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Assistive technology, considered in its broadest sense, may be anything an individual makes use of to enable extended or supportive possibilities for mental and/or physical capacities/needs. This means the pencil, the phone, the computer, the toothbrush as well as cooking utensils, bicycles, cars, planes all fall into the category of "assistive technology." We all, in fact, utilize assistive aids to live our lives.

In the construct of disability, assistive technology may encompass a vast array of possibilities including structural alterations (i.e., changes to the original structure of a physical environment, special equipment), assistive devices (e.g., hearing aids, vision aids, and wheelchairs), material adjustment, and environmentally-based behavioral modification (Fuhrer et al. 2003). In this presentation, I will specifically place emphasis upon "assistive technology devices" (ADs) meaning "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve functional capabilities of individuals with disabilities" (Alper and Raharinirina 2006). Further, I will focus upon the wheelchair as a prevalent assistive device and draw attention to the ways in which dance invokes and revitalizes design possibilities for assistive devices.

Historically, innovations in wheelchair technology have been largely driven by changing social and political contexts, including the economies and ideologies of war, as well as rehabilitative practice and medicine, capitalism, and disability activism (Woods and Watson

1

2003). In the process of this evolution, disabled bodies moved from social positions of passivity, dependency and inequality, to positions of improved independence and empowerment.

In the late 20th and early 21st centuries, AT design/development has continued to be similarly influenced by the disabling effects of war, disease, and the continued socio-political activism in the disability/disability studies field. However, more nuanced concerns have arisen calling for more device options in general and options which further increase quality of life (Alper and Raharinirina 2006). The voices of people with disabilities are increasingly present in qualitative studies of disability and AT design. AT device development is beginning to represent a larger spectrum of disability. Chin and head control systems, tongue control, voice control, eye tracking and thought control systems, all indicate a move toward greater diversity in wheelchair and other AD design (Huo and Ghovanloo 2010; Simpson and Levine 2002; Barea et al. 2002; Megalingam et al. 2013). Smart wheelchair technologies, including Android capabilities, have provided additional possibilities for device operation and, thus, scope of users (Kim et al 2012; Zafar et al. 2014; Milenkovic et al. 2013; Santhanam and Viswanathan 2013). However, AT/AD design and development still has a long way to go with regard to user satisfaction, expectations, and long-term quality of life enhancement.

Design is a product of expectation. Things, services, systems, policies are designed for what designers expect people to do/be or expect people to want to do/be. Assumptions are made. Values are placed. The designers in positions of power (e.g. media, business, government) in large part shape our existence as human beings. Historically, connotations of ability and disability aligned with the medical model and often assumed that a disability permanently defined a person's conditions as not able, passive, and dependent, as well as economically burdensome, thus AT designs were shaped accordingly.

Several researchers suggest that emotional and aesthetic responses are often left out of design processes, especially designs for people with disabilities (Newell et al. 2011; Desmet and Dijkhuis 2000; Alper and Raharinirina 2006). Newell et al. state: "Many products designed for older and disabled people show evidence that the design team do not engage emotionally with the user groups: assuming that older and disabled people lack aesthetic sense and unlike other user groups are motivated entirely by the functionality of the products" (2011, 237). The "function-only" priority is problematic in fully serving the user. Through these types of observations, designers both in and outside of disability have urged both "emotion-driven design" and other similar forms, which reprioritize focus from "function" to emotional and embodied experience.

Researchers in the field of embodied cognition have similarly contributed to these trends in design and product thinking. Embodied cognition promotes that "human thought and knowledge are inherently and fundamentally perceptual and that the meaning of objects and situations is based on how a person's body can interact with them" (Kreuzbauer and Malter 2005, 169). Thus, embodied sensory experience (sight, smell, touch, sound) become more central to design in this view. In traditional knowledge-process views, knowledge is understood to be represented by non-sensory symbols and the world is translated cognitively as an abstract mental language of associated symbols ("associative semantic networks") (Kreuzbauer and Malter 2005). Instead, the embodied/emotionally-based view of design asserts that shape, touch, and bodily engagement suggested by devices is a priority. For thinking about disability, this body-centered approach more strongly draws awareness to the unique needs of bodies of difference and their negotiation of devices.

