on the professional role of the interaction designer, he or she must thusly be prepared to know relevant standards and guidelines for technological as well as physical design aspects, and know fitting methodological universal design approaches. The shift from "traditional" to "universal" approaches typically lies in broadening the view of the users, considering extreme users or context-of-use (edge-case design). The interaction designer thus needs end-user knowledge on relevant user groups (including disabilities), and when and how to include marginalized users in user-centered processes, design to fit these user needs, foster user empathy, and triangulate knowledge of situated user needs with established guidelines.

3. METHODOLOGY

While quantitative research concerns the systematic investigation of phenomena via statistical and mathematical logic, qualitative methodology provides an understanding of why and how elements are interrelated via analytical logic (George & Bennett, 2005; Yin, 2012). When we want to study phenomena in-depth and in their respective context, we need to use a qualitative research strategy. Thus, to articulate which competences and skillsets, and universal design expertise in particular, educational institutions offer achieved through their study programs, a qualitative multiple case study design is the most appropriate. A multiple case study enables the researcher to explore differences both within and between cases, and to draw comparisons (Yin, 2003, cited in Baxter & Jack, 2008).

Moreover, document analysis is our main tool to gain an in-depth, rich understanding of HE IxD educational programs and their universal design focus, as it provides a highly complex textual dataset to analyze inductively (Andersen, 2013; Yin, 2012). Our aim is not to generalize our findings statistically, but analytically (Yin, 2012). This is illustrated in the personas-based "archetypes" created based on key tendencies revealed in the analysis, which is presented later in this article.

The archetypes are abstract and analytical representations of how the study programs are represented online, and not based on a case study of "real people". Note that we make the assumption that Norwegian HE IxD study programs deliver according to the online descriptions, as in Norway program course tables, course description, learning outcomes and pedagogical approaches presented to students are legally binding. From the key tendencies in these empirical data, we build abstract and theoretical constructs.

In our approach, the archetypes are utilized similarly to the way "personas" are used in the design (Cooper, 2004). Unlike personas, archetypes are not necessarily focused on representing users or evoking empathy, but rather on describing a high-level "types" for an understanding of traits and characteristics (Mebuke, 2016). By theorizing archetypes and envisioning their skillsets from the empirical findings, we investigate not only the universal design focus of the programs, but also the connection between IxD competencies and universal design expertise. Using this approach, we address our stated research questions:

1. *To what extent, if any, is universal design expertise included in IxD HE study programs?*
2. *What are the abstract archetypes representing interaction design professionals?*
3. *What is the universal design expertise needed by these interaction design professionals?*

As stated in the introduction, the empirical data for this study is from a Norwegian context. However, we believe our findings will be valid outside a Norwegian context, as the archetypes are abstract representations of analytical constructs, and therefore valid regardless the context they derive from (such as the specific educational institution). Analytical constructs are important for theory development and might assist other researchers in reflecting on appropriate universal design expertise for interaction design professionals – regardless of their geographical location. As such, our findings should be of interest to scholars and practitioners internationally, due to the fields' global relevance in a time where the technological development moves fast regardless geographical borders, and where universal design legislation is continuously broadened, specified, and more strongly enforced.

3.1 Step 1: Case Sampling

Since comparisons are drawn between multiple cases, it is imperative that the case sampling process allows for a careful case selection (Yin, 2003, cited in Baxter & Jack, 2008). For case sampling, we used our view of IxD as our main selection criteria. As already stated, we consider IxD as focused on "*how to design users' experiences when interacting with various products, over time and in their context of use*". Any study programs identified as having this focus were included in our sample, regardless of whether the content was focused on digital interfaces, physical products, interactive technologies, media channels or on services, regardless of focus on experiences or products, and regardless of focus on their design or their development.

Our first step was to get an overview of IxD study programs offered in Norway. The search for IxD programs was initiated by entering the websites of all HE institutions in Norway and screen the programs at all departments in media studies, design and informatics/computer science. Then, in-site search features with the search strings "interaction design", and "design" was used for each institution to make sure we did not overlook any relevant programs. Next, we checked the Wikipedia[1] listings of IxD educations available in Norway. We also searched for IxD programs at utdanning.no, which is the official Norwegian national education and career portal, and includes an overview of education in Norway and about 600 career descriptions.[2] Between March 1st and April 18th, 2017, all existing BA and MA programs were mapped, including those that would be run for the first time from the autumn of 2017. Further, we searched the Norwegian Universities and Colleges Admission Service (NUCAS[3]) overview on May 2nd, 2017. NUCAS coordinates the admission to ordinary undergraduate study programs at all public HE institutions in Norway, and to some of the private university colleges. There is no "IxD" classification available for Norwegian HE, so we searched the labels "Design", "Media" and "Technology" (NUCAS, 2017).

Our second step was to screen the programs against our IxD definition, using the program's name and online descriptions. For HE institutions offering several studies within IxD, the decision was made to select the study track with the strongest IxD component. One-year study programs that can be extended into a BA or master's MA degree were omitted, and viewed as parts of the other programs. Combined BA+MA tracks, with recruitment to an MA with an identical name and shared research groups, are analyzed as a single study program.

From this screening and sampling process, ten study programs were identified from ten different HE institutions (see Table 1). The sample includes one college graduate (CG) program, five BA and four MA (of which two 3+2 year tracks, one 2-year track and one 5-year track) degrees. Three of the programs are named "interaction design", while the rest have other name constructs including the term "design" (e.g. "multimedia", "digital" or "ICT"). Four of the HE institutions are Universities and six

[1] Please refer to https://no.wikipedia.org/wiki/Interaksjonsdesign
[2] Please refer to https://utdanning.no/tema/om_utdanning.no/about_utdanning.no
[3] Please refer to https://www.samordnaopptak.no/info/english/

are University Colleges. Five of the HE institutions are located in the capital of Norway, Oslo. Of the remaining five, one is in Halden, one in Grimstad, one in Gjøvik, one in Bergen, and one in Volda. We anonymize institutions and pseudonymize study programs to "detach" overall findings from specific study programs.

3.2 Step 2: Data Collection and Analysis

In a qualitative study, the sample is typically small, which makes it possible to first study each program in-depth, and then them comparatively in order to identify key tendencies. After the case sampling, data collection and analysis was started with a close reading of program and course descriptions, study aims, and other content details.

The analysis process took place iteratively. The researchers gained an overview of the study programs by a close reading of their profiles, course descriptions, study aims, and other details about the program. For three programs, content or course descriptions were not stated online. The institutions offering these study tracks were contacted by email and the requested descriptions were sent to us via email (HE Institution 2, HE Institution 9, and HE Institution 10in Table 1). These three had not yet finalized all course descriptions. Even so, the content that was available online together with the descriptions received were considered sufficient for the study in relation to the intent, main content and focus of the programs. Against this background, we revealed interesting themes that we wanted to explore systematically and in depth in accordance with our research questions.

On April 18, 2017, the authors met for a full-day workshop, moving from independent impressions to a collaborative analysis. Several half-day or shorter discussions and meetings followed this.

As part of the workshop, each program was first analyzed internally against initial themes. Each program's online presentation was considered through a close analysis of what was stated in the overall description and other official texts posted online by the HE institutions. Each program's content was considered through a systematic thematic analysis of information gathered from course tables, course descriptions and listed topics in mandatory courses (including courses mandatory for IxD specialization tracks), information on approaches to teaching, assessment and learning outcomes (what students are expected to achieve in knowledge, skills and general competences) for each course, and for the program overall..

