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Human augmentation: transference of design approaches from designing for sports to designing for disability

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“Objects, like people, can live double lives. And contemporary sports equipment thrives – with subtlety, wit, and pure exuberance – on its rich double life. The new materials and technology of such equipment have redefined the way sports are played, enhancing speed, force, distance, height. At the same time, however, their forms spell out clearly and consistently our cultural profile. For all the energy and vitality this equipment represents, what it may do with the greatest agility and grace is serve these two functions at once.” (Busch, 1998)

Paul Hogan, whilst chair of the European Institute for Design and Disability, in contrast made the following remark about disability devices:

“Most of the products on display are engineered and not designed. No thought appears to have been given to the psychological impact of the design on those who have to use them. The majority of products ... are ugly, shiny and say in the most emphatic way to the purchaser, "You are a cripple".” (Hogan, 1994, p.2)

So why is there such a dichotomy?

Certainly designing for people with disabilities can be complex and problematic stemming from a number of situational issues such as insufficient financing for projects, limited access to research and development facilities, and a lack of coherent and accurate information available to the designer (Allen, 2002). Detailed knowledge of the needs, wants and aspirations of the market can also be difficult or time consuming to establish – indeed, demographic information and anthropometric data of user population can be scarce or, worse, inaccurate.



The complex nature of some disabilities, the varied and specialist disciplines involved and the way in which some disability devices are provided presents added complexity to the design problem. There is sometimes ineffective communication between parties concerned in the assessment, design, development, manufacture, use and evaluation of some disability devices. Further, inconsistencies of definitions, political correctness and the complexities of terminology also provide a difficult start for a designer entering into the area of design and disability.

The market for disability products is perceived to be small by industry (Martin, 1991). Much of the market is fragmented with several manufacturers competing in very specialised markets, often with very similar products (Young & Sandhu, 1995). Consequently they share a dividend that is insufficient to sustain them all. Many companies produce only one product, competing for market dominance and in turn creating over-saturation in some markets whilst there is insufficient representation in others. Other companies produce bespoke products, often at great expense but with little profit.

Designing in an environment where there is insufficient financing, a lack of venture capital, tax and administrative burdens, and poor management is difficult, and is sufficient reason to put off most designers from designing for the disability sector. It is not hard to conclude that this situation is, in part, responsible for discouraging designers from participating in this field. That, coupled to the high failure rate of small and medium sized enterprises in the rehabilitation sector (Young & Sandhu, 1995), presents a legacy of wariness, or hesitancy at best, amongst designers, manufacturers and financial backers. The lack of confidence in the market is another component of the problematic state of affairs responsible for products being inadequate. In short, designers do not readily get involved.

The size of the market for products catering for people with disabilities could be perceived as a reason (or an excuse) for low quality products, and yet many companies can produce high quality products in small niche markets. Consider mainstream commercial consumer products, or products within small niche sporting markets, where people often aspire to acquire such products.

A dichotomy exists, therefore, between the disability product market and other product markets. The consequences of this dichotomy are severe for both the disabled population and for the companies attempting to cater for this market. In 1989, Jim Sandhu, in a paper entitled "Design for Empowerment – People as Consumers", went as far as saying:

"Clearly, a form of apartheid exists between designers of products for ordinary people and those designing for special needs ... One group has the eyes and ears of the market place, designs from the top downwards, a priori knows what is good for consumers and often looks for market openings for new designs which have little to do with actual needs. The other much smaller group is seen as a mirror image with reverse attributes." (Sandhu, 1989, p3)



This statement, along with that of Paul Hogan (op cit), became the basis of a two-part industrial design project to explore the notion of, and possibilities for, augmenting human ability. The first project focused upon sporting goods and the opportunities therein to enhance human performance and safety within a chosen sport. The second, mirroring, translating and applying the learning from the first project, explored the opportunities to enhance human ability of those considered to be elderly or those who have a disability.

Before discussing the outcomes of the projects, it's important to consider the wider contexts and empowering qualities of artefacts.

“Willingly or not, designers, by the choice of how artifacts are designed, can affect society. To this extent, even without forethought, the designer makes choices, and these are affected by an underlying set of values. It is important to make this fact more salient. I am suggesting a value-laden approach to design that emphasizes an understanding and indeed the active involvement of the people who will be affected by the design. Our designs can shape society even inadvertently, and as a consequence we need to pay more attention to the longer-term effects our designs have on society.” (Bannon, 1986, p29)

Designers are in a responsible position: the products of their work can, and often do, shape and influence people's attitudes, and those of society more widely.