The blurring of the distinctions between abled and disabled bodies and the reimagining of the assistive device as embodied design is perhaps no more visibly prominent than in the dance genre. Disability scholar Petra Kuppers suggests that performers with physical disabilities are simultaneously marginalized and invisible by the discourses of medicine, while as performers they are hyper-visible and instantly categorized (2004, 49). Thus performers and companies with physical disabilities have utilized the opportunity for hyper-visibility to deconstruct negative perceptions of disability as passive and dependent. Dance, in particular, is a forum in which active bodies move through space and time in dynamic and unusual ways. ATs and ADs in the broad conception I asserted earlier have been present in dance since its beginnings. Choreographers and dancers have frequently sought out bodily extensions in the form of unique costumes, headwear, footwear, and transport devices such as flying wired extensions. Chairs (including rolling chairs) have been regularly used in the modern/contemporary dance genre as choreographic devices. In dance, the incorporation of objects into the body is nothing new. In this regard, dance enacts the paradigm of embodied design on a regular basis. In this aura of "cyborg dance extensions," it would seem natural to include an AD, such as a wheelchair, in a dance context.

Disability scholar Telory Davies expresses that dancers with disabilities who use aids create "new versions of the dancing body" as technology assisted bodies (Davies 2008, 48). Davies describes a piece performed by Nadia Adame (AXIS Dance Company), choreographed by Stephen Petronio, in which she utilized her cane for the first time. By combining disabled imagery, breakdancing isolations, and partnering, Davies asserts that a new aesthetic sensibility in dance was created. Adame's interdependency with the cane defies the expected "self-sufficiency" of dancers. Davies concludes that "Rather than assume that a disabled body is

deficient because of its reliance on technology, Adame's dancing presupposes a new model of self-sufficiency that incorporates her technology" (2008, 53). Of course, ADs in the form of canes have been regularly employed in dance, specifically tap dancing by abled bodies, again disturbing the neat divisions between able and disable and between (medical) ADs and creative devices, such as toe shoes. It also suggests that abled bodies, not only "disabled" bodies engage with ADs – a reminder that "bodily" ability/status is also vulnerable and in flux for all.

Explorations in dance with devices, such as wheelchairs, have taken some time to evolve to the current point in which abled/disabled binaries are aggressively broken. In earlier works and in some continuing practices, the device is used conservatively more as an "aid" and the person is always led, rather than leading, and is always supported, rather than supporting. In many earlier practices, as represented in both photos and choreography, one would see the abled body dancer performing stunning leaps off the device, while the wheelchair dancer sat rather passively. Rather than drawing attention to possibilities <u>between</u> bodies, the intent seemed to be to distract the eye away from the person in the wheelchair in favor of the technical prowess of the "able" dancer. The wheelchair dancer in this context was positioned as less able.

In viewing the contemporary work of integrated companies, and performers with disabilities several important themes emerge in regards to dance and AT use. Firstly, in many cases, both abled bodied and disabled dancers are using the AT/AD. As symbol, this staged interaction of abled and disabled bodies flowing together in, with, and through various devices counters the separation systems produced in society, such as the disabled only bathroom stalls and parking spaces, which while well-intentioned, continue to produce ideas of isolation and separation between normative bodies and others (Fritsch 2013). Additionally, both abled bodies and disabled bodies support and are supported. Interdependence between bodies is portrayed in these

interactions, opposing the often highly independent-only goals asserted in an individualistic society, OR, the dependent-only view of individuals with disabilities. Mixed ability dance destabilizes these separations by placing bodies of difference together in the same interactive, mutually beneficial space.

The embodied partnership expressed between device and body in dance evokes new conceptions for the actual design of AD, and hence, for continuing to reframe notions of disability. From a dance lens, one might assert: How does the AD design attend to and support dynamic relationships with others? How does the AD design enable creative movement expression, rather than just "function"? How may the AD design be transformed aesthetically and tactilely to better match identity, interests, and desires of users?

ADs are often described as industrial looking, cold, and non-stylish, as well as awkward and uncomfortable (Desmet and Dijkhuis 2003). The reason often sighted for eyewear becoming a "successful norm of difference" was its transformation from having a medicalized function priority to being a stylized fashion item. Glasses had to address the unique bodies they were intended to serve in order to effectively work in society and to be de-stigmatized. Standardization techniques cover limited terrain. Disability, perhaps better than any other aspect of human diversity, crystallizes this limited way of dealing with the human condition. Because dance performers with ADs merge aesthetic, expressive, and functional goals, often placing expressive communication as a priority, the dance lens suggests a similar reprioritization for assistive device design. More importantly perhaps, is that the interactions shown in abled bodies interacting with disabled bodies through the devices prompts a consideration of devices, which is centrally tactile, emphasizing the sensuality and intimacy of bodies. If the device design priority

6

is tactile, what does that imply for the look and feel of the materials chosen for bodies to interact with?

