

# Introducing Accessibility for Blind Users to Sighted Computer Science Students

## *The Aesthetics of Tools, Pursuits, and Characters*

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Abstract: We analyze current approaches in motivating students to pursue accessibility, with a focus on blind users, by examining scientific reports of courses in the computer science and engineering curriculum. We identify three main motivational resorts: a ‘web of arguments’, referring to issues of morality, legality, and interest; the practice of mainstreaming, which normalizes accessibility, and empathy. We argue that an aesthetic frame could contribute to a forceful, persistent motivation, and we propose an aesthetic motivational repertoire, on three dimensions: aesthetic value of technological tools, of engineers’ own work, and of their direct and indirect relationships with blind persons. We present arguments, practices, and online resources to support teachers that introduce accessibility for blind users to sighted students.

## 1 INTRODUCTION

There is a significant thread of research dedicated to teaching accessibility for computer science and engineering students. We are interested in examining how authors (who, in these cases, are also teachers) justify the importance of teaching accessibility, and how they address students’ interests and concerns. We argue that the dominant approach can be enriched in order to support persistent motivation for accessible design – that is, outside of the University campus, after graduation, when IT professionals have to confront competing demands and conflicting priorities. We propose that *aesthetic experiences* – as regards technological tools, one’s own engineering work, and blind user characters – can consolidate the current modus operandi for motivating students, which is mostly focused on considerations of legality, altruism, and profit.

The paper is structured as follows: we first analyze the literature concerning accessibility in the computer science curriculum, and we highlight the dominant motivational approach, identifying three resorts: the ‘web of arguments’, *mainstreaming*, and *empathy*. We then go on to propose *aesthetic* considerations as an additional resource, in relation to three issues: the aesthetics of the *technologies*

designed by computer specialists, of their *work*, and of the blind *characters* with which they establish a relationship through their performance. Students’ construction of *blind personas* can be a useful and flexible learning tool with an aesthetic edge. The final section concludes the paper.

## 2 INDUCING ACCESSIBLE DESIGN: THREE PILLARS

Teachers of accessible design appeal to three ways of engaging their students with this perspective: *argumentation*, persuasion through *empathy*, and routinization through *mainstreaming*.

### 2.1 The Web of Arguments

In articles that discuss various approaches to teaching accessibility, the value of introducing it to students is not treated as a self-evident matter: most authors offer a justification, relying on several arguments (Ludi, 2002; Rosmaita, 2006; Cohen, Fairley, Gerry, & Lima, 2005; Harrison, 2005).

The “*social responsibility argument*” (Rosmaita, 2006), or *ethical reasoning* (Wang, 2012), appeals to the goal of universal access for the World Wide

Web, as stated by the World Wide Web Consortium (W3C). The “Web for All” design principle stipulates: “The social value of the Web is that it enables human communication, commerce, and opportunities to share knowledge. One of W3C’s primary goals is to make these benefits available to all people, whatever their hardware, software, network infrastructure, native language, culture, geographical location, or physical or mental ability” (W3C, 2012a). W3C pursues this goal via the Web Accessibility Initiative (WAI), that develops the Web Content Accessibility Guidelines (WCAG) (W3C, 2012b).

The “*legal argument*” (Rosmaita, 2006; Wang, 2012) invokes legal requirements for Internet accessibility; for example, in the United States these derive from the Section 508 of the Rehabilitation Act. Rising numbers of impaired students bring to the forefront the issue of legally mandated equal access in education (Cohen et al., 2005). In countries where such legal requirements exist, skills for accessibility design contribute to *employability* and can thus be shown to be useful for students’ future careers (Ludi, 2002; Cohen et al., 2005).

The *market* argument stresses the fact that impaired users represent a significant proportion of citizens and customers, which are lost through inaccessible design (Ludi, 2002); this argument also capitalizes on utility, this time from a business perspective, complementing the increased employability.

The “*march of technology*” argument (Rosmaita, 2006) points to the fact that accessibility does not refer to impaired users only, but also to *all users in restricted contexts* that become increasingly common as technology permeates more areas of life: “Automobile drivers—who otherwise have normal vision—are blind with respect to the web while they are driving. Likewise, a person surfing the web on a small mobile handheld device is, for all intents and purposes, a low-vision person accessing the web” (ibid., p. 271).