A known weakness with document analysis concerns epistemological issues. Documents are produced by the respective educational institutions, and we need to be aware that texts are written as "sales documents" (Atkinson & Coffey, 2004) to attract students. Thus, online presentations (what they state) were compared to the content themes (what they provide) for each study program, to check whether these match and gain a more reliable program profile. Thus, as already mentioned, what we study is how institutions represent IxD study programs, not if these institutions deliver what they promise (e.g. through interviews) nor the graduated students (e.g. assessing students competencies).

Next, the study programs were compared to get an overview of their similarities and differences. During the internal and comparative analysis, we continuously coded findings into themes and key characteristics. Thus, our coding of the data emerged as we moved back and forth between the data and our conceptualization of it, and we needed to deconstruct our categories and create new several times as the analysis proceeded. We organized the content analysis by iteratively constructing and deconstructing thematic categories, as suggested by Labuschagne (2003), in order to control validity, and internal and external reliability (Shadish, Cook, & Campbell 2002). Further, this made it possible to compare the study programs with one another thematically, which was essential for developing the archetypes, along with forming an in-depth sense of each study program's characteristics.

The analysis revealed that the programs could be sorted on overall contribution orientation (**societal** or **user** oriented), targeted industry (**media** or **IT**), and the didactic emphasis (on **theoretical** knowledge or **practical** experience). Societal needs are emphasized in some program descriptions, for example

highlighting an industry need for the competence taught or for discipline-specific societal opportunities or challenges. These are classified as having a **societal** orientation. Other programs emphasize human aspects more, e.g., highlighting the need to stay user centered and motivating students to make innovations to meet the needs of end-users. These are classified as having a **user** orientation. The orientations may be combined—and thus the categories are not considered mutually exclusive. The analysis further revealed that the study programs reach out to different industries. Only two programs target both **media** and **IT** industries. The didactic approach axis looks at the way the content is taught. **Theoretical** teaching refers to a focus on traditional academic training, with oral and written skills—for example, writing academic essays and discussing fictional cases. **Practical** emphasis, on the other hand, points to teaching in realistic settings, such as through internships or utilizing real-life scenarios. The teaching thus often involves the industry, which typically provides real cases, supervises work, or evaluates student results.

As we delved into the details, we also sorted the programs based on their overall content focus (emphasis on **technology** competence or **design** competence), and their underlying motivation (driven by ethical **values** or by fulfilling **industry** needs). Technology focused programs typically emphasize ability to code and provide front-end or full-stack expertise, providing strong technological and IT competences to the interaction designers. Other programs are more design focused, for example emphasizing creative skillsets and design process knowledge. Studies focusing on utilizing IxD for communication are classified as more design than technology oriented. Industry focus refers to program content emphasizing industry-relevant skills. Value focus refers to exercising ethical considerations, such as an emphasis on user-centered, socio-technical, or societal aspects. Some programs are clearly more **values** or **industry** focused, and clearly emphasize **technology** versus **design**, while others highlight both. We mapped the study programs along the dimensions in a coordinate grid. We identified programs in all four "corners" of the grid, as well as some that fall more towards the center of the grid. At this stage, we started to draft the archetypes from the data set. Finally, we mapped from the content which types of universal design expertise the programs signaled they would teach, and sorted the programs based on their overall degree of universal design focus.

From the comparative analysis, we thus identified key patterns. We used these to identify and describe five "archetype" representations (or abstract personas) of interaction designers. The five archetypes represents key characteristics (or stereotypes of interaction designers), given that the study programs deliver what they state textually in their online study program presentations, and as such indicate what high-level skillset and strengths interaction designers types from this programs would hold.

4. FINDINGS

Table 1[4] is an overview of the ten IxD study programs. All BA programs are full time tracks, while MAs can be taken either full time or part time. Regarding admission requirements, all HE studies have general study competency requirements (GSC). GSC is usually acquired via high school, but may also be obtained via test scores in combination with work experience by older students. The only exception for GSC requirements is one of the private university colleges offering a CG degree, which accepts vocational skills combined with a partly completed GSC upon consideration.

4.1 Universal Design Focus

Although we found a heterogeneous universal design focus across the IxD programs, the main finding is that most programs have a weak or absent focus. There are no distinct differences between Universities and University Colleges. The programs were rated along a continuous scale from "high" to "low" based on their degree of universal design content, including web accessibility and general

[4] (GSC = general study competency, CS = Computer Science, eqv. = equivalent).

focus on inclusiveness across user abilities and contexts of use. Programs in design and IT have a spread in their focus. Media degrees, however, all have a low or absent focus on universal design.

Three IxD study programs are completely **lacking** in any focus on universal design and its related topics (as outlined in the literature section). These studies do not mention any ethical considerations, regulations and laws, or any other related knowledge, skills or general competences related to universal design, design for the elderly, disabled or marginalized users, whether at a course level or at a program level. This is disheartening, as all these programs include courses where universal design competence is needed in order to educate professionals able to fulfill current legislations. For example, these programs educate IxD professionals in web development and visual design, without ensuring they will be able to deliver legal solutions to the market with regards to web accessibility.

Table 1: *Overview of the IxD Study Program Sample (GSC = general study competency, CS = Computer Science, eqv. = equivalent).*

Pseudonym	**Study program characteristics**	**Institution**	**Admission Requirements**
HE Institution 1	Informatics Degree: 3 year BA, full time.	University College, Private	GSC
HE Institution 2	Informatics Degree: 3+2 year BA, full time + MA full/part time.	University, Public	GSC (BA), C+ average BA with 80+ ECTS in CS (MA)
HE Institution 3	Informatics Degree: 2 year MA, full/part time.	University College, Public	BA in Engineering or eqv. BA with 80+ ECTS in CS
HE Institution 4	Design Degree: 5 year MA, full time.	University College, Public	GSC + Passed admission test
HE Institution 5	Media Degree: 3 year BA, full time.	University College, Public	GSC
HE Institution 6	Media Degree: 3 year BA, full time.	University, Public	GSC
HE Institution 7	Media Degree: 3 year BA, full time.	University College, Public	GSC
HE Institution 8	Technology/Media Degree: 3 year BA, full time.	University, Public	GSC
HE Institution 9	Design Degree: 3+2 year BA, full time + MA, full/part time.	University, Public	GSC (BA), BA with 80+ ECTS in CS/design/media (MA)
HE Institution 10	Design Degree: 2 year CG, Full time.	University College, Private	GSC or vocational skills

Four programs are categorized as having a **low** universal design focus. In addition to displaying very limited attention (typically, one single-sentence competence goal within one of the courses), the goals included are focused on theoretical knowledge only. None of the programs with a low universal design focus mention WCAG, other WAI criteria, or universal design principles.

One program is regarded as having a **medium** focus on universal design. This study program includes an expectancy of the ability to apply universal design, and not only a theoretical awareness. WCAG is explicitly mentioned (as an example of universal design guidelines). Still, the universal design focus is limited to two courses relating to web design and web development, with three competence goals on the subject.