Additionally, the new orientations in space suggested by dancers with devices prompts a consideration of what else and how else the device could promote movement possibilities. The way in which the device is used suggests a very different conception of an AT or AD as a "medical aid." Since when have medical aids been tilted on their sides or flipped over in inventive ways to support another dancer climbing on, spinning on, or falling atop the device? *What* the AT/AD is and *how* it is *supposed to* function is completely altered in the dance context. The wheelchair, crutch, or brace is transformed as a creative embodied instrument completely outside the realm of traditional "rehabilitation." The way in which the device is balanced and leaned upon, reoriented in space, tossed, flung, tilted off axis and allowed to fall re-imagines disability as a unique place of interactive and risky moving possibilities. The device focus is reprioritized. The device is also not used in an inert, static way separate from the body, but rather in a dynamic, embedded way, suggesting, if not prompting new design transformations for the device, both in and outside of dance.

One major problem with most wheelchairs has been the issue of pressure sores and the lack of circulation compounded by the device's static nature and materiality. By reorienting bodies and devices in space, dance highlights the need for devices to be motion oriented, not static and unresponsive. In essence, the AD in this context is re-imagined as dynamic, malleable, and interactive. Additionally, the rigorous risk dancers with devices engage in suggests a different type of robustness for the device – one which perhaps would also support the "robust" goals in device design for daily living activities.

Lastly, dance suggests that individuals with disabilities *should be* dancing with their devices; inserting a new normal for health professionals when considering the long-term condition of disability and the patients with whom they are working. Perhaps medical professionals who have the power to write prescriptions and determine ADs for their patients should consider dance as a prescriptive possibility, even more so, or at least in equal regard to other traditional forms of therapy and recreation recommendations. As an intervention which probes these questions and raises concerns regarding the prioritization of AD/AT design development and application, I worked collaboratively with engineers to create a more dance specific wheelchair incorporating new possibilities for materiality and motion based on tactile, embodied concerns. Important to me was a view that specifically embraced the notion of interaction with the wheelchair user.

Two factors played a role in informing my development of the *Rolling Dance Chair Project*: (1) my 21-year experience as a caregiver to my father who had a severe brain injury due to car accident and, (2) my experience as a dancer and choreographer working with dancers, both those with and without disabilities. Through these dance and life experiences, I began to notice the ways in which the wheelchair was not always conducive to human movement interaction, closeness, and the interactive dynamics of dance. Moving between how the chair could simply address some basic functional needs of daily living – transporting a person from point A to point B – and how the artistic, creative, visionary aspects of lived dance/arts experience might take on new possibilities, produced an intersecting design approach which simultaneously merged aspects of utility and basic function with attention to visual form and qualitative, feeling aspects of human experience. The interactive relationship between the individual and their physical and social environment was my point of entry for examining the design of wheelchairs within a dance and movement-related context. My goals were to change the control system to enable the

chair to move in an intuitive, seamless, hands-free manner, and to add other movement dynamics such as omnidirectionality, height change, and seat rotation. Combined, these functions all would hopefully add new dimensions to how the chair users and their partners experienced space and spatial access. This process necessitated multiple collaborators, predominantly two Engineering companies, to bring the design to fruition. As of 2013, I have a patented prototype integrating the chair features I envisioned and have now brought to realization. Five wheelchair users have experimented in the chair thus far, four of whom are dancers with disabilities. Through the bodies of these individuals and other perspectives, the design continues to evolve. (Show video and slides).

In sum, in bringing dance in partnership with AT/AD design, there is a re-formulation of how ability and disability enact their possibilities. The device is not only reframed, but reprioritized through dance in its function. It becomes an intimate, interactive, corporeal partner – a mode of human expression, a means of interaction and support, and a medium of motion and exploration. In these acts, one is prompted to consider the mechanics, form, and materiality of the technology and envision new innovations.

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