The argument of *direct benefits for all users* adds that we-as-able-users are likely to become closely involved with impaired users, as we, our parents, and significant others age (Ludi, 2002): “Visually impaired computer users are a minority, but it’s a growing minority, and it is growing faster as baby boomers near retirement age. Further, it’s a minority that will eventually include us all” (Rosmaita, 2006, p. 274). This argument lends further support to the market-related considerations.

The “*technical reason*” (Wang, 2012) indicates that designing for accessibility increases

interoperability and standard compliance (also pointed out by Rosmaita, 2006), thus serving the general public and increasing designers’ skills and employability (Waller, Hanson, & Sloan, 2009).

Overall, these arguments capitalize on accessibility as a matter of a) *morality* – addressing disabled people’s needs and rights, b) abiding the law – and c) a matter of *interest* – for developer employees, for businesses, and for the government. In a nutshell, “the audience is growing, the law requires it, and the industry trend is toward it” (Harrison, 2005, p. 23).

Authors also address potential counter-arguments. The issue of *cost* appears as the most prominent expected hurdle: “I think that all would agree that when faced with an inaccessible website and an accessible website with the same functionality, the accessible website is better. The debate is really over who pays to implement accessibility, and why they should have to bear that cost” (Rosmaita, 2006, p. 274). How do authors address the issue of cost? There are two main answers. On the one hand, accessibility is deemed “lightweight to introduce” (Cohen et al., 2005) – that is, costs are not high, when introduced skillfully and early. On the other hand, retrofitting accessibility is significantly more costly, therefore it is better to design directly for accessibility (Cohen et al., 2005; Rosmaita, 2006).

Another expected counter-argument, introduced by Waller et al. (2009), is that designing for accessibility might “stifle” creativity (rather than “spark” it), and it might lead into tradeoffs with other important considerations such as “design goals, technological limitations, customer objectives and software objectives” (p. 157). There are no explicit answers advanced for this concern.

Both types of counter-arguments raise the following question: how can students approach accessibility so that they would continue to engage it outside of the classroom, when facing such counter-arguments from team members or leaders (or even from within themselves)? Each project has to navigate a plethora of competing requirements and considerations: how can accessibility stand a chance against issues of beautiful design, or the use of innovative-but-inaccessible technologies to entice large numbers of mostly-able users? Since, for any argument, there is a counter-argument, providing students a set of good justifications for accessible design seems to be necessary, but not sufficient for successful confrontations ‘in the field’.

## 2.2 Empathy

A second resource for strengthening motivation for accessibility consists in cultivating sighted students' *empathy* with blind people, through a closer experience of their living situations and perspectives. There are several means through which teachers of accessibility cultivate empathy, as discussed in the reviewed publications.

The first such means is *literature*: Rosmaita (2006) requires students to read Rod Michalko's memoir *The Two-in-One* (R. Michalko, 1998); Michalko is a sociology professor who has written compelling accounts of blindness and analyses of the "sighted world" (R. L. Michalko, 1977), including the University classroom (R. Michalko, 2001), by examining interactions between blind and sighted people.

The second avenue for introducing students to the experiences of blind people consists in face-to-face communication – that is, *actually meeting blind people*. Such encounters can be organized as lectures from blind academics, discussions with blind users of technology (Harrison, 2005), possibly also blind students (Rosmaita, 2006), or, at a higher level of complexity, collaboration with blind people in design projects (Waller et al., 2009).

The third way of cultivating empathy is to ask able students to *simulate blindness* while using computers, for example, by turning off the monitor and navigating with a screen reader (Freire, de Mattos Fortes, Barroso Paiva, & Santos Turine, 2007; Harrison, 2005; Rosmaita, 2006).

## 2.3 Mainstreaming

A third resource deemed useful for long term motivation refers to how accessibility is framed through curriculum design. The aim is to cultivate an appreciation of accessibility as a default option, a norm rather than an exception or an add-on feature. A resource for framing accessibility as normality, rather than a feature marked as controversial and optional, consists in *mainstreaming* it throughout the curriculum (Waller et al., 2009), by including it in multiple areas and types of learning activities, or throughout a given course (Ludi, 2002; Wang, 2012; Harrison, 2005), by including it in multiple lectures and assignments rather than as a specific, isolated discussion.

Mainstreaming accessibility has two advantages: at a *symbolic* level, it un-marks it as a special topic, rendering it a normal and strongly normative requirement. As regards *skills*, students face

challenges of accessible design continuously, in multiple tasks and projects. If it becomes routine, accessible design escapes the need for justification: it is just how it's done. Mainstreaming accessibility throughout a course or program curriculum is expected to achieve a *routinization of concern*, thus going 'under the radar' of competing arguments.