Finally, two study programs have a **high** level of universal design focus. These programs have universal design perspectives included in many of their courses where they are relevant to the topic at hand, and are related to actual skillsets as well as to theoretical knowledge. Examples of universal design aspects are: the including of marginalized users in the user research, principles of universal design in user-centered design, adding mobility aspects and emotional aspects to user-experience

design, web accessibility topics in courses on web development, color and contrast needs in user-interface design (including color blindness), universal design as innovation strategy (extreme users), teaching inclusive approaches in design methodology, assistive technologies and interaction styles in human-computer interaction courses, etc. Other topics on universal design are more academic, such as defining disability, understanding trends and demographics, and knowledge of universal design terminology, standards, and regulations.

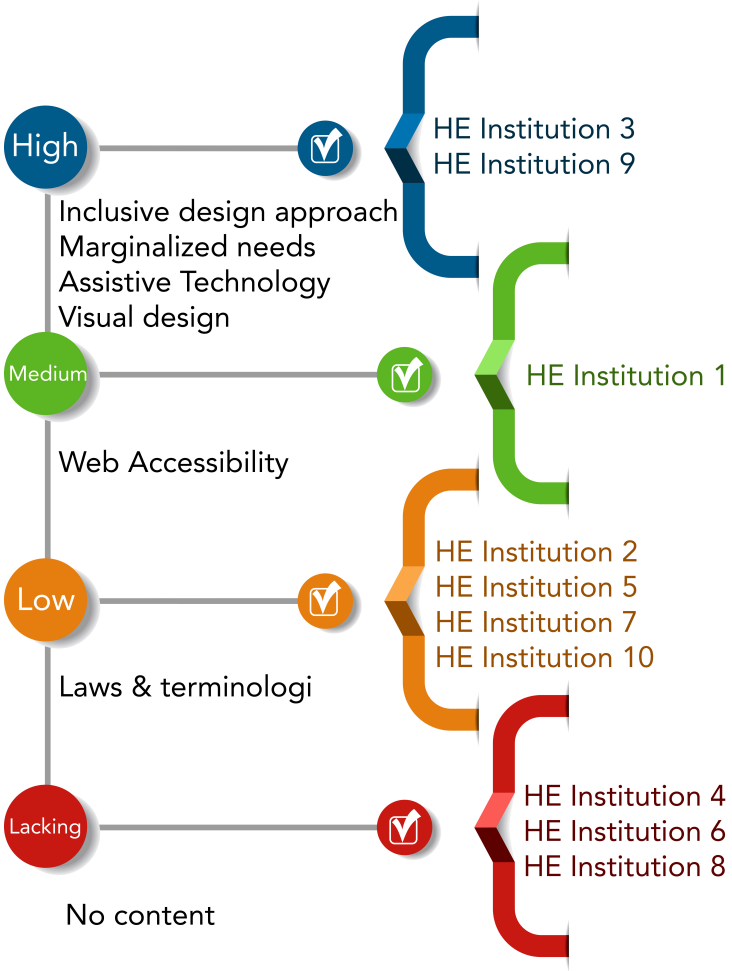

Figure 1: *Universal Design Focus of HE IxD Programs*

Figure 1 presents the program ratings, using their pseudonymized names. In the following sub-section, we briefly present each of the ten study programs, synthesizing the findings per program.

4.2 Presenting the Programs

Table 2 presents a summary of the comparative content analysis sorting, which draws on online program profiling (typically expressing overall intentions with the program, including values, orientations, industry collaboration and motivations), as well as legally binding program learning outcome, legally binding course tables, legally binding course descriptions, legally binding course-level learning outcomes, and to some extent the proposed curriculum (may be subject to change). The legally binding documents provide the basis for assessment of program content, and didactic styles. In some cases the online program profile descriptions did not fully lined up with the legally binding presented content. For example, the profiling may be advertising an intent that is not fully reflected in the formulated learning outcomes. If so, we describe this in the following study program presentations.

Further, study programs could not always be sorted as "either-or" on our analytical dimensions of **societal** or **user oriented** orientation, ethical **values** or **industry** needs as driving motivation, **media**

or **IT** industry targeted, emphasis on **technology** or **design** competence, and **theoretical** or **practical** didactical emphasis. The dimension categories are not necessarily mutually exclusive, and program descriptions reflect any ambiguities or dual sorting along the dimensions. However, we are overall able to identify the differences between the programs using these analytical dimensions. Based on comparisons of these extrapolated program traits and of the program content, we are able to create analytical constructs for our abstract archetypes of educated interaction design professionals.

Table 2: *Summary of Comparative Study Program Sorting*

	Key Content Categorization				**Orientation**		**Industry**		**Didactics**	
	Industry	Values	Technology	Design	User	Society	IT	Media	Theory	Realism
HE Institution 1	•		•		•		•			•
HE Institution 2		•	•			•	•		•	
HE Institution 3		•	•			•	•		•	
HE Institution 4		•		•		•	•	•	(•)	•
HE Institution 5	•			•	•			•	•	(•)
HE Institution 6	•			•	•			•		•
HE Institution 7	•			•		•		•	(•)	•
HE Institution 8	•		•	•	•	•		•	•	(•)
HE Institution 9	•	•	•	•	•	•	•	•	(•)	•
HE Institution 10	•	•		•	•		•		(•)	•

4.2.1 HE Institution 1

"You become a technical designer who will master web development and interaction design."

This program results in an IT BA degree and it lacks a clear design focus, but includes several IxD topics. The study is user oriented and front-end focused, and includes web and mobile development and user testing. A medium level universal design focus is provided through the web design and web development courses, focused on web accessibility. The program has an applied focus, incorporates practical casework and portfolio-based evaluation, and many cases are assigned by external clients. Industry collaboration is emphasized, and specifically with the IT-industry.

4.2.2 HE Institution 2

"You understand how IT influences individuals, organizations, and society and vice versa."

This track is also an IT degree with a strong IxD component. Descriptions focus on informatics skills, such as the ability to "explain how computers are built and function" and refer to apps, websites, and programming. User research and design processes are mentioned. The study targets the IT-industry. Both MA and BA offer opportunities for an increased focus on IxD, information design, software engineering, mobile or web technologies etc. Societal value ideals are promoted by an emphasis on awareness of legal obligations, technology as an influencer of organizations and social systems, and the ability "to reflect on key ethical, societal and academic issues related to own and others' work". Courses teaching practical skills and case-based reflection are more prominent in the BA, while theoretical reflection is emphasized at the master's level. Only a low, theoretical focus on universal design is provided. Overall, the emphasis is on analytical reflection and theoretical insights. No industry collaboration is mentioned.

4.2.3 HE Institution 3

"...suited for you who want to be a specialist in universal design of ICT-systems."

This program is also technological and is based on an IT-degree. It is value focused around the topic of universal design, with a societal orientation. There is a strong focus on universal design and accessibility, with social gap and equal rights-based disability model perspectives. Environments can create disability barriers, thus our societal responsibility is to reduce these. The program draws on user-centered design principles, but is otherwise not focused on design. The study program educates candidates for the IT-industry. Emphasis is on analytical reflection and evaluation of existing ICT-solutions, mainly using expert evaluations and technical accessibility checks. Assessments are done through traditional written and oral exams and written hand-ins. There is no apparent industry collaboration or business-related courses.

4.2.4 HE Institution 4

"...educate specialized students with a common grounding in design thinking."