Csikszentmihalyi & Rochberg-Halton (1981) discuss a very insightful sociological study presenting a compelling examination of mankind's relationship with material objects. They argue that material culture is not just a passive reflection of society, but has an active role helping to create its identity. This happens at the level of society, but also at the level of the individual. The psychological issues they raise, particularly the connection between man-made items and the constructs of selfhood, however, are of particular interest here.

Identity

“... men and women make order in their selves (i.e., “retrieve their identity”) by first creating and then interacting with the material world. The nature of that transaction will determine, to a great extent, the kind of person that emerges. Thus the things that surround us are inseparable from who we are. The material objects we use are not just tools we can pick up and discard at our convenience; they constitute the framework of experience that gives order to our otherwise shapeless selves.” (Csikszentmihalyi & Rochberg-Halton, 1981, p16)

This statement mirrors similar discussion by Dewey who argues that we live in a series of situations and transactions between people and the environment that shape and influence us (Dewey, 1938). The term transaction is particularly poignant – the relationship between object and individual is interactive in that objects are not only a reflection of who a person is, but are in themselves a part of an individual's identity. People form relationships with products, and in time people superimpose the relationship with the product upon the



product in its own right. This superimposition affects a person's judgement and the product's perceived value and importance to that person.

Material artefacts not only convey aspects of ourselves, but they create them. A beautiful piece of clothing may make people look beautiful when they wear it, but it also has a significant role in making people feel beautiful, and can affect how they act. Moreover, like actors, we often will dress or use material artefacts as props to communicate a different persona. People will often dress-up, or put on 'airs and graces', to change their perceived social status. Material possessions, therefore, have an important role in establishing social identity as well as in the construction of selfhood. Whether it is the clothes we wear, the car we drive, the brand of fragrance we use, or the material possessions we deem precious or significant to us – all communicate to others aspects of our identities.

Social identity

Whilst material possessions have an important role in the constructs of one's identity, their role in establishing social identity is probably more significant. People need to feel that they are accepted by society – that is, that they are a part of society, not apart from it. The majority of people (to a greater or lesser extent) compare themselves to others, as a form of self-questioning and appraisal, looking for clues to establish whether they fit into what is deemed socially acceptable and normal.

“Society establishes the means of categorizing persons and the complement of attributes felt to be ordinary and natural for members of each of these categories. Social settings establish the categories of persons likely to be encountered there. The routines of social intercourse in established settings allow us to deal with anticipated others without special attention or thought. When a stranger comes into our presence, then, first appearances are likely to enable us to anticipate his category and attributes, his 'social identity'.” (Goffman, pp11-12)

Hence clothing, artefacts and personal possessions (in addition to physical appearance and manner) constitute the constructs of a stranger's social identity. Clothing is an obvious example where the individual is placed into social and cultural groups based upon the observer's value judgements. Attire can be used to establish or impart social standing, or to express an individual's tastes, interests, aspirations and attitudes.

Csikszentmihalyi & Rochberg-Halton (1981) take this point further, revealing that material possessions often define people.

“It is difficult to imagine a king without a throne, a judge without a bench, or a distinguished professor without a chair. In these examples the chair is an essential element of the role of a king, judge, or professor. In the rites of investiture the authority of these positions are given to all three through the symbols of chair and robes. In other words, the ideal of authority is invested in king, judge, and professor; that is, they are literally clothed with the vestments of the positions and can



thus command the attention of their subjects through these objects. The original meaning of invest was “to clothe”, in the sense of endowing...” (Csikszentmihalyi & Rochberg-Halton, 1981, p15).

Within sports, teams are identified by what they wear, but it is also prevalent for supporters to don team colours or clothing so that they can be identified as a fan. For companies such as Nike, the loyalty of fans is an extremely important part of its business – sports apparel is worn by a wide range of the population, be they athletic or not. Nike have gone as far as saying:

“If you have a body you are an athlete ... Ours is a language of sports, a universally understood lexicon of passion and competition. A lot has happened at Nike in the 33 years since we entered the industry, most of it good, some of it downright embarrassing. But through it all, we remain totally focused on creating performance opportunities for everyone who would benefit, and offering empowering messages for everyone who would listen. We feel lucky to have a genuine, altruistic reason to be: the service of human potential. That's the great benefit of sports, and we're glad to be in the middle of it.” (Nike, 2006)

Perhaps what Nike actually meant when they stated that they “remain totally focussed on creating performance opportunities for everyone who would benefit” is that everyone has the opportunity to buy and wear Nike goods and, in doing so, the positive association of athleticism is bestowed upon the wearer. Otherwise, the use of the word ‘everyone’ is problematic, as it implies that all are accommodated and considered. One would hope that Nike’s “altruistic reason to be: the service of human potential” (Nike, 2006) would surely include the untapped potential of people with disabilities.