## 3 AESTHETICS: A NEW PILLAR

We propose that there is a fourth pillar for sustaining long-term student motivation, besides the web of arguments, empathy, and mainstreaming. This resource is largely missing from the examined literature: aesthetics.

Taking into consideration the aesthetics of accessibility does not refer strictly to the display of a technology, although this is as stake as well; an essential focus is on the process of technological design itself, and the people with which we are connected through work. We discuss these dimensions in the following sections.

### 3.1 Aesthetics and Accessibility of Tools: a Trade-off?

When aesthetics of technological tools are invoked in the reviewed articles about teaching accessibility, they are often presented in a trade-off with accessibility. For example, Wang presents designers' perspective as follows: "Without appreciating the social importance of accessibility, Web designers and developers can hardly be motivated to "burden" their design with accessibility limitations" (Wang, 2012).

Along a similar line, Waller et al. report that "[s]tudents are also asked to examine and discuss the trade-offs between good aesthetic design, sound software engineering and the need for accessibility, for example through mock debates on whether accessibility considerations stifle or spark creativity" (Waller et al., 2009).

These quotes illustrate that the perceived trade-off between accessibility and aesthetic design (Mbipom, 2009) is often not challenged by teachers; professors accept the assumption that accessibility is a potential hurdle for a beautiful (or otherwise aesthetically interesting) design.

From a statistical perspective on the current state of technology, this trade-off may well exist – although there is research that indicates otherwise. For example, Mbipom (2009) analyzed 30 web pages and concluded that those that are perceived as

“clean”, “clear” and “organized” comply better, on average, with WCAG 1.0, while being seen as “beautiful” or “interesting” does not make a difference. In a similar study (Mbipom & Harper, 2011), the authors analyzed 50 web pages and found that those evaluated as “clean” had fewer accessibility barriers, while the attributes of “pleasing”, “fascinating”, “creative” and “aesthetic” did not correlate significantly with accessibility.

These correlations are interesting descriptions of the status-quo. Still, they may derive from a general low level of accessibility, rather than from a real independence of accessibility and design. While there are good reasons while cleanliness and clearness associate with higher accessibility, it is possible that the missing correlation between aesthetic sophistication (“interesting”, “fascinating”, “creative”) and access hurdles actually derives from the overall low level of accessibility of all pages under study. That is, if designers do not bother to develop accessible pages and there is a uniform low performance in this respect, accessibility would not correlate with design features because it would not be variable. Low variation can lead to low correlation with any attribute. The challenge remains to cultivate an appreciation for *high accessibility* that accompanies an interest in *cutting-edge aesthetic* design. Cultivating performance simultaneously on these two dimensions raises specific challenges.

Regan (2004) discusses aesthetics and accessibility, diagnosing a “failure of the imagination”. He observes that many accessible sites are indeed aesthetically uninspiring and designers ignore access requirements because they orient their work towards inspiring models. There is a need for aesthetically provocative accessible sites, to infuse professional enthusiasm for accessibility in design work. Such enthusiasm is possible, as he found out by observing a team of designers who set out to create an innovative and accessible site: they saw it as a challenge, and engaged it with full energy. Still, initial frenzy led to confusion and deep concern in the following days, as designers began to struggle with the un-visual world of the screen reader. As Regan insightfully notices, designers are visual professionals: they have fine tuned their visual sensitivity and orientation skills for years. Asking them to work in a non-visual environment can easily switch from a challenge to an aggravation. In addition, screen readers are complex applications, which require some familiarity for proper operation, and thus add to the initial vexation. Therefore, engaging designers in accessibility work is not trivial, and not “lightweight”: “Designers often

spend years honing their instincts for the visual UI. A comparable and parallel effort should be made for alternative environments” (Regan, 2004, p. 37).

Therefore, while respecting the most important accessibility guidelines (such as adding ALT descriptions to visual content, using headings, avoiding unnecessary tables, and allowing for resizable fonts, among others) is not particularly complicated (although adding captions may come across as tedious and thus ‘postponable’), a creative take on accessibility requires a high level of determination to engage with a non-visual environment. Such a creative approach is required in order to transform accessibility from a professional burden to a challenge, and to inspire technology designers rather than to vex them.