The first three years of this design degree five-year MA may be replaced by a design-discipline BA. The online profile emphasizes design driven processes and design thinking, it highlights the creative aspects and is design oriented. The program presentation does not clearly match the learning outcome descriptions. The industrial design background of the program is evident through courses related to physical production, production technology, and methods. Although the profile states that teaching utilizes external enterprises and industry work environments, it is unclear to what extent industry collaboration and an industry focus are included in the education. A societal orientation with a value focus seems far more prevalent. The students are taught design reflection, design theory, and design methodology; however, universal design perspectives are missing. Portfolio-based evaluations are extensively utilized, but multiple-choice school exams and design reflection hand-in assignments are also included. Students are mainly educated to work within the IT-industry.

4.2.5 HE Institution 5

"...provides you digital competence closely related to creative disciplines."

The online profile describes a study that is closely associated with the media industry. It is however difficult to determine how much practical collaboration with the industry the program offers. No internships, real-life casework, or external project assignments are highlighted, instead, the program seems to value academic writing skills. Thus, the assumption is that the program has more fictional casework and project evaluation. The program has a well-balanced mix of individual portfolio assessments, written and oral school exams, and project reports. The program seems user oriented. The online profile emphasizes creative processes, thus appears design focused. When considering the content of the study program, learning goals are however more focused on technological skills. The study program description is somewhat vague, with quite general learning outcomes, making it hard to pinpoint the true focus. The universal design focus is low and limited to web development.

4.2.6 HE Institution 6

"Teaching takes place in close cooperation with media businesses ..."

This online study program mentions topics such as front-end development, web programming, games, and mobile solutions. It thus seems technological. However, the study content does not clearly fit the online presentation. Based on the specified learning outcomes, it appears that design receives more focus than technology. Both design practice and design theory (ethical and analytical) is covered. Technological competences seem aimed toward utilizing existing digital tools within a media context. Production of media content is included. The program targets the media industry and stresses close industry collaboration. The program is user oriented, but without a strong ideological or value-loaded focus on user-centeredness. Universal design is completely lacking from the program. The study

program has an overall assessment style based on fictional casework, with hand-ins of textual reports for grading based on practical assignments, in addition to portfolio-based assessments.

4.2.7 HE Institution 7

"…you design and create content for today's and tomorrow's platforms."

The study is presented as focusing on technology as a mediating platform in society, and has a societal orientation. The program does not have a clear IxD component, but design perspectives are highlighted in designing interactive digital solutions and concepts. The presentation emphasizes web and multimedia, the producing of media content and visual communication. Students are mainly educated to work within the media industry**.** There is not a strong technology focus, instead humanistic perspectives seem to be the influencing factors in the study program. Universal design is given very little focus. The study mentions collaboration with industry, but though teaching and assessment methods are similar to those at HE Institution 6, a close connection to industry seems lacking. An applied focus is present in the program content description, although academic reflections are also taught. Exams are a mix of individual and project work, and include written assignments, case reports, produced work, portfolios, oral exams, and home exams.

4.2.8 HE Institution 8

"…foundation in technology so you can develop complete multimedia products."

This study profile is clearly targeting the media industry. Content wise, it includes graphic design, and 3D visualization, in addition to animation, video-, and audio-production. The IxD component appears weaker than its focus on digital media production. The study is viewed as somewhat society and user oriented, and theoretical reflections as well as design and development skills related to user-friendly solutions are expected. However, no ethical or methodological stances or values are highlighted. Universal design is lacking. Extensive self-study is combined with problem-based learning and workshops. The students are evaluated partly through written hand-ins and partly through practical design and development projects. Portfolio assessment is emphasized. No industry collaboration is mentioned.

4.2.9 HE Institution 9

"… making the world better through designing and building great user interfaces..."

A strong value focus is conveyed in the BA+MA track, together with societal engagement, idealizing contributions to a better world through design, as well as a strong user orientation. User-centered methodology is emphasized. Online profiles fit contents with respect to the emphasis on design skills, including user experience (UX), human factors, service design, information architecture, visual design, and a strong universal design focus. However, in-depth content information reveals that the track also includes technological and industry focuses—e.g. offering web-technology and front-end skills. As such, the education merges the design, technological, industry and value focuses. Reflection and analytical skills are stressed, both as related to practical case experiences and theoretical knowledge. The track focuses on cross-disciplinary teamwork, methodology, and uses case-based learning. Some industry-related practice and collaboration is included, especially at the BA level. Students are mainly educated for the IT-industry.

4.2.10 HE Institution 10

"The job of an interaction designer is to make technology functional and user friendly."

This program is profiled as technology and value focused: understanding human needs and designing and developing websites and apps to bring value to users. When the learning outcomes and program contents are considered, this picture changes slightly. Here, the technological focus is downplayed, whereas the user orientation and value focus remain present. Like the HE Institution 9 program, the study provides a cross-disciplinary introduction to IxD spanning from front-end to service design, but

it has a low focus on universal design. The program expects their students to be able to make ethical and methodological reflections. The study appears hands-on and practice-oriented, emphasizing processes in industry and IxD-related teamwork. The study program mainly aims to educate students for the IT-industry, covering design, values, and industry focus.

4.3 Archetypes of Interaction Designer being Educated

In the following section, the five identified archetypes are presented. Based on the data analysis, we find universal design aspects are largely weak or absent in IxD education. Table 3 summarizes key findings on archetypes and universal design, showing the overall weak and lacking focus on universal design in current IxD education.

Table 3: *Summary of Universal Design Focus and Archetype Representations*

	Universal Design Focus	**Archetype Representation**
HE Institution 1	Medium	Front-ender
HE Institution 2	Low	Full-stacker
HE Institution 3	High	Full-stacker
HE Institution 4	Lacking	Design Tinker
HE Institution 5	Low	Communicator
HE Institution 6	Lacking	Communicator
HE Institution 7	Low	Communicator
HE Institution 8	Lacking	Communicator
HE Institution 9	High	User Empath
HE Institution 10	Low	User Empath

4.3.1 The Front-ender

The first theorized type of interaction designer is the Front-ender. The HE Institution 1 program (presented in 4.2.1) is informing the abstract creation of this archetype, as this program is more technology focused than design focused, utilizing a didactic approach focused on realistic teaching over theoretical, and tailoring the program content to the skillsets needed by the industry.

The main characteristic of this abstract archetype is defined as proficiency in web development and web design, hence the name Front-ender. A Front-ender candidate fresh out of school is hypothesized to have up-to-date industry relevant skills in web and mobile programming. In addition, basic knowledge and skillsets within human-computer interaction, user-interface (UI) design, user-centered design (UCD), mobile development, responsive design, and web accessibility competences are envisioned. Front-ender types of interaction designer are theorized to have limited full-stack abilities and limited user research and design skills.

4.3.2 The Full-stacker

The programs from HE Institution 2 (presented in 4.2.2) and HE Institution 3 (presented in 4.2.3) form the basis for our construction of the Full-stacker. These associated study programs are focused on technology, focusing on analytic and evaluator abilities and exercising reflection on theoretical insights.