The notion of a ‘universally understood lexicon’ is also intriguing – the message conveyed through sporting goods is of athleticism, prowess, and performance. Indeed, there are many positive messages conveyed by sporting goods that reflect upon their wearers/users. But, compare the positive associations of sporting goods with the associations of disability devices; both serve a purpose of augmenting human ability. However, the manner in which they do so and the messages conveyed by these products are very different.

Disabl-identity

When it comes to an encounter with someone with a disability what is clear is that first impressions are made “based on the most obvious and superficial data” (Thomas, 1982, p70). Thomas goes on to state that, “the most obvious datum they [people with disabilities] communicate is their disability” (p70). For people with disabilities, many of the clues indicate that they do not conform to what is deemed ‘normal’, and so many feel apart from society. Society reinforces these clues, as Thomas (1982) points out:

“To be perceived as a handicapped person is to experience a distinct social status. These perceptions and the values associated with them give meaning to being handicapped, and such meaning appears



to involve feelings and styles of behaviour which provide the handicapped person with clues to his social and personal worth.” (pp16-17)

Society’s perceptions and labeling of people with disabilities can have a profound effect upon their personal worth – their personal image of themselves. If people are told something often enough they start to believe, or at least question, it. Such questioning can be emotionally and psychologically damaging. Many people with disabilities experience feelings of rejection, inferiority, loneliness, depression and frustration. Many have low self-esteem and lack confidence, often withdrawing from others. Some, as a result of their impairment, their self-image, or the way they are perceived or treated by others, experience such emotions as anger, sadness, disgust, fear, grief, bitterness, jealousy, or shame. For some these feelings are heightened because such emotions cannot always be released due to their physical impairments.

Many people with disabilities are reliant on others for assistance. Although this is generally much appreciated by those being helped, some experience frustration at the resultant lack of control, autonomy and independence. Being helped can be viewed as synonymous with being helpless. The use of disability aids, to a certain degree, offers some form of independence for their users through the opportunity to become more socially integrated. They are able to look after themselves, and so can live in the community instead of in government, charitable or private institutions.

It is important to consider, however, the effects of the use of such disability devices by people with disabilities. Often disability devices are seen as extensions of their users. Self-image is very important, and often the very devices designed to help people in fact compound their problems by drawing unwanted attention to their impairments (Murphy, Collins & Moodie (1994), Hogan (1994)). This gives rise to a situation where many people are reluctant to use aids as the devices may contribute to their problems compounding a psychological stigma of inferiority.

So how can the dichotomy between the empowering design of sporting goods and the disabling design of disability devices be redressed? Perhaps, part of the answer could lie in the quote by Nike (*op cit*), particularly the notion of “offering empowering messages” in the products we create for ageing and disability markets. With this in mind the author initiated a design project carried out in two parts in an Undergraduate Industrial Design studio class to explore the notion of augmenting human ability. The first part of the project focused upon sporting goods and the opportunities therein to enhance human performance and safety within a chosen sport. The second, mirroring and applying the learning from the first part, explored the opportunities to enhance human ability of those considered to be elderly or those who have a disability.

Human augmentation – part 1: Sports

The students were asked to design a product falling under the category of “sports goods”, but significantly, their product had to enhance human performance and/or safety, thereby augmenting human ability. Importantly the product had to be a human-machine-interface – that is, the product had to augment the human (for example, an improved bat or racquet may improve a sports person’s ability and performance,



whilst, by and large, a new type of ball may improve a sport for spectators, but does not necessarily augment the sports person's ability).

From the outset of the project the students were encouraged to creatively explore ideas and possible design directions. To extend the initial ideas and provide a solid foundation for further design and study, the class were divided into groups to investigate specific aspects of sporting goods design. The students reported their joint findings to the rest of the class in the second week of the project and the work acted as a class resource. Group investigations looked at such areas as winter sports, field sports, street sports, water sports, extreme sports, racquet and bat sports. Within these sporting areas, the groups identified significant aspects of the market, including brand leaders, demographics, and social and cultural aspects of the sporting community. The investigation also attempted to forecast relevant emerging materials and technologies, design trends, socio-cultural issues, and market opportunities.