Two possible ways to encourage students to think about high accessibility and innovative aesthetics in convergence, rather than in trade-off, are:

- Encouraging a minimalist design aesthetic, based on the “less is more” maxim, and privileging information *structure* and richness of *content* over decoration;
- Emphasizing *flexibility* itself as an aesthetic criterion. Students can learn to understand aesthetics not only through the eyes of sighted persons, but also through the perspectives of screen reader and screen magnifier users, or of color-blind or dyslexic users. Flexibility endows aesthetic value from the possibility of *meaningful use*; there is also an element of *surprise*, as flexibility is not always manifest at a glance.

### 3.2 The Aesthetics of a ‘Job Well Done’: Pursuing Technical Mastery

The aesthetic imagination of computer science students can be energized not only in relation to the *tools* they create, but also in relation to their own *work*. The aesthetic value of accessible design as technical wizardry is, we argue, an important motivational resource.

The idea that accessible design is a proof of smart engineering is not uncommon, as we have seen above in the “march of technology” (Rosmaita, 2006) and “technical reasons” (Wang, 2012) arguments. The question is, how to better translate accessibility requirements into a professional challenge for proving technical mastery? This is more a matter of framing and illustrating, than of explicit arguing. For example, the story of dramatically improved accessibility of touchscreen



phones brought forward by the iPhone (Tsaran, 2009) displays accessibility-work as *inspirational*, from a design perspective.

The “march of technology” argument is particularly valuable to frame accessible design as savvy design, because it transforms the *limitations* of disability into *opportunities* of technological reach in ever more diverse situations. This can be a starting point for exercises of UX imagination: in which walks of life can we imagine accessible technologies to be attractive to various types of users? How can accessibility turn into expanded usability? If blind users and ‘power users’ are alike in their strong preference for using key shortcuts (Vuppala & Krishna, 2012), and driving users are for all practical purposes blind to visual information (Rosmaita, 2006), what other similarities can one find across unlike life and work situations?

More concretely, teachers can frame the accessibility designer as a *whiz* by cultivating a professional appreciation for *structure*. Structured design is a strong requirement for accessibility, which is enhanced through clear specification of types of entities (for example, through headings) and by a clear prioritization of content according to its importance. The weakest motivational force derives from framing structure as a requirement of WCAG, a requirement of the law, or a need of a group of users – that is, extrinsically mandated. For a more forceful motivation, the requirement of structure can be framed as an aesthetic criterion of design wizardry, along the following lines:

a) Clear, organized interfaces are highly usable: clarity is a dimension of *beauty*;

b) Structure relates to *depth* rather than surface; understanding how a blind person reads Web pages through assistive technologies that linearize and verbalize content can amount to understanding an alternative, underlying structure of our shared and yet diverging world; the informational structure of visible realities holds a certain aesthetic appeal for computer science students and professionals – as it was maybe best illustrated by the Matrix digital rain (which could be used as a teaching metaphor);

c) Last but not least, an explicit promotion of *minimalism* as aesthetic current would support an appreciation of structured, no-frills design that favors accessibility (Mbipom & Harper, 2011); minimalism has had its ups and downs in web design, for example, but, as Thorlacius argues in his discussion, we can probably agree on a matter of possibility: “A minimalist Web site with no extraneous aesthetics, and visual effects only in the form of typeface and text layout, can be just as

aesthetically pleasing as a Web site with lots of pretty pictures and fancy Flash installations” (Thorlacius, 2007, p. 71-72).

An important resource for cultivating aesthetic appreciation for structure in design consists in the experience of *ridiculousness* for poorly designed technologies that mime structure through visual effects (for example, in web design, highlighting headings through font formatting, assembling lists through paragraph formatting, or using tables unnecessarily). As an example of a learning situation in this such humor becomes possible, Benavidez, Fuertes, Gutiérrez, & Martínez (2006) ask students to examine two apparently identical sites, one which is accessible and one which is not. Teachers can create humorous situations that downgrade appreciation for design that is structure-less, tagging it as ‘amateurish’ or ‘lazy’, for example. This symbolic fight can then happen again and again when graduates, future professionals, decide consciously or infra-consciously to what extent to structure their technologies, rather than accept older, unstructured versions – which may be already available for revamping, may be easier to delegate to a team member, or may be otherwise more convenient. An aesthetic disregard for ‘sloppy, witless work’ may counterbalance ‘convenience’ better than alternative arguments of cost and benefit.

The experiential absurdity of structure-less or otherwise low accessibility design can be brought to life by navigating it through the assistive technologies that blind or low vision people would use. Screen readers’ ‘non-human voice’ (Tsaran, 2009) is often a topic of amusement among those who experience it, as it is its mechanical ‘parrotting’ of everything written (Finke, 2011); at the same time, unnecessary repetition of content verbalized by the mechanical voice of the reader can be not only unhumorous, but downright aggravating (Gerber, 2002).