The “Full-stacker” interaction designer thus inferred as having a classic informatics (or Computer Science) background. The Full-stack interaction designer is theorized as having received basic knowledge of typical back-end skills, such as programming, databases, networks and operation

systems, and computer hardware knowledge. This archetype is constructed to have full-stack development capabilities (thus the name), be well versed in software engineering, and we imagine interaction designers resembling this abstract archetype may potentially help bridge the gap between designers and developers (for example in agile settings). In addition to proficiencies in mobile and web technologies, we picture a candidate fresh out of school is knowledgeable of cutting-edge technology. However, this archetype may lack extensive training in design methodology, user research and user empathy. The IxD training of the Full-stacker is hypothesized based on the corresponding study programs as having been mostly HCI and UI focused, such as considering input/output modalities and information design.

4.3.3 The Design Tinker

The third archetype represents an interaction designer with a design degree. We have one study track forming the basis for this archetype: from HE Institution 4 (presented in 4.2.4). Overall, the HE Institution 4 program is considered to particularly emphasize design and values, which fit an abstract "tinkering" archetype.

The name "Design Tinker" refers to the creative process of "tinkering" – experimenting with ideas and materials to explore, improve, or create something. This bottom-up and hands-on experimentation of moving between theory, experimentation, and reflection is viewed as a different approach to innovation than the traditional top-down analytics of computer scientists and engineers.

In contrast to interaction designers with informatics degrees, represented by e.g. the Full-stacker and Front-ender archetypes, the Design Tinker is envisioned as having a disciplinary core in design thinking, design theory and design reflection. Based on our analytical constructs, the Design Tinker is viewed as an interaction designer well versed in problem solving through design thinking and using creativity triggers. He or she is assumed to hold broad design skills, in addition to interaction design competence. We thus hypothesize interaction designers reflected by the Design Tinker archetype may label themself as belonging to a design-discipline that overlaps with IxD, such as information designers, graphic designers, industrial designers, product designers, service designers etc.

Design Tinkers are assumed to have limited development and programming capabilities. However, the Design Tinker is expected to be familiar with physical prototyping, and thus hold capabilities for problem solving by tinkering and prototyping with technological artifacts (utilizing sensors, IoT, etc.). Overall, this type of interaction designer is envisioned suited for tasks where a broader design skillset is needed, and predicted capable of designing more than technological contact points and interfaces.

4.3.4 The Communicator

Students graduating from HE Institution 5 (presented in 4.2.5), HE Institution 6 (presented in 4.2.6), HE Institution 7 (presented in 4.2.7), and HE Institution 8 (presented in 4.2.8) are likely to reflect the Communicator archetype construct. The level of technological focus somewhat vary between these programs, but the focus is overall on applying, rather than developing, technology; using technology as a mediating platform and utilizing interactive digital solutions within the media context. All the programs are user oriented, but lack a strong value-based focus. Although design aspects are given some emphasis, IxD is not a primary focus in these programs. All the four programs represented by this archetype are primarily educating candidates for the media industry. As such, this interaction designer archetype is extrapolated from the interaction designer programs providing a media degree.

The Communicator represents an interaction designer schooled in how to use technology to develop media services and to communicate with users, trained in content production and visual communication. The Communicator is theorized as skilled in media design and in media production (such as animation, video- and audio-). We also envision this type of interaction designer has some skills relating to front-end development, games, and web and mobile solutions. A Communicator archetype is further anticipated as skilled in reflecting on ethical and societal implications related to

applied solutions, including universal design. It is also assumed that Communicators probably hold some basic skills in visual design, UI, and creative processes

4.3.5 The User Empath

Finally, we find study programs that provide in-depth IxD training. Studies from HE Institution 9 (presented in 4.2.9) and HE Institution 10 (presented in 4.2.10) fit this category (representing two tracks and three programs; a two-year CG, three-year BA and an optional two-year MA add-on). These programs have a strong focus on training students in user-centered IxD skills, and universal design perspectives are included in all programs. They are of very different length (two to five years) and offer different degrees (CG, BA, or MA). Although the level of in-depth reflection skills varies, all communicate value-based design choices and focus on user needs. They are also quite interdisciplinary, and include topics related media-studies, cognitive psychology, management perspectives, technology, and design.

From the empirical base of these studies, we build our final archetype: The User Empath. We envision this type of interaction designer has received an interdisciplinary training, and draws on both design and IT topics, including UI and visual design, and web and app development. Due to the interdisciplinary programs inspiring this analytical construct, we believe a User Empath type of interaction designer is likely to hold basic competence in IxD-related disciplines, such as service design, information architecture (IA), HCI, and human factors. A User Empath will thus have an education that covers several topics within the UX-field and as related to IxD, including reflection on universal design, ethics, and design methodology.

We imagine this archetype would be trained in user research and user testing, and view it as the most likely IxD archetype to be skilled at user-involved, participatory, user-sensitive and empathic design techniques, such as workshops, ethnography, empathic design, in-situ interviews, shadowing, and participatory observation strategies. Further, that this type of interaction designer is likely well versed in design methodology. We hypothesize based on the empirical data that the mainly focus is on user-centered design and cross-disciplinary teamwork, but it could also include e.g. creativity and innovation training. In addition to strong user-centered design competences, we envision the User Empath holds some visual design skills. Finally, we theorize this archetype skillsets covers basic front-end design and development skills, mainly as related to websites and apps

5. DISCUSSION

First, regarding the question, **To what extent, if any, is universal design expertise included in IxD HE study programs?**, the analysis revealed that many of the IxD programs lack a focus on universal design, including the teaching of web accessibility. This is worrying and somewhat surprising, as usability and accessibility are concepts well integrated into IxD and UI design (Petrie & Kheir, 2007), and both national and international legislation is in place to ensure a minimum level of accessibility in our societies. The low presence of universal design in study programs in IxD in Norway is an important finding, and one that is highly critical for educational institutions to address in order to decrease and not increase the digital gaps in a society where the digital development moves fast.

Universal design perspectives are vital when designing products for a wide variety of users (Bergman et al., 1996; Connell et al., 1997), and therefore they were expected to play a more central role in the study programs that cover design and product development. Innovative companies, for example Apple, have learnt that designing devices and systems that are easy for everyone to use is a business opportunity. From a business perspective, it should be equally important for future entrepreneurs and start-ups that their designers have skills in universal design if they are to target a large audience.

Further, web accessibility is regarded as a key component if all users (citizens) in our digital society are to be included, and it is legislated in Norway as a mandatory part of all new IT-solutions targeting

to the general public (Norwegian Ministry of Government Administration, 2013). From 2021, accessibility will also become mandatory for existing IT-solutions in Norway, both public and private (Norwegian Ministry of Government Administration, 2013). Accepting the fact that inclusion of universal design is also manifest in worldwide guidelines and standards (Hosein, 2004; UN, 2006; Access, 2010; US, 2008), we could expect that educational institutions serving the media and IT industries would pay more attention to this in their study programs and course plans. At the very least, one would expect HE institutions to make sure that newly educated interaction designers possess the necessary competence to adhere to current Norwegian and international legislation.