Students established their own criteria for their projects and presented their three strongest concepts in the third week of the project. In a peer-based critique one concept from each student was short-listed and in a pin-up session, referred to as "Mergers and Acquisitions", the class established teams of 4 to 6 people whose projects had a common interest. These teams then developed their own brand based on a collective philosophy established by the team members. Each student's individual concept had to be developed to ensure that his/her design fitted into a product range under this brand. The resultant brands were launched in the following week's class.

The intention of this part of the project was primarily to identify the needs, wants and aspirations of the intended market in order to devise an appropriate marketing and branding strategy to target this audience. A secondary motive was to encourage the students to work more cooperatively and toward a common goal and, to that end, share their knowledge and resources for a common good.

Human augmentation – part 2: (dis)Ability

Building upon the design strategies and approaches developed in the studio class during the first project, the students were asked to take a similar approach to tackling the design of assistive devices.

A wide variety of projects were undertaken. This paper briefly discusses three of them.

- Tone – a hearing aid for the baby-boomer who is in denial of his diminishing hearing;
- Power Walker – a high-tech power-assisted walking stick for the elderly; and,
- Syton – a wheelchair for a 10 year old boy with muscular dystrophy

Tone

The 'Tone' hearing aid, by Joel Kong, was designed in response to the observation that many older men, particularly of the baby-boomer generation, may have impaired hearing but appear reluctant to wear a hearing aid. The market for hearing devices amongst this group is large; indeed, "the National Center for Health Statistics reports that 20.4 percent of people between the ages of 45 and 64 now say they have at least mild



hearing loss.” (Geller, 2002). The reluctance to wearing a hearing aid could be attributed to a number of reasons, but one of the strongest disincentives for this group is that hearing aids are associated with ageing, are uncool and there is “a public mindset that awards hearing aids all the cachet and sex appeal of, say, orthopedic shoes” (Geller, 2002). This observation has also been made by the battery maker, Energizer, who are well aware of this great market opportunity, but also of the reluctance of baby boomers to adopt wearing hearing aids. In 2004, Energizer launched a marketing campaign, "It's Hip to Hear" where prominent baby boomer musicians, such as Mick Fleetwood of Fleetwood Mac and the signer Pat Benetar, promoted the campaign. Pat Benetar was quoted as saying, "From Aerosmith to the Rolling Stones, our music defines us, but all those years of rockin' are beginning to take a toll" (Bess, 2004).

Whilst marketing campaigns promoted by enigmatic baby boomers may go some way to encourage people to admit to their hearing loss and therefore consider the use of a hearing aid, the problem remains that the majority of devices on the market are still ‘unsexy’. The design of the ‘Tone’ hearing aid set out to address this issue, by drawing semantic cues from the more commercial sectors of music-, communication-, entertainment- and media- device markets. To stimulate the design process, the question was posed, “what would a hearing aid by Sony, Bang & Olufsen, or Nokia look like?” Within the design studio we also discussed how spectacles were perhaps the best example of how a disability device can not only be an aid, but a fashionable item as well. Indeed, wearing glasses can actually have a beneficial effect upon a person’s social identity – the wearer being perceived to be intelligent or fashionable. This example further stimulated the discussion and design exploration of Joel’s hearing aid, and eyewear brands, such as Gucci, Giorgio Armani, Hugo Boss, Kenneth Cole, and Kenzo were also considered to help inspire the final design.

The resultant hearing aid, ‘Tone’, is a two-tone silver and black earpiece made from a vapour metallised rigid polymer housing the electronics with an over-moulded soft thermoplastic elastomer part that snugly fits to the ear. The design also has an induction charging unit in brushed metal to recharge the earpieces. A proposed feature of the hearing aid was to incorporate a blue tooth transceiver enabling the device to also be used as a hands-free mobile phone.



Figure 1: ‘Tone’ hearing aid



Figure 2: 'Tone' hearing aid and induction charger



Figure 3: 'Tone' hearing aid

PowerWalker

The 'Power Walker', by Simon Brook, is a modern take of the walking cane that incorporates a number of novel high-tech features. Simon approached this project as a piece of transportation design, and so there is a strong reference to automotive styling in the final piece.

The Power Walker can transform from a walking cane to a forearm crutch by rotation of the handle and support (see figure 4), and makes use of an internal electric motor to adjust the height of the cane to perfectly fit the user. This feature also can provide assistance when getting in and out of a seating position (see figure 5). Other features include an LED lighting cluster to illuminate the terrain in front of the cane and an inbuilt phone alarm system set to dial for assistance if a fall is detected.