### 3.3 Aesthetics of Blind Characters

A third source of aesthetic appreciation of one’s work in accessible design could derive from a feeling of working in connection with blind people, end users and most direct beneficiaries. The question rises, how can empathy and a feeling of sharing experiences across different life worlds be better produced, and turned into an aesthetically valuable experience?

### 3.3.1 Representing Blind Users

The issue of representation of blind people for sighted students is concomitantly challenging and relatively under-discussed in the literature. As we have seen, teachers of accessible design do stress the importance of meeting blind people and witnessing their experiences of technology, either through lectures or through collaboration. Such encounters generate many insights into the specific worldviews and experiences of blind persons – bringing forward both their problems and their skills and achievements, often unimagined by able students who are not familiar with disabilities.

We propose that such encounters can be consolidated, as an experience, by adding opportunities for explicit reflection on the diversity of blindness, the shared-and-disparate worlds in which sighted people coexist with blind people, and the almost unimaginable skills that blind people develop to master the world.

Sighted students and sighted persons in general are often deeply impressed when meeting blind people, and when their preconceptions are confronted with real lives and actions. At the same time, experiences of direct interaction can be enhanced by mediated interplay.

Firstly, if direct interactions are not reflected upon and if they are not elaborated into *narratives*, their memories may fade, and their value for out-of-classroom work, which is our focus, declines as the years go by.

Secondly, there is often a limited number of blind people that a sighted student will be acquainted with personally, through her or his University experience or otherwise; while knowledge can be deep, there will remain a certain limitation in breadth, concerning the variety of life situations encountered.

Last but not least, given the extraordinariness of some of these experiences, sighted students may be at some loss of how to *make sense* of what they have observed, in an *existential*, rather than a behavioral way. What do the actions and interactions they have been part of tell about human nature – about the diversity or similarity of life situations, the capabilities and limitations of people, the power of individual and the power of relationships or of technologies? There is an important work of sense-making and conceptualization, which is the topic matter of disability studies, which should be at least touched upon in order to reach the full knowledge and motivational potential of such encounters. While there may not be time enough for a familiarization of

students with theories of disability, one could probably find some intervals for a more informal exploration. In the following section we aim to indicate some *online resources* for this work of sense-making, through which blind users become *strong characters*, sharing the world and the work with skilled technology designers.

### 3.3.2 Online Encounters

Based on the reviewed literature, it seems that introducing online blind characters to visually able students is a rarely used resource for teaching accessibility. Still, there is a rich blind presence on the Web; as it is to be expected, there is no shortage of narratives, shared experiences, and opportunities for digital interaction.

Online characters can complement meeting blind people face-to-face in at least two respects. On the one hand, there is the *narrative richness*: there are many deep, insightful, detailed online written accounts of living with blindness, ranging from several paragraphs to book length; they offer students vocabularies for making sense of this condition of being in the world. On the contrary, University-mediated encounters with blind people are often limited in the amount of interaction they can afford for individual students, and in the diversity of topics touched in conversation and narration. On the second hand, there is the *diversity of life situations*: we can digitally reach people who are blind students, parents, IT professionals, teachers, unemployed, artists and so on; these identities are, of course, overlapping, but usually some of them will be more prominent in a given account.

Online encounters with blind characters are an apt method, for teachers, to reverse the dominant framing of blind persons as needy, vulnerable, and incomplete. Students can experience in so many instances the frustration of blind people when being treated as partially human - illustrated, for example, by Atkinson (2007): “Misconceptions start to spout from even your oldest friends’ mouths because negative attitudes about blindness permeate us all. You are about to cross over into the dark side and see what wriggles and writhes on the underbelly of society. Folk will see you as the sufferer, the pitiful, the afflicted, the subhuman – that’s you, yes, you. If you use a cane or a dog, people will stare as you walk down the street. People will assume you are more lacking in intelligence than your sighted counterpart. People you have never met before will ask if you want children, and if you do, they will ask

if the kids will have the same condition that you have, and whether that is right or wrong. Welcome. Your reproductive autonomy is in the docks of the moral courts of the nation's minds. (...) Going blind (...) is a grand experiment that most don't get to try: to observe as your brain rewires and watch as the human body adapts in infinite ways" (Atkinson, 2007). Online encounters facilitate a gradual re-definition of blindness from 'lack' and biological 'disease' to a condition in life that is strongly shaped by how it is defined and acted upon.