Currently, the general manager of a private or public company, or other organization, is legally responsible for adhering to the law. This makes sense as this person is in control of the budget. However, it is reasonable to expect that procurers will be advised of current legislation by service providers so that plans and offerings from the media- or IT-industry will comply with current legislation—just as an architect must comply with building regulations. The prioritization and focus on universal design in the design and development processes of IT projects is a critical success factor if inclusive ICT-solutions are to be achieved (Harder & Begnum, 2016). Knowing that procurers often lack the necessary expertise in universal design, we argue that it is an ethical matter to ensure that professionals are adequately educated so that they can advise providers regarding their legal responsibilities. We urge the HE sector to take responsibility for ensuring that there is an adequate universal design focus in IxD education. This is supported by §47 of the 2016 EU regulation on the accessibility of websites and mobile applications, which states that members should: "take the necessary measures to raise awareness of, and promote web training programs relating to, the accessibility of websites and mobile applications, for relevant stakeholders and in particular staff responsible for the accessibility of websites or mobile applications" (EU, 2016a).

The EAA Annex directive proposition suggests placing the responsibility for ensuring universal design across stakeholders in the supplier chain. The aim is to complete the EAA work before the end of 2017. There is therefore reason to believe that interaction designers may soon be held legally responsible if they disregard universal design legislation in their professional work. This adds to the importance of Norwegian HE institutions ensuring that their IxD students receive the necessary competence and knowledge, and understand both their current and potential future legal responsibilities.

On our second research question, **What are the abstract archetypes representing interaction design professionals?**, we have identified five different archetypes of interaction design being educated in Norway. We find that among Norwegian IxD programs there is tremendous heterogeneity as regards type of institution, study program length, degree achieved, academic focus, content and overall aim, didactics, and level of industry collaboration. The five constructed archetypes each emphasize various key characteristics from the programs, ranging from the highly technical to the more user-oriented with softer skills.

Although there is a common agreement as to the importance of user-oriented development, e.g. through activities such as usability testing (as consistent with e.g. Hornbæk, 2006 and Nørgaard & Hornbæk, 2006), we find a scattered focus on user inclusion and user empathy across the various study programs. The large variation in the IxD archetypes being educated raises some challenges, both for the industry as well as for the individuals. Currently, this seems critical in four instances: 1) when failing to recruit or recognize the correct type of interaction designer to adequately match a positions competence needs; 2) when failing to recognize and utilize the competence available, e.g. on project teams; 3) when failing to educate professionals with the necessary expertise, as needed by society and required from the industry; and 4). when failing to recruit students into IxD programs, thereby e.g. maintaining an industry shortage.

For example, recruiting interaction designers with the right expertise is a challenge for industries in Norway. Several previous studies (e.g. Fallman, 2008; Sørum & Pettersen, 2016) discuss the many aspects considered important within IxD. By presenting these archetypes, we aim to make it easier for organizations to better address the skills they need when recruiting, and to ensure a better match between their business needs, the job descriptions, and the new employees. We visualize a scenario where organizations are able to review the archetype descriptions, and on this basis improve their communication regarding the type of skillsets they are looking for. Likewise, interaction designers will have an easier way of communicating their competences, e.g. that that they are a mix between two of the archetypes.

Another challenge relates to the hiring of new employees: namely, whether to utilize in-house or to hire new IxD expertise. Thus, the archetypes may contribute to make available skillsets amongst applicants as well as those currently held by organizations be more apparent. Further, industry might benefit from the archetypes when staffing and planning their internal resources, as the archetypes could enable them to map the range of skillsets at hand or needed for a particular project. Increasing the visibility of available skillsets may not only aid management, but also communicate the capabilities of interaction designers. As such, a recognition of available competences may facilitate more established professional IxD roles, e.g. in cross-disciplinary teams. A more explicit way of communicating IxD skillsets may combat the tendency to reduce UX skills to interface design as is often reported in agile settings (Kuusined, 2015; Constantine, 2001; Begnum & Furuheim, 2016).

Further, the archetypes may reveal to educational institutions the competence gaps that need to be filled in the IxD education they currently offer, and also contribute to ensuring that tacit knowledge of the program is made explicit in the external presentations, thereby ensuring a better match between program profiles and actual content. It is unlikely, and frankly not desirable, that the same type of interaction designers should be educated across all institutions. Even though the industry currently reports that it is not the quality of the education, but rather the quantity of candidates that is the issue, having a way in which to communicate what IxD skills are needed presents an increased opportunity to ensure a match between what the industries need and what is taught. Previous studies (Sørum & Pettersen, 2016) have also indicated that IxD skills and topics as taught in various educational programs are often inadequate to match the competence needs of the design industry. Consequently, we can speculate that there is a mismatch between the topics considered significant in an educational context versus the knowledge that is needed in the industry. Such a mismatch between theory and practice has also been highlighted by Goodman, Stolterman, and Wakkary (2011), who also emphasize the importance of minimizing this gap.

In addition to within-programs improvements, improved articulation not only of the IxD field but also regarding specific educational programs has the potential to ensure that political and managerial strategies in the HE sector understand the overlap between, or the uniqueness of, IxD programs, and whether institutions are competing with or complementing each other. This might aid strategic adjustments, future mergers, student exchange opportunities, and collaboration between study programs.

Finally, in Norway, the HE sector is currently striving to meet the industry's need for more interaction designers. Thus, the sector has strengthened and collectively built up its IxD education programs during the last decade, and especially in the last five years. The first program named "Interaction design" was launched in 2013. However, low application numbers remain a challenge; both in terms of filling all available programs with motivated students and being able to select the students that best fit specific programs from among several candidates. As there is no standard or homogeneous skillset required to become an "interaction designer", and because IxD is in many ways an umbrella term, the HE sector perceives challenges related to communication the content of the profession to students and high school career advisors. We propose the archetypes can be used to better reach potential students, as they communicate more easily to young people what the IxD profession is about, which roles they

are likely to fill, and what abilities are needed. This may lead both to increased recruitment, and a better match between potential students and the HE study programs they select.

Our view is that the IxD field is not static or definite, but is constantly changing in relation to technological and societal developments. Thus, to attempt to specify one "correct" interaction designer archetype would not be a relevant aim. Rather, we argue that articulating IxD archetypes could combat the four challenges identified above, without limiting the field in time or content. As the field changes, new archetypes may be added and existing archetypes may be updated with new skillsets.

With regard to our third question: **What is the universal design expertise needed by these interaction design professionals?**, the findings show that the level of universal design competence currently being taught is low. As such, what universal design competence is needed is largely undefined from the empirical data. Our study revealed that three out of the ten programs are completely lacking in attention paid to universal design, while a further four study programs have only a low focus on this topic. One program has a medium focus, and only two were found to include extensive universal design aspects. In this regard, we express our concerns regarding future solutions created by students of the IxD programs. Currently, Norwegian IxD studies do not appear to be contributing to the intended shift toward a more inclusive society as set in motion by national and international legislation. If students are not taught the importance of adhering to existing regulations as part of their education, and are not even informed that these regulations exist, we perceive that it is unlikely that they will discover them on their own — and they may even be resistant to taking these regulations seriously in their professional work. However, if universal design standards, regulations, best practices, and quality control are taught as part of an IxD education, we consider it likely that newly educated interaction designers will suggest and share these in their places of work.To make a contribution towards aiding the HE sector in rectifying the lack of universal design focus, the decision was made to include a proposal on universal design expertise perceived as key for each of the five archetypes. Thus, in addition to discussing the implications of a shortage in universal design skills in the study programs, the paper and the archetypes makes an explicit contribution to ensuring that the necessary additional expertise in universal design is implemented in the field. Through advocating for universal design competences, we hope to open up a debate on the necessity of such skills in IxD and the responsibility of educators to arrive at agreement on what level of universal design competence is relevant for interaction designers.

As universal design expertise must be embedded into the interaction design profession, the abstract archetypes provide a foundation for discussing which universal design expertise is relevant for interaction designers. Our first assumption, based on the data, is that many professionals working as interaction designers in the IT-industry have a cross-disciplinary background in informatics and front-end and UI-design. A few programs offering in-depth IxD content, focus more on user-centered values and skills, while also attempting to balance design and technology content. In the media industry, our findings indicate that professionals holding IxD responsibilities are likely to have a cross-disciplinary background in media technologies, media design and media production.

Second, those who enter IxD positions in the IT-industry are usually expected to do either front-end coding or user-interface design. For both these tasks, we suggest they need **web accessibility** competence to achieve the minimum universal design standards as determined by current legislation. Currently, web accessibility competence needed is mainly WAI WCAG, responsive design, app accessibility, and following coding standards. IxD professionals also need to now how to check accessibility, including the UI. The basic methods for doing this are automatic validation, expert inspections, and user tests with disabled users. A basic understanding of assistive technologies such as screen readers, screen magnifiers, and switch-systems is highly beneficial.

Third, interaction designers utilizing user-centered approaches should understand key **needs** of major user groups in danger of exclusion. In particular, we believe users with severe visual impairments

should be prioritized. Other highly relevant user groups for digital product design are in our view persons with dyslexia (or reading- and writing difficulties), first-generation non-western speakers (and tourist), persons with severe motor disabilities, and persons with cognitive challenges (such as dementia, fatigue, context-, or emotion-related challenges). For physical product design, we would argue persons with dexterity challenges, persons with impaired hearing, and persons with non-typical sensory experiences (including many with autism-spectrum disorders, ADHD) should be considered. Further, for service design, we believe non-digital users (such as many elderly over 80 years of age) needs to be emphasized, in line with UN recommendations. Forth, those interacting directly with users in user research and design phases should know how to apply **inclusive design methodology** into user-centered approaches, including empathic design techniques, direct user contact with disabled and marginalized user groups, end-user involvement, and contextual disability awareness (such as in the social "gap" model). Further, anyone

Finally, anyone producing multimedia content should know how to make this inclusive and multi-modal; e.g. using captions, tagged pdf-reading order, alt-texts, subtitles, or audio description. Both content design and information design touches upon visual, cognitive, and audile aspects, including readability and understandability. In other words, **content accessibility** expertise is needed. From these assumptions, we propose the following universal design expertise for the five archetypes.

5.1 The Front-ender

Based on the identified professional role of the Front-ender, we propose universal design expertise focused on ensuring technical accessibility. However, we also suggest the Front-ender types of professionals should hold universal design expertise connected to user-interface design tasks, e.g. accessible navigational structures, colors, and contrasts. We propose Front-enders are taught the following universal design expertise:

- Knowledge of WAI accessibility guidelines and expertise in adhering to the WCAG criteria;
- Ability to code according to best-practice standards, including mobile (app) accessibility;
- Ability to do automatic accessibility assessments using online or downloaded tools;
- Understanding of the needs of disabled user groups that can be accommodated through accessible coding, especially visual impairments, including color blindness. Awareness of users with dyslexia, reduced cognition and motor control is beneficial, although not expected;
- Ability to do formative user testing with disabled users;
- Knowledge of assistive technologies, including switch-systems, screen readers and magnifiers, and the need to ensure compatibility with these;
- Ability to do expert accessibility evaluations of user interface and front-end code according to accessibility best practices and guidelines and simulated assistive technologies (e.g., keyboard to simulate switches). Ability to do basic expert testing with assistive technologies is beneficial, though not expected;
- Awareness of current international and national legislations and responsibilities.

5.2 The Full-stacker

We propose interaction designers reflecting this archetype include universal design expertise focused on technical accessibility:

- Ability to code according to best-practice standards, including mobile (app) accessibility and WAI accessibility guidelines;
- Ability to do automatic accessibility assessments using online or downloaded tools;
- Knowledge of assistive technologies such as switch-systems, screen readers and magnifiers and how these assistive technologies function in relation to complex and server-based systems. Ability to consider assistive technology in relation to IoT, health technology and other technological innovations is beneficial, although not expected;

- Ability to do expert accessibility evaluation of systems to ensure accessibility and assistive technology compatibility, including basic user-interface accessibility evaluations. Ability to do a more thorough expert evaluation of user interfaces and front-end code and the ability to do basic expert testing with assistive technologies are beneficial, although not expected;
- Awareness of the needs of disabled users groups;
- Ability to do formative user testing with disabled users;
- Awareness of current international and national legislations and responsibilities.

5.3 The Design Tinker

Proposed universal design expertise for the Design Tinker relates to user-involved and empathic design techniques that increase the inclusiveness of ergonomics and interactions, e.g., as related to service design (contexts of use, digital and physical touch points) and product design (tangible artifacts). The following universal design expertise is proposed as fitting for the Design Tinker:

- Understanding the needs of user groups with specific needs, such as the effects of reduced motor control, dexterity, fine motor skills, and cognitive abilities, through illness, age, low vision, and blindness as related to the use and ergonomics of digital and non-digital solutions;
- Understanding the effects of dyslexia and visual impairment on information design;
- Awareness of users in danger of exclusion, including the elderly over 80 years and first-generation non-western immigrants;
- Ability to do user involvement with marginalized user groups, including user testing, interviews and observation;
- Knowledge of the social "gap model" on disability as related to different contexts of use;
- Knowledge on how to simulate the needs of marginalized users for empathic design strategies as well as for expert testing, e.g., by using assistive technologies such as wheelchairs and crutches, or by applying limitations to their vision, dexterity etc.;
- Awareness of current international and national legislations and responsibilities.

5.4 The Communicator

For the Communicator, we thus suggest universal design expertise emphasizing abilities that ensure accessible and inclusive content (text, video and images) in user interfaces and media services:

- Understanding the needs of disabled user groups related to user-interface design and content design, especially hearing impaired and visually impaired users;
- Knowledge of audio description for the visually impaired and closed captions for deaf and hard of hearing audiences of video content, in addition to subtitles for non-native speakers;
- Understanding the implications of dyslexia and visual impairment for textual and visual information design;
- Ability to do user-centered design involving disabled users, including user testing;
- Knowledge of WAI accessibility guidelines and expertise in adhering to WCAG criteria;
- Ability to do automatic accessibility assessments using online or downloaded tools;
- Awareness of current international and national legislation and consequent responsibilities.