To keep the weight down, and for aesthetic appeal, the cane is predominantly constructed from light-weight carbon fibre and anodized titanium alloy, with leather padding over the handle for comfort and sweat absorption.



Figure 4: 'Power Walker' walking cane



Figure 5: 'Power Walker' walking cane

Syton

The 'Syton' Mobility Aid, by Tom Marminc, is a wheelchair designed to provide children with muscular dystrophy greater mobility and functionality and help reduce the stigma associated with using wheelchairs.

Through a process of literature review and interviews with people who have muscular dystrophy, Tom identified that a major problem for Muscular Dystrophy sufferers – and sufferers of other disabilities too – was the inability to sit down or alight a wheelchair without the assistance of others. Indeed, he noted that “the most difficult and frustrating thing about the disease was not the actions it made impossible, but the lack of independence and persistent stigma of being disabled.”



With this in mind, Tom set 2 goals for the project:

1. To reduce or eliminate the stigma associated with wheelchairs
2. To provide a real and tangible benefit over existing wheelchairs

The resultant product, 'Syton', is more of an electric urban buggy than a wheelchair, incorporating a number of novel features. In order to address the first of these goals, Tom stated: "The appearance and aesthetic of the 'Syton' were paramount to the reduction of the associated stigma. It had to be unrecognizable, beheld by peers as an object of desire rather than derision." To this end, the design's aesthetic takes visual cues from the automotive industry, incorporating; fibreglass panelling to provide more of an aerodynamic automotive aesthetic than is present in the conventional tubular space frames of wheelchairs; headlights; and surface detailing more akin to sports cars than wheelchairs (see figures 6, 7 and 8).



Figure 6: 'Syton' mobility aid

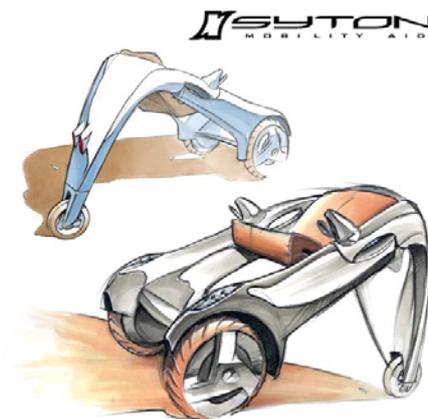


Figure 7: 'Syton' mobility aid

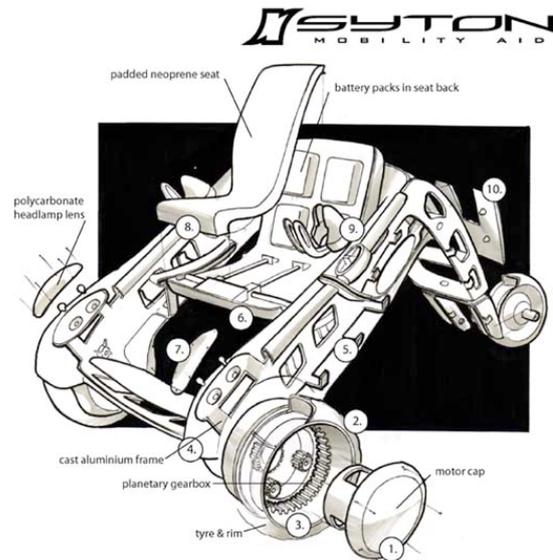


Figure 8: 'Syton' mobility aid

A key aspect of the design is that it folds at its midpoint and raises the seat while the armrests enable the user to stand or sit down as easily and as independently as possible. The vehicle incorporates independent electric motors in each wheel that not only allow for tight turning radii, but assists in raising and lowering the user.

Tom's design was entered into the student section of the Australian Design Awards, sponsored by Dyson, and received the Bronze Award.

Reflections on the project: towards empowerment of people with disabilities

These three case studies exemplify the approach and the diversity of the outcomes from this project. In addition to the three case studies outlined here, there were a number of other exciting products that emerged from the studio, including one that was a finalist in an international design competition.

The short time-frame, and undertaking this project at undergraduate level, meant that in some cases there was less rigour and focus upon the efficacy of the outcomes than could have been achieved from a longer project or if the project were tackled by a more senior group (post graduate students for instance). Whilst some of the final designs lacked such rigour, the project's strength was the vigour with which the students embraced the exercise. The diversity of outcomes that a cohort of thirty or so students brought to this project provided great breadth and exposure to problems and design opportunities in the field of ageing and disability. Whilst the project was short in duration, the lessons gained from the exercise will remain with the students for a long time.