The tropes of extra-ordinariness and *heroism* are very important for making sense, as a sighted person, of blindness; the online environment offers access to many blind characters with extra-ordinary achievements that impress others through their strength, unimaginable skills, and wisdom. It also introduces characters that are ordinary in every respect lest of being blind, and it also introduces characters that are confused, overwhelmed, or otherwise vulnerable; therefore, there is a wider range of emotional responses that the sighted observer or interlocutor could experience.

The online environment also offers a different kind of *facility of interaction*. Blindness is often experienced, by sighted users, as a *stigma* – as an embodied feeling that the interaction flow is collapsing, awkward or otherwise difficult. The following account of a blind person renders this obstacle intelligible: "There is an invisible wall between the sighted and the visually impaired," Ms. Squarci said. "One of the women I interviewed, she has been blind since she was 4 years old, she told me sighted people are almost scared to deal with the blind. Being blind is like speaking a language. If sighted people don't find eye contact – which is the first hint of communication – they feel lost and they don't engage" (Gonzalez, 2013). The online environment allows sighted users the comfort of timing interaction as they see fit, also unidirectionally or asynchronously; of taking time to get acquainted to visually disabled portraits without the anxiety that one might reveal discomfort and therefore appear as prejudiced and socially unskilled. That is, the online medium can be used as a training ground, a *sandbox for interaction* between sighted students and blind people. This could also provide students the opportunity on reflecting on their emotions when encountering blind people online, helping with the emotional work required for successful interaction in all social situations.

A very specific resource facilitated by the online environment refers to the *aesthetics of blind faces*. The discomfort of sighted people when looking at a

blind person can be confronted and strongly challenged by visiting online exhibitions of *visual portraits of the blind*, such as, among others Gaia Squarci exhibition (Gonzalez, 2013); Sam Ivin Photography (Ivin, n.d.); Julia Fullerton-Batten, Blind (Fullerton-Batten, n.d.); Charlie Simokaitis, Fade to white (Simokaitis, n.d.).

Through online exploration and ventures, various dimensions of interaction between sighted and blind people could be touched: the *humor* of blindness, through its many mishaps, including the ill-suited reactions of sighted people; its *absurdity* and, conversely, its capacity to highlight *meaning* in life; its malleability in being experienced as a *disability*, as a *repertoire of skills*, or as utter *normality*, depending, among others, on the tools and relations that constitute the capability of any human being from the perspective of distributed, 'person-plus' (Perkins, 1993) competence.

### 3.3.3 Blind Personas in Learning Practice

Teachers may dispose of anything from several hours to semesters of study for introducing accessibility, depending on the learning context. Blind *personas* (Johansson & Messeter, 2005; Pilgrim, 2002) are a flexible tool to acquaint students with the aesthetics of accessible design and to evaluate their learning and motivation. Students can participate in individual or team projects to construct and present blind personas as users of specific technologies, highlighting relevant background aspects of their lives and concrete details of their experiences with technology. Personas can be sketched in a couple of hours or portrayed through in-depth research, depending on available time. A *persona* offers a rich ground for expressing the aesthetics of blind characters, accessible tools, and accessible design. Personas are also useful tools for design in general, beyond accessibility concerns. Such learning projects take advantage of the variety of students' aesthetic preferences and professional interests as a resource for collaborative learning about the diversity of blind people's life experiences and technology use.

## 4 CONCLUSIONS

We analyze the literature concerning accessibility in the computer science and engineering curriculum, focusing on the repertoires of arguments and practices that authors put forward to support students' motivation. We find a persistent concern

for *arguing* with students and readers that accessibility is a reasonable, efficient, moral and ultimately legally required pursuit. We also identify *empathy* and *mainstreaming* as two motivational drives distinct from the logical ‘web of arguments’, instilling the interest for accessibility in emotions and routines.

We propose an additional resource to consolidate students’ persistent motivation: an *aesthetic* appreciation of accessible tools, of working with accessibility in mind, and of characters of blind people – the direct beneficiaries of these pursuits. We advance a first version of an aesthetic motivational repertoire, including arguments, practices, and online resources. Students’ construction and presentation of *blind personas* is a flexible and useful learning tool to this purpose.

Harrison (2005) writes, reflecting on her teaching: “If students are given the challenge of designing an accessible site, they will rise to meet that challenge” (p. 26). An aesthetic imagination could make this venture even more engaging.

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