5.5 The User Empath

For the User Empath, we suggest universal design expertise related to edge-case and inclusive user-centered design approaches, as these are viewed as its key professional competencies compared to the other IxD archetypes:

- Understanding the needs of marginalized users and the effects of reduced motor control, dexterity, fine motor skills, and cognitive abilities, together with illness, age, low vision and blindness as they relate to the use and ergonomics of digital solutions. Awareness of users in

danger of exclusion, including the elderly over 80 years and first-generation non-western immigrants is beneficial, although not expected;

- Ability to do user involvement with marginalized and disabled users, including user testing, interviews and observations;
- Ability to simulate the needs of marginalized users for empathic design strategies as well as for expert testing and evaluation;
- Understanding the social "gap model" on disability as related to different contexts of use;
- Understanding the needs of disabled user groups as related to user-interface and visual design, navigational structure, and digital ergonomics—especially the effects of dyslexia and visual impairment on textual and visual information design, and the effects of reduced cognition, fine motor skills, and vision on interactions. Knowledge of audio description and closed captions is beneficial, but not expected;
- Knowledge of assistive technologies, including switch-systems, screen readers, and magnifiers, and how these influence human-computer interaction. Understanding the needs of disabled user groups that can be accommodated through accessible coding is beneficial, although not expected;
- Ability to do automatic WCAG accessibility assessments using online or downloaded tools;
- Awareness of current international and national legislation and consequent responsibilities

Table 4 summarizes the universal design expertise proposed in relation to the constructed archetypes. It should be noted that the proposed universal design expertise is based on a relevance assessment for each archetype, founded on our theoretical framework for universal design in IxD. As such, proposed universal design expertise depends on the identified skillsets within each archetype. The summary of our proposed expertise highlight our stance that all professionals contributing to the digitalization of services (including media services) are likely to be covered by accessibility regulations, and therefore they need to know at least the current national and international **legislation**.

Table 4: *Summary of Proposed Universal Design Expertise*

Expertise:	**Front-ender**	**Full-stacker**	**Design Tinker**	**Communicator**	**User Empath**
Legislative responsibilities.	•	•	•	•	•
WAI/WCAG/ mobile (app) accessibility/code standards	•	•		•	•
Assistive technologies	•	•	•		•
Accessible code impact for visual & motor impairments	•	•			(•)
Accessibility assessment, Expert inspection code/UI	•	•		•	•
User testing with disabled	•	•			•
Inclusive user involvement			•		•
Empathic design techniques			•		•
User-need knowledge; dyslexia, vision	(•)	(•)	•	•	•
User-need knowledge; motor skills, cognition, age			•	•	•
User-need knowledge; illness, dexterity, other			•	(•)	•
Contextual "gap" awareness			•		•
Inclusive information design			•	•	•
Inclusive multimedia				•	(•)

In summary, this study reveals an unfortunate absence of a universal design focus, which should be consistently present in all IxD education. Our findings suggest that Norwegian HE institutions are not staying updated on relevant universal design skills as required by national and international law, and as such, are in danger of not equipping their students, as future professional interaction designers, to adhere to current and anticipated legislation. Proposed universal design expertise for interaction designers is tied to the constructed archetypes, and based on matching the professional activities of these abstract IxD representations. To this end, we demonstrate that an increased awareness and articulation of current educational content may contribute to addressing possible competence gaps.

5.5 Limitations of Our Study

This study is not without its limitations. First, it articulates abstract archetypes as based on educational programs only, and does not articulate any other types that may exist in the industry. Second, only Norwegian study programs were included in our study. We do believe that we have captured key characteristics that are likely to be present outside of the Norwegian context, as discussed in Section 3. However, a key characteristic of the Norwegian educational system is that programs offered at universities and public colleges are free of charge. Private institutions do have enrollment fees, which are typical of many schools and universities elsewhere. This could result in differences between educational programs, for example related to the context of teaching, didactic styles and resources at hand. Further, though similar, the legislation in EU and US somewhat differs from Norwegian laws. This could also influence the universal design focus in IxD study programs. Finally, we make the assumption that Norwegian HE IxD study programs deliver according to the (legally binding) description represented by institutions, and not made further investigations into whether institutions deliver what they promise (e.g. through interviews and observation with students and teaching staff.

6. CONCLUSION

As the use of digital channels increases, the role of the interaction designer plays a vital component in facilitating satisfactory and accessible user experiences and interactions. Legislation linked to universal design is becoming increasingly important, while there is no clear perception of the content of interactions design (IxD) programs. Consequently, this study presents a qualitative multiple case study of relevant higher education programs in Norway, aiming to investigate the level of universal design focus by articulating the expertise currently being taught in such study programs.

In our study, we identify five archetype constructs of interaction designers: 1) Front-ender, 2) Full-stacker, 3) Design Tinker, 4) Communicator, and 5) User Empath. These archetypes communicate the interdisciplinary nature of the field with each differing in its characteristics and skills, ranging from the highly technical to the more user-oriented with softer skills. Through these, we indicate the current content of interaction design programs in higher education. Knowledge of the key characteristics of IxD study programs is interesting, both as a theoretical contribution to the field and for the industry recruiting these workers, and for the students considering their options for IxD studies. We discuss how the archetypes may we valuable as strong IxD communication tools for a wide range of audiences, and further demonstrate in our research how an increased awareness and articulation of current educational content may contribute to addressing possible competence gaps.

By articulating the field, we did not aim to statically define a “correct” type of interaction designer, but rather to make visible the dynamic and plural nature of the field, while at the same time supporting competence awareness, and particularly contribute to address possible competence gaps such as that related to universal design.

That few programs include adequate universal design expertise is worrying. Norwegian HE IxD students are not necessarily conversant with their legal and ethical accessibility responsibilities. We argue universal design expertise should be a key element in current IxD educational programs. Since

universal design expertise must be linked to professional activities, we propose which universal design skillsets are necessary for each of the five archetypes. By linking universal design expertise to archetype skillsets, we emphasize the importance of considering professional relevance. By adding universal design competences to the archetypes, we hope to support both educational institutions and individual professionals in identifying the need for universal design expertise, and thereby open a discussion about universal design skillsets that would need to be included in the IxD discipline.

6.1 Future Work

We invite future research to investigate how our archetypes may be further developed; including how they as abstract representations fit IxD as a discipline with global characteristics. Further, the archetypes could be validated empirically against graduates from the included study programs, for example through self-categorization, or descriptions from employers. It is our hope that other scholars will conduct similar studies in their respective contexts, so we can observe if there are any differences internationally in how the studies are organized, compare archetypes constructs and discuss relevant expertise. We believe we have captured all the relevant study programs in Norway, and future research could advantageously focus on exploring whether the identified archetypes of IxD professionals' skillsets are evident elsewhere and over time, or if they need to be expanded on.

Further, we believe it is important to not only compare archetypes of interaction designers, but also whether the national challenges on lacking universal design focus in IxD HE study programs as described in this paper are found internationally. Universal design competence fitting for IxD professionals should be researched and discussed internationally. Perhaps international IxD study programs are better at ensuring universal design competence for their students. If so, these experiences may contribute to improve upon proposed universal design competence for our identified archetypes.

Future studies could also study the link between legislation and degree of placing universal design on the study program agenda. We encourage follow-up research on the consequences of a lack of universal design awareness in the IxD discipline, both for users in danger of exclusion, and in relation to the legal implications for interaction designers as the European Accessibility Act (EAA) move toward completion.

Finally, investigating opportunities for raising awareness of universal design within the IxD profession is important future work, and we particularly welcome investigations into how the archetypes could be utilized to aid organizations, students, and educators in universal design skillset training.

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Figure & Table legends

Figure 1: Universal Design Focus of HE IxD Programs

Table 1: *Overview of the IxD Study Program Sample*

(GSC = general study competency, CS = Computer Science, eqv. = equivalent).

Table 2: *Summary of Comparative Study Program Sorting*

Table 3: *Summary of Universal Design Focus and Archetype Representations*

Table 4: *Summary of Proposed Universal Design Expertise*