People, be they disabled or not, have the need to feel as if they belong to society, and products have an important role in the construction of social identity (Goffman *op cit*, Csikszentmihalyi & Rochberg-Halton *op*



iii). On initial encounter, the needs of people with disabilities often appear distinctly different to those of the so-called 'majority of the population'. Such a difference would appear to require special consideration in the design of artefacts for people with disabilities. Whilst to a degree this is valid, over-emphasis on the differences can create more of a problem than attempts to resolve them.

Orpwood (1990) argues that many of the problems faced by people with disabilities when using disability products are hard to anticipate, drawing the conclusion that designers are not able to use their own experience effectively when designing for such people. Designers' experiences of disability are often very limited, and whilst there may be those who are knowledgeable, those with an empathic understanding of the disability experience are rare. It is all too easy when designing for people with disabilities to assume that the same values and priorities are shared by both the designer and the end-user. This can result in designs that are unusable by, or inappropriate for, their intended users. Conversely, designers may over compensate and produce designs based upon their own preconceptions of the needs and abilities of the people for whom their designs are intended. In both cases the designer is guilty of assumption, and unable to properly respond in the absence of information on the needs, abilities, values and lifestyles of people with disabilities. In addition the designer is unlikely to be familiar with people with particular disabilities prior to designing for them, as many people with disabilities are not fully integrated into society.

The importance of integration and acceptance of people with disabilities into society has been recognised by disability groups yet few products have helped to facilitate this. Indeed, the field of Rehabilitation Technology/Assistive Technology has been dominated by a medical model of disability, which proposes that a person with a disability is handicapped by his or her impairment, rather than a social model of disability that identifies the environment (places, artefacts) as the handicapping factor. Hence, many disability products have been designed to repair, replace, or provide a substitute for what people are believed to have 'lost' by their impairments. Few disability products would appear to have taken account of the social or psychological impact their designs have upon their users.

It is the author's contention that conventionally many disability products have addressed, at best, only utilitarian goals in solving problems associated with disability. Designers of equipment for people with disabilities have shown insufficient regard for communicative goals that deal with how such products are perceived. Such communicative goals include raising status, prestige, desirability, self-esteem, and pleasure for their users. It is proposed that disability products can be greatly improved by paying greater attention to such communicative goals. This is not just a case of re-styling, but an exercise in meshing needs, wants, aspirations, purposes, abilities and capabilities of potential users of disability products with technological and functional requirements.

There is also a great need to change people's attitudes towards people with disabilities. Designers may be in a position to do this: the products of their work can, and often do, shape and influence people's attitudes. The size of the market for products within the disability sector, and the scope and need for products within it, provide a tremendous opportunity for industrial designers to get involved and focus their attention on



resolving the issue of poor products within the disability sector. There are opportunities to make money, produce better products, and ultimately direct problem-solving to the task of fulfilling human needs. By designing products that augment human ability, particularly with the needs of people with disabilities in mind, the industrial designer can offer much for the benefit of everyone.

The empowerment of people with disabilities, however, will require more than the involvement of designers. Educating the public, and making the needs, wants, abilities and capabilities of people with disabilities explicit, would be an ideal solution, but an arduous one. Entrenched attitudes are hard to change. However, the contribution that industrial design can make through the design of products that cater for people with disabilities is an important step towards such societal change.

Designing for the needs of people with disabilities teaches a designer a great deal. Attempts to tackle complex problems and catering for the needs of people with disabilities develops and broadens a student's understanding, knowledge and skills. The synthesis of this enlightenment ultimately results in better solutions and, hence better products.

This project explicitly exposed the dichotomy between the empowering messages endowed by sporting goods and the crippling messages conveyed by disability products, and proposed that by adopting and translating the approach taken in the design of sporting goods to the field of ageing and disability, better outcomes may emerge. The initial outcomes of this project were very encouraging, and bode well for the empowerment of people with disabilities by making disability products more socially acceptable and even desirable. Whilst the products of the students' work were for the purpose of empowering athletes and people with disabilities, an important aspect of the project, however, was the empowerment of the students as enlightened designers – indeed making the *designing* of disability products more socially acceptable and even desirable.

Acknowledgements

The author would like to thank students from Monash University's Industrial Design department, and in particular Tom Marminc, Simon Brook and Joel Kong for their assistance in providing the case study material shown in this paper